



December 2013

Forest management plan 2014–2023

Conservation Commission of Western Australia

Conservation Commission
WESTERN AUSTRALIA

THE GOVERNMENT OF WESTERN AUSTRALIA

Department of
Parks and Wildlife

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Cover

Main picture:
Boranup forest. Photo – Tourism WA
Insets, from left to right:
Mia Mia, Narrogin. Photo – South West Aboriginal Land and Sea Council, Cannington.
Scarlet bracket fungus (*Pycnoporus coccineus*). Photo – Richard Robinson/DPaW
Numbat (*Myrmecobius fasciatus*). Photo – DPaW
Jarrah cabinet. Photo – Forest Products Commission, Kensington
Bushwalkers in Gloucester National Park. Photo – Tourism WA

Forests – Djarlma

When the great *Waugal* created the *boodja* (land), he ensured that there were *wirrin* or spirits to look after the land and all that it encompassed. Some places such as the *kaart* (hills) and *ngamar* (waterholes) *boya* (rocks), *bilya* (rivers), *boorn* (trees) were created as sacred sites and hold *wirrin*, both *warra* (bad) and *kwop* (good). Noongar believe that the spirits of their ancestors live in the forests. The ancestral spirits of their *demanggar* (grandparents) are there to give them their healing and their food. Everything in Noongar *boodja* has a purpose; if the forests are not preserved and maintained then they will have no ancestral spirits to guide them and give them sustenance and healing, the forest spirits will go to sleep forever and Noongar will become sick in both mind and body.

(*Courtesy of the South West Aboriginal Land and Sea Council*)

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[1] Development of the 1999 Western Australian Regional Forest Agreement (RFA) included forest ecosystem mapping within the RFA boundary. This plan covers a broader area (see Map 1) and Appendix 10 refers to the only vegetation association mapping that covers the whole plan area.

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Introduction to the plan

Western Australia's national parks[2], conservation parks, nature reserves, State forests and timber reserves are vested in the Conservation Commission of Western Australia (Conservation Commission). The Noongar people are the traditional Aboriginal custodians of the plan area, which covers all land categories[3] vested in the Conservation Commission across the State's south-west, within the Swan, South West and Warren regions of the Department of Parks and Wildlife (the Department[4]), and the lands collectively referred to as 'Redmond' forest block within its South Coast Region (Map 1). These land categories cover a total area of more than 2.5 million hectares.

Within the plan area (Map 1), there are about three million hectares of native vegetation across private and public land, of which about 2.37 million hectares, or 79 per cent, are forest. On lands vested and proposed to be vested in the Conservation Commission within the plan area, there are about 2.38 million hectares of native vegetation, of which about 81 per cent, or 1.93 million hectares, are forest. In other words, this plan deals with the management of around 79 per cent of the total native vegetation and 81 per cent of the total native forest across private and public land within the plan area.

Coinciding with much of the area covered by the plan is the boundary of the 1999 Regional Forest Agreement (RFA) (Map 1). The existing and proposed system of formal and informal reserves and other protected areas means that within the RFA area, about 62 per cent of native forest ecosystems are protected from a range of disturbance activities. However, in this plan there is a focus on the management of State forest and timber reserves, because it is primarily on these land categories that a broader range of disturbance activities is permitted.

The Conservation Commission is the proponent for the purpose of the assessment of the plan undertaken by the Environmental Protection Authority (EPA) under the *Environmental Protection Act 1986* (EP Act). The Conservation Commission, the Department, the Forest Products Commission (FPC) and others as relevant, will seek to achieve the plan's goals through the operations proposed to be undertaken as included in this plan, and consistent with any conditions placed on the plan by the Minister for Environment under the EP Act.

The basis of the approach to forest management in the plan stems from the principles of ecologically sustainable forest management (ESFM). That is, the economic and social values derived from the use of the natural areas covered by the plan, should be provided through a management system that is based on consideration of its impacts on biodiversity and is precautionary in nature.

Section 19(2) of the *Conservation and Land Management Act 1984* (CALM Act) describes five principles of ESFM and requires the Conservation Commission to advise the Minister for Environment on their application (see the 'Background' chapter). As was the case for the *Forest Management Plan 2004-2013* (the previous FMP) (Conservation Commission 2004), this plan has adopted the Montreal Criteria as the framework within which to set goals and proposed operations (management activities) in line with these ESFM principles. Australia and 12 other countries

[2] Apart from one at time of writing, Murujuga National Park near Karratha, created in January 2013, which is freehold land leased back to the State for 99 years. It is not vested in the Conservation Commission.
[3] For clarification, this does not include marine waters.
[4] While the Chief Executive Officer is the statutory entity responsible for management of land to which the CALM Act applies, the Chief Executive Officer is assisted in the performance of its functions by the Department. Accordingly, a reference to the Department should be read as a reference to the Chief Executive Officer.

participating in the 1995 Montreal Process agreed that the criteria and indicators they had developed provided a common understanding of sustainable forest management at a whole of forest scale.

The Montreal Criteria are:

- the conservation of biodiversity
- the maintenance of ecosystem health and vitality
- the conservation and maintenance of soil and water
- the maintenance of the forests contribution to the global carbon cycle
- the maintenance of productive capacity
- the maintenance of heritage
- the maintenance of socio-economic values.

The Conservation Commission's overall goal in formulating this plan is for biodiversity to be conserved; the health, vitality and productive capacity of ecosystems to be sustained; soil and water resources to be protected; and the contribution to global carbon cycles to be sustained. Further, the social, cultural and economic benefits valued by the community are to be produced in a manner taking account of the principles of ESFM. Management plans for land vested in the Conservation Commission also have the objective of protecting and conserving the value of the land to the culture and heritage of Aboriginal persons (CALM Act section 56(2)). Consistent with that legislative requirement, and as is relevant, proposed operations (management activities) in this plan are undertaken in the context that seeks to protect and conserve Noongar culture and heritage (also see the 'Heritage' chapter).

This 'Introduction to the plan', the following 'Executive summary' and the 'Background' discussion of the principles of ESFM are provided by way of summary only, and do not constitute a formal part of this plan. The operative text of the plan, as required under section 55 of the CALM Act, begins on page 24 and comprises only:

- The information under the heading 'Purposes for reservation of indigenous State forest and timber reserves' and any associated appendices.
- The information under the heading 'Relevant policies and guidelines of the Department'.
- The numbered clauses under the heading 'Operations proposed to be undertaken (management activities)' and any associated appendices. Note that where an operation refers to **(Plantations)** or **('Other exotics')**, that operation only relates to activities undertaken on plantations or areas of other exotics respectively, as these are defined in the 'Glossary'.

Any other information contained in this plan is for information only. Also included is a set of comprehensive key performance indicators, which will form the basis for mid-term and end-of-term reviews and reporting by the Conservation Commission. These have been revised from the set included in the *Draft Forest Management Plan 2014-2023* (Draft FMP) (Conservation Commission 2012b), which was released for public comment under both the CALM Act and the EP Act, for three months from 15 August 2012. The public consultation period closed on 7 November 2012.

In developing this plan, the Conservation Commission has reviewed, in conjunction with the Department, more than 5,000 public submissions received on the Draft FMP. The text of this plan has been approved by the Minister for Environment under section 60 of the CALM Act, and replaces the previous FMP.

In developing the desired goals of this plan, the Conservation Commission has adopted a precautionary approach. It has been particularly concerned with the vulnerability of forests to climate

change in developing the plan. The potential impact of climate change on the health and productive capacity of the natural ecosystems has been central to the Conservation Commission's consideration of the elements that make up the plan. While the Conservation Commission is confident that all old-growth forests will continue to be protected, and that a refined system of fauna habitat zones (FHZs) will help enhance biodiversity outcomes, the effects of weed, pest and disease infestations and changes in weather patterns have already been witnessed in the State's south-west and, it is assumed, will continue during the period of this plan.

Knowledge about the potential cumulative and entwined effects of changing climate on various values and processes is incomplete. In this context, the sustained yield modelling undertaken for this plan and reviewed by a panel of independent experts has incorporated the latest climate projections (CSIRO, 2007). In addition a 'safety margin' has been applied to account for various risks, to determine the allowable levels of timber harvesting. Achieving a balance between the range of environmental values and the provision of goods and services, for the next 10 years and for future generations, has been a particular challenge. It has been demonstrated to the Conservation Commission that timber yields can continue to be sustained and benefits be provided to the community of Western Australia, through continued management of the forests. To ensure that the management approach and practices remain sound, the plan includes revised measures for improved monitoring that will help inform adaptive management.

Brian Easton
CHAIRMAN
CONSERVATION COMMISSION OF WESTERN AUSTRALIA

Executive summary

Key aspects of this plan are summarised below under the chapter headings based on the Montreal criteria, and the additional chapter for 'Plan implementation and management'.

Biological diversity

The plan carries forward proposals for reserves from the previous FMP not yet implemented, as listed in Appendix 1 and shown on Map 2.

Additional information gathered since the previous FMP came into effect in 2004 supports the recognition of the Whicher Scarp as a separate forest ecosystem. Map 2 highlights areas proposed to be reclassified as and added to the existing national park. This proposal would increase the area of existing and proposed formal reserves by 4,010 hectares, including 2,370 hectares of the Whicher Scarp ecosystem.

All old-growth forest will continue to be protected in either formal or informal reserves (and the definition of old-growth forest under this plan remains unchanged). Since 2004, the status of some areas of forest has been reviewed, resulting in about 2,260 hectares of additional, previously unmapped old-growth forest being set aside in informal reserves. In this plan, the public nomination process for old-growth forest will be continued, but it is intended that the administration will be transferred to the Department (as per Draft FMP management option 2).

Travel routes in the Warren Region and along the Munda Biddi Trail have been reviewed. Locations have been modified in the Warren Region and travel route buffers will now apply to parts of the Munda Biddi Trail (previously, no travel routes applied along any part of the trail).

Adding these changes to the existing system of formal and informal reserves and other protected areas means that within the RFA area, about 62 per cent of native forest ecosystems would be protected from a range of disturbance activities.

The plan also seeks to maintain biodiversity through a range of complementary measures, including where practicable, recovery planning for threatened species and ecological communities.

Mineral and petroleum operations in the plan area involve significant modification of the environment. Although many of these activities are approved and governed by processes managed by other government agencies under separate legislation, there is still considerable input required from the Conservation Commission and the Department in relation to processes associated with approvals and rehabilitation. Given the potential cumulative, long-term impacts from mining, this plan includes a number of mitigating activities.

As required by the previous FMP, an expert panel has reviewed silvicultural practices (in 2011), and based on their recommendations, modifications to silviculture guidelines have been made to enhance biodiversity and other outcomes. Changes include added protection of marri trees, which are key habitat for black cockatoos. Habitat requirements (such as nesting, roosting and foraging needs) for a range of fauna will be considered in selecting habitat trees and hollow logs for retention.

FHZs were introduced in the previous FMP to provide a source of fauna to help recolonise disturbed areas after timber harvesting. The FHZ network has been refined for this plan, resulting in a reweighting of the allocation of area to those forest ecosystems with lower levels of reservation, a

slightly greater area of mature forest in FHZs and a higher proportion of mature forest in FHZs, a lesser area of regrowth forest and a lesser total area in FHZs, a greater range of size of FHZs in recognition of the characteristics of the landscape in which they are located, and the inclusion of some larger FHZs in areas of known fauna values.

Monitoring remains important, and through this plan, the Department will seek to maintain and extend the key forest biodiversity monitoring program, *FORESTCHECK*.

Ecosystem health and vitality

The plan area is subject to a range of pressures affecting ecosystem health and vitality, including disease caused by *Phytophthora* species, altered fire regimes, insect outbreaks such as gum leaf skeletoniser, and foxes and cats that impact native fauna. Climate change may also affect ecosystem health and vitality directly, through drought deaths, or indirectly through increased impacts from weeds, pests or diseases.

The plan proposes a renewed focus to prioritise the management of pests and diseases to complement the approach that has been adopted for weeds. This will minimise their impact on the health and vitality of ecosystems and reduce the risk of introduction or naturalisation of weeds, pests and exotic pathogens. The approach will consider the range of *Phytophthora* species and other diseases impacting ecosystems.

It is intended that the *Western Shield* program, which reduces predation pressure on threatened and priority species of fauna, be continued.

Management activities will be continued to use and respond to fire in a manner that mitigates the risk of adverse impacts of bushfire. Appropriate fire regimes will also benefit biodiversity and therefore promote ecosystem health and vitality, in turn promoting resilience to climate change.

Cleared areas such as mine sites and basic raw material pits will continue to be rehabilitated.

Soil and water

The approach developed for the previous FMP to protect soil and water quality will be continued. This includes the approvals process for timber harvesting operations under moist soil conditions.

The plan provides for silvicultural treatment to address threats to ecosystem health and vitality (referred to as ‘silviculture for ecosystem health’). An example of this approach is to increase the water available to identified areas, such as ecosystems that depend on surface water. The plan also provides for ‘silviculture for water production’, which involves silvicultural treatment to maintain or enhance water supply, with ancillary benefits for ecosystem health and vitality. ‘Silviculture for water production’ will be subject to approval of catchment management plans.

Reduced rainfall and declining groundwater levels mean the risk to stream water quality from rising groundwater transporting salt stored in the soil profile has significantly reduced. Accordingly, the phased harvesting requirement will be removed in the Department’s Swan and South West regions and part of the Warren Region. The phased harvesting requirement for other parts of the Warren Region will be retained. However, the planning process for timber harvesting is to be revised so that in partially cleared catchments categorised by the Department of Agriculture and Food WA as having a high salinity risk, there is a requirement to address the potential for adverse effects on salinity of streams.

Climate change and carbon cycles

Given current knowledge and uncertainties of the likely magnitude and result of changes to climate from increases in atmospheric levels of greenhouse gases, management activities included throughout this plan encompass broad precautionary measures. Planning for climate change has been considered in developing the range of proposed operations (management activities) outlined in the 'Biological diversity', 'Ecosystem health and vitality', 'Soil and water' and 'Productive capacity' chapters. Some socio-economic benefits may also be affected.

Wood inventories within the south-west forests have measured the standing tree volume, which has been used to provide an estimate of above-ground biomass. In the Draft FMP, broad regional estimates of the above- and below-ground native forest carbon stocks were calculated from the biomass figures. In that analysis, it was projected that at the whole of forest scale, the quantity of carbon stored in live trees in the forests would increase by between three and five per cent during the plan's 10-year period.

Given the allowable cuts set for this plan, it is estimated that the quantity of carbon stored in live trees in native forests will be within the mid to upper end of this range. The quantity of carbon stored in live trees in native forests is projected to increase by up to five per cent under this plan. Further reporting on carbon stocks is scheduled for the next draft plan.

Adjustments for the potential impact of climate change on the growth rates of jarrah and karri trees and stands have been applied when projecting future sustained yields, as explained in the 'Productive capacity' chapter.

It is intended that the Department periodically review guidelines for silviculture and fire management, with a view to incorporating techniques that recognise the contribution of the areas covered by the plan to global carbon cycles, consistent with other mitigation and adaptation strategies and achievement of other silvicultural objectives and goals for forest management. It is also intended that the Department investigate opportunities that may arise from an emerging carbon economy.

Productive capacity

This plan focuses on the productive capacity of State forests and timber reserves within the plan area – including both native forests and plantations. Key forest products are sawlogs and other log grades (collectively termed 'other bole volume'), and other forest produce including public firewood, burls, craftwood, wildflowers and seeds and honey.

Several issues have become more prominent in recent years that have a bearing on wood production from forests, including:

- Climate change – to take account of potential effects, CSIRO (2007) projections of climate change to 2070 have been applied when modelling changes in forest productive capacity for this plan.
- Degradation of forest – given the expected changes in the south-west climate, there may be an increase in bushfire frequency, intensity and scale, and prolonged droughts, potentially affecting more areas of native forest and plantations. Infestation by *Phytophthora* dieback can also have dramatic long-term impacts on the productive capacity of areas of native vegetation.
- Log product mix – harvesting in old-growth forest ended in 2001. The subsequent high level of reservation of mature forest has resulted in a higher proportion of smaller sized and lower quality logs from regrowth forests being supplied to the forest products industry.

These matters have been factored into calculations of sustained timber yield from native forests. In the case of natural disturbances that lead to the death of trees, the expected level of future disturbance is modelled on past observations. However, there are occasions where larger patches of forest may be affected, for example by bushfire, and management of such areas may be assisted if they can be salvage harvested. In this plan, the Department will determine, based on a case-by-case basis, if wood arising from salvage harvests will count toward the allowable cut. The Department will take into account the likely public benefit, considering the costs and ability of affected areas to successfully regenerate and/or be successfully rehabilitated and provide for a range of ESFM values, in the absence of salvage harvest.

Based on the sawlog sustained yields modelled for this plan, and assuming a continuation of the utilisation, silvicultural and industry settings as existed under the previous FMP, this plan proposes an average annual allowable cut of 132,000 cubic metres of first and second grade jarrah sawlogs, and 59,000 cubic metres of karri first and second grade sawlogs. This in turn would make available up to 292,000 cubic metres per annum of other bole volume of jarrah, 164,000 cubic metres per annum of other bole volume of karri, and 140,000 cubic metres of all bole logs of marri. Provision is also made for the potential levels of yield that would arise from improved utilisation of available wood resources, particularly through the development of markets for lower grade logs. Approval by the Conservation Commission, based on a review by the Department, is required to progress beyond the aforementioned figures toward upper limits of the average annual allowable cut of: 160,000 cubic metres of jarrah first and second grade sawlog; 59,000 cubic metres of first and second grade karri sawlog; 521,000 cubic metres of other bole volume of jarrah; 164,000 cubic metres of other bole volume of karri; and 254,000 cubic metres of all bole logs of marri.

The area cutover for the period of this plan is likely to be greater than for the previous FMP because there is a greater proportion of lower yielding forest types and silvicultural treatments likely to be included in areas harvested during the period of this plan.

State forest and timber reserves also provide other forest produce such as public firewood, burls, craftwood, wildflowers, seeds and honey, which will continue to be managed and regulated by licensing arrangements. Community demand for collection of public firewood from lands covered by the plan remains strong. Given the supply limitations and environmental impacts associated with this activity, it is intended that the Department, and where applicable in conjunction with the FPC, implement trials in selected areas of the three management options described in the Draft FMP. Subject to the results, the Department may seek to progressively reduce public firewood areas. Even so, it is likely that some public firewood areas would still be made available during the term of this plan.

This plan also covers plantations, and areas of ‘other exotics’, with the latter largely being associated with mine site rehabilitation.

Heritage

Amendments to the CALM Act that came into effect in 2012 require that the Department’s management of lands and waters includes the objective to protect and conserve the value of the land to the culture and heritage of Aboriginal people in a manner that does not have an adverse effect on the protection and conservation of the land’s fauna and flora. The new provisions of the CALM Act and *Wildlife Conservation Act 1950* (WC Act) also provide a statutory framework for joint management and enable Aboriginal people to undertake customary activities, such as preparing and consuming food, preparing or using medicine, and engaging in artistic, ceremonial or other customary activities.

It is intended that the Department assess areas within the plan area for their importance for Noongar culture and heritage, as required, in consultation with relevant stakeholders and agencies.

The plan also seeks to protect and conserve other Australian heritage values and recognise and determine the significance of other Australian heritage values.

Socio-economic benefits

The plan addresses the management of the socio-economic benefits flowing from the use of the plan area, including recreation and tourism, timber harvesting, access via roads and bridges, basic raw materials extraction and bioprospecting.

In this plan it is intended that basic raw materials be sourced from a network of (fewer) strategic pits, which will be identified in consultation with relevant government agencies and basic raw material users; that strategic infrastructure, including roads and bridges, be identified to help in seeking funding for their construction and maintenance; and, in order to increase the socio-economic benefits from improved use of non-sawlog material, the Department will work with the FPC to plan for a log product and wood quality mix that supports a viable forest products industry.

An increase in area cutover to achieve the allowable cut from the jarrah forest may have adverse impacts on the costs of wood supply to the forest products industry. This, along with the changes to log size and quality, will require further industry adaptation. There is some risk that the plan may not be able to achieve its goal to sustain social and economic benefits, if the industry's viability is adversely affected.

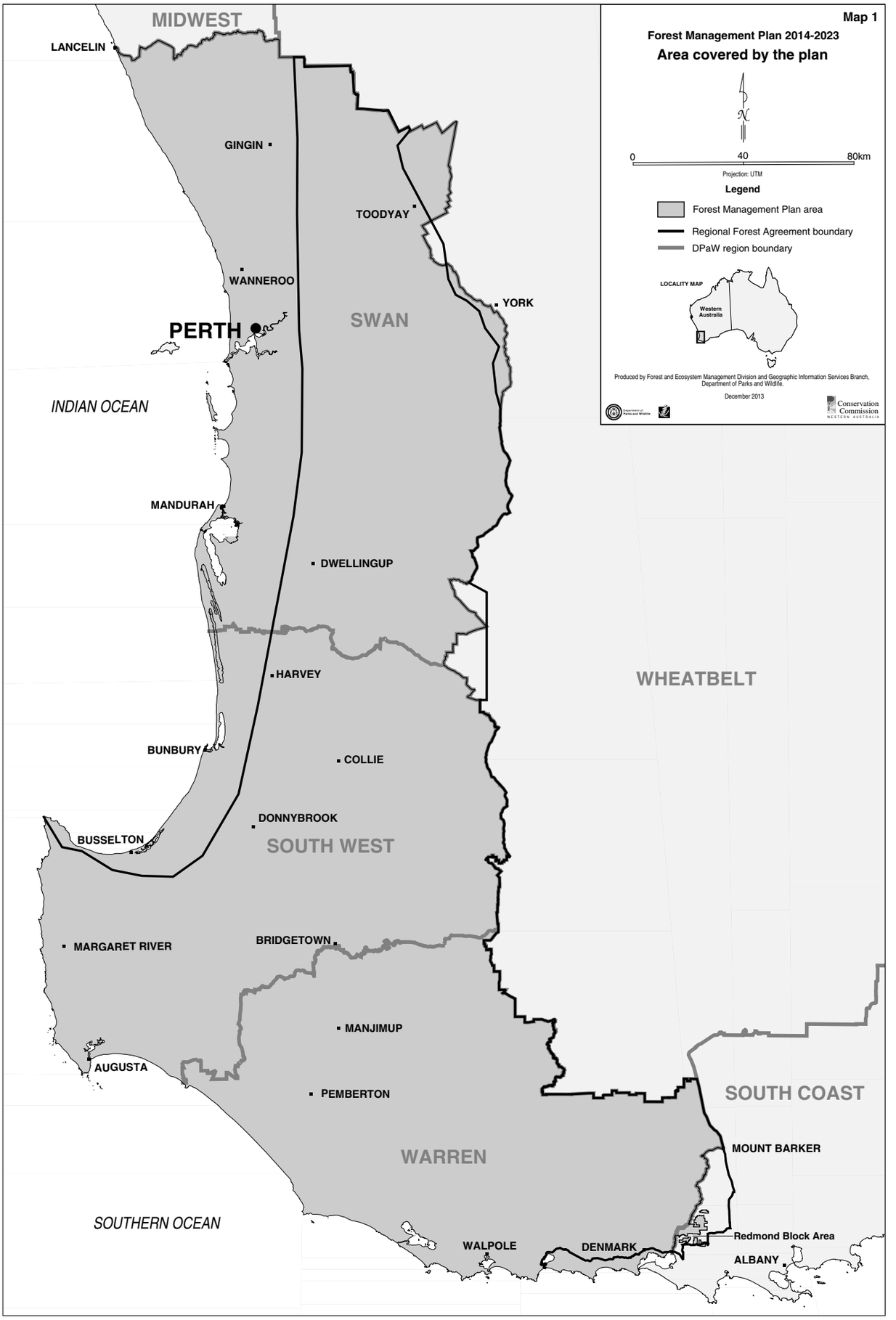
Mineral and petroleum operations on land to which the plan applies provide significant economic and social benefits to the State, and are approved and largely governed by processes managed by other government agencies under legislation such as the EP Act, *Mining Act 1978* (Mining Act) and State Agreements (see Appendix 2). However, management activities are included as relevant to the roles of the Conservation Commission and Department (see 'Biological diversity' and 'Ecosystem health and vitality', in particular).

Plan implementation and management

This chapter looks at processes to monitor and evaluate the implementation of the plan. It is intended that the interagency arrangements between the Department and the FPC be formalised in writing to clarify and improve the current arrangements.

Current arrangements for formally reporting on the implementation of the plan at mid- and end-of-term will be retained. The Department, in consultation with the Conservation Commission, undertook a review of key performance indicators (KPIs) for this plan, and several new and modified KPIs are included. A review of KPIs will also be undertaken at the end of this plan, prior to commencement of the next.

The plan provides for opportunities for consultation with and participation by the community, and relevant non-government organisations and government agencies.


Map 1
Forest Management Plan 2014-2023
Area covered by the plan
N
0
40
80km
Projection: UTM
Legend
Forest Management Plan area
Regional Forest Agreement boundary
DPaW region boundary
LOCALITY MAP
Western Australia
Produced by Forest and Ecosystem Management Division and Geographic Information Services Branch, Department of Parks and Wildlife.
December 2013
Conservation Commission
MIDWEST
LANCELIN
GINGIN
TOODYAY
WANNEROO
YORK
PERTH
SWAN
INDIAN OCEAN
MANDURAH
DWELLINGUP
HARVEY
WHEATBELT
BUNBURY
COLLIE
DONNYBROOK
BUSSELTON
SOUTH WEST
MARGARET RIVER
BRIDGETOWN
MANJIMUP
AUGUSTA
PEMBERTON
SOUTH COAST
MOUNT BARKER
WARREN
SOUTHERN OCEAN
WALPOLE
DENMARK
Redmond Block Area
ALBANY

Background

Principles of ecologically sustainable forest management

ESFM is a set of guiding principles that seeks to conserve biodiversity and ecological integrity, while continuing to provide ongoing social and economic benefits to the community, through the sustainable access to wood and non-wood forest resources and enjoyment of other forest values, including its use as a place for recreation. The Conservation Commission has a statutory role to provide advice on the application of these principles to the Minister for Environment (see section 19 of the CALM Act).

The proposed operations (management activities) included in this plan are guided by the principles of ESFM, as described in section 19(2) of the CALM Act, as ***highlighted*** below.

That the decision-making process should effectively integrate both long-term and short-term economic, environmental, social and equitable considerations. **(Sustainability)**

Decision-making that integrates both long-term and short-term economic, environmental, social and equitable considerations is commonly recognised as sustainable development, or as complying with principles of sustainability. Essentially, this plan seeks to achieve an appropriate balance between different values and uses.

That if there are threats of serious or irreversible environmental damage, the lack of full scientific certainty should not be used as a reason for postponing measures to prevent environmental degradation. **(Precautionary Principle)**

The precautionary principle is concerned with decision-making under uncertainty. The precautionary principle recognises that sometimes action should be taken to prevent damage even where there is no absolute certainty that damage will occur.

That the present generation should ensure that the health, diversity and productivity of the environment is maintained or enhanced for the benefit of future generations. **(Intergenerational Equity)**

This is commonly known as the principle of intergenerational equity. It means that decisions taken today should ensure that at least an equal set of opportunities is available to succeeding generations. Along with the rights to use the resources available, it imposes certain obligations to care for ecosystems so that they retain their health and productive capacity. Again this is a fundamental component of sustainable use and, in relation to the timber industry, specifically the concept of sustained yield. However, it is acknowledged that some uses such as mining are non-renewable.

That the conservation of biological diversity and ecological integrity should be a fundamental consideration in decision-making. **(Conservation of Biodiversity and Ecological Integrity)**

Conservation of biodiversity is one of the purposes for which State forest and timber reserves are managed, and a fundamental consideration in ESFM. The existing and proposed conservation reserves will be managed in an integrated way with State forest and timber reserves, to achieve biodiversity objectives that are consistent with the *National Strategy for the Conservation of Australia's Biological Diversity* (Commonwealth of Australia 1996). This strategy has since been reviewed to produce *Australia's Biodiversity Conservation Strategy 2010-2030* (Commonwealth of Australia 2010a),

which, together with *Australia's Strategy for the National Reserve System 2009-2030* (Commonwealth of Australia 2010b) has been endorsed by the Natural Resource Management Ministerial Council. The 2010 strategy recognises that much of the 1996 strategy remains relevant.

A key principle from the 1996 strategy is that:

> *Central to the conservation of Australia's biological diversity is the establishment of a comprehensive, adequate and representative* (CAR) *system of ecologically viable protected areas integrated with the sympathetic management of all other areas, including agricultural and other resource production systems.*

In forest areas, the concept of maintaining sympathetic (or complementary) management across production land-uses was recognised in the RFA (Commonwealth of Australia and State of Western Australia 1999) in the following statement:

> *The strategy for conserving biodiversity relies not just on a CAR reserve system, but also on the application of ecologically sustainable forest management across all land categories.*

Significant additions to the reserve system were a feature of the previous FMP and resulted in a reserve system that generally exceeds the minimum standards under the *Nationally Agreed Criteria for the Establishment of a Comprehensive, Adequate and Representative Reserve System for Forests in Australia* (Commonwealth of Australia 1997). This plan includes limited proposals for further additions to the conservation reserve system, beyond those identified by the previous FMP, and provides added emphasis on the requirements for ESFM across production land uses, as part of a commitment to seek to ensure that biodiversity is effectively conserved at the whole of forest level and across the plan area[5].

Australia's Biodiversity Conservation Strategy 2010-2030 (Commonwealth of Australia 2010a) contains eight principles that are relevant to the application of the above principle in the plan, including:

- biodiversity is best conserved by protecting existing natural habitats
- effective conservation of biodiversity operates at the landscape scale across public and private tenures; natural ecosystems are dynamic but have a finite capacity to recover from external threats, impacts and pressures
- knowing that our knowledge is limited, we should apply the precautionary principle while employing adaptive management approaches using new science and practical experience.

That improved valuation, pricing and incentive mechanisms should be promoted.

The Conservation Commission has a statutory role to provide advice on the application of the above principles to the Minister for Environment (see section 19 of the CALM Act). In addition, this plan seeks to ensure that proponents causing disturbance bear the cost of measures to minimise any adverse environmental impacts and it also seeks to achieve environmental goals in the most cost effective way.

[5] For example, refer to the 2011 *Review of Silviculture in Forests of South-west Western Australia* (Burrows *et al.* 2011).

Management goals and scales of management

In addition to legislation, Government policy, the Conservation Commission's Strategic Plan and the Department's Corporate Plan provide overall direction.

The overall goals of this management plan, which are outlined in following chapters, are to seek to:

- conserve biodiversity and self-sustaining populations of native species and communities and to allow for the recovery of biodiversity from disturbance operations
- maintain ecosystem health and vitality
- protect soil and water resources
- adapt to climate change and sustain the contribution of the areas covered by the plan to global carbon cycles, consistent with relevant legislation and the achievement of other goals
- sustain the productive capacity of native forest ecosystems and plantations as they progressively adapt to changing climatic conditions
- protect and maintain Noongar and other Australian cultural heritage
- sustain social and economic benefits, through the provision of a range of goods and services valued by the community
- ensure that management is undertaken in a systematic manner in accordance with the plan and is continually improved so as to achieve desired outcomes.

These overarching goals are supported by a number of subsidiary goals for which the plan sets out a range of corresponding operations to be undertaken (management activities).

Ferguson *et al.* (2001) identified a need for explicit setting of whole of forest goals as an integral part of the forest management plan development process. The principles of ESFM have been and are used as a key framework to guide planning and decision-making. These principles need to be applied in a practical sense at various scales (or tiers) in managing the forest, reflecting both the scale and direct effects of operations locally, and as a component of an integrated management system linked into broader scales of strategic planning over longer timeframes. These tiers of management operating at different scales may variously apply to the whole of forest (all land categories), or to issues that relate to production forests alone (State forests and timber reserves). All need to be applied as part of a fully integrated approach to management of the lands covered by the plan.

As in the previous FMP, this plan seeks to address management goals using three scales of management, which are defined as follows:

Whole of forest

All land categories that are subject to the plan (see Table 1)[6].

Landscape

A mosaic where the mix of local ecosystems and landforms is repeated in a similar form over a kilometres-wide area. Several attributes including geology, soil types, vegetation types, local flora and fauna, climate and natural disturbance regimes tend to be similar and repeated across the whole area. It could be a (sub) catchment or, for convenience, an administrative management unit such as a forest

[6] This plan will defer to existing area management plans where they exist, but also function as a management plan for areas where no specific area management plan exists.

block or an aggregation of forest blocks. Landscape scale could span a few thousand to more than many tens of thousands of hectares.

In this plan, reference is sometimes made to Landscape Management Units (LMUs), which are based on mapping of vegetation complexes (see Mattiske and Havel 2002). A map of these LMUs (Map 3) is included at Appendix 3.

Local

A discrete area of land to which one or more operations have been or are planned to be applied. It could span tens of hectares to perhaps a few thousand hectares.

Additionally, some places within areas covered by this plan have been planted with exotic species. **Plantations** are defined as those areas that are predominantly pine species. '**Other exotics'** are defined as areas of exotics within smaller arboreta and trial plots, or that have resulted from past mine site rehabilitation (see Map 4, the 'Glossary' and the 'Productive capacity' chapter).

Legislative framework

The Conservation Commission is an independent controlling body established under the CALM Act. Among the functions of the Conservation Commission are: to have State forest, timber reserves and conservation reserves vested in it; and to prepare management plans for those lands as prescribed in Part V of the CALM Act, according to certain purposes and objectives.

The Conservation Commission has developed this plan through the agency of the Department, in consultation with the FPC in respect of State forest and timber reserves, and the Department of Water and the Water Corporation in respect of public drinking water source areas. The plan has also been informed by consultation with several other agencies and key stakeholders during development of the Draft FMP, and various submissions received on the Draft FMP released for statutory public consultation in 2012.

The WC Act, administered by the Department, provides for the conservation of flora and fauna throughout the State. The Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) also contains provisions relating to the protection of nationally-listed threatened species and ecological communities. In that part of the plan area covered by the RFA (see Map 1), the Commonwealth and State governments have agreed that the CAR reserve system and the forest management system meet the requirements of that Act for the protection of threatened flora and fauna and ecological communities (RFA clause 56). Therefore, the provisions of the EPBC Act for environmental assessment are not triggered for forestry operations.

The land subject to this plan is vested in the Conservation Commission, which has a number of functions as described in section 19 of the CALM Act. For areas with management plans, this includes developing guidelines for assessing their implementation, setting performance criteria, and assessing the performance of the Department and the FPC (as relevant) in implementing those plans. The Department manages land vested in the Conservation Commission according to available resources and management plans. Under the *Forest Products Act 2000*, the FPC is responsible for the harvesting and regeneration of native forest and plantations in State forests and timber reserves, and for the sale of forest products and some associated industry development matters.

The governance framework for the plan is summarised in Appendix 4. As noted in the executive summary, it is intended that the interagency arrangements between the Department and the FPC be formalised in writing to clarify and improve the current arrangements and by the creation of several key additional elements, including that the Department is formally recognised as the regulator (see the 'Plan implementation and management' chapter).

Other relevant legislation

Other Commonwealth and State legislation that has relevance and application to this plan is outlined in Appendix 2.

CONSERVATION AND LAND MANAGEMENT ACT 1984

FOREST MANAGEMENT PLAN 2014-2023

Pursuant to sections 60(2) and 61 of the *Conservation and Land Management Act 1984*, I

(a) approve the following Forest Management Plan 2014-2023

(b) revoke, from 1 January 2014, the Forest Management Plan 2004-2013.

The Forest Management Plan 2014-2023 comes into operation on 1 January 2014.

Minister for Environment

Date: 25·11·2013

Forest Management Plan 2014-2023

1 Application of the plan

Structure

As mentioned, the proposed operations (management activities) in this plan are set out under the seven criteria for sustainability developed in the Montreal Process. However, some issues are relevant to a number of the Montreal Criteria. Generally, each issue is addressed under the criterion most relevant to that issue, although it is appropriate and has been necessary to address some issues under a number of criteria. Management challenges associated with climate change are of particular importance (EPA 2012) and this is covered mainly, but not only, in the 'Biological diversity', 'Ecosystem health and vitality', 'Soil and water', 'Climate change and carbon cycles', and 'Productive capacity' chapters.

Chapters based on the Montreal Criteria include the following (as relevant):

- *Background* – text to provide an introduction to the matters in the chapter and any links to the management of other sections. This section highlights key issues of relevance to the particular chapter, including those that may have gained greater importance during the term of the previous FMP, and where circumstances may have changed.
- *Goal(s)* – a statement of the desired outcome(s).
- *Identified values and threats* – a listing of the values identified that the plan seeks to manage and a listing of identified threats to those values.
- *Relevant policies and guidelines of the Department* – a listing of the policies, guidelines, manuals and other documents which the Department, and other proponents where required by the Department (such as the FPC), will have regard to in conducting the proposed operations.
- *Operations proposed to the undertaken (management activities)* – activities proposed that seek to achieve goals by protecting identified values and/or addressing identified threats.
- *Key performance indicators* – performance targets for key goals (where appropriate). Associated standard reporting measures are covered through the proposed operations (management activities) 130 to 132.

The goal statements which reflect the Conservation Commission's purpose in proposing operations (management activities), are not intended to impose any legal obligation on, or prescribe any action to be taken by, the Department, the FPC or others. The Department and the FPC will act in accordance with the plan by undertaking the operations (management activities) proposed. In doing so, the Department, and others, where required by the Department, will have regard to certain policy, guidelines and/or other documents, as identified.

Scope

This plan applies within the geographic area of the Department's Swan, South West and Warren regions, and the lands collectively referred to as 'Redmond' forest block within the South Coast Region (Map 1), other than marine waters.

This plan covers the management of lands vested in the Conservation Commission:

- Indigenous State forest and timber reserves (Map 5 existing, Map 2 proposed through this plan), including State forest classified as a forest conservation area through section 62(1) of the CALM Act.
- Nature reserves, national parks, conservation parks and other land referred to in section 5(1)(g) and (h) of the CALM Act that has a conservation purpose (Map 5 existing, Map 2 proposed through this plan), recognising the whole of forest context and the role of the formal reserve system in the development of the approach to ESFM.
- State forest and timber reserves planted with exotic species (Map 4 shows the major areas). The application of the plan to these areas is limited to specific proposed operations (management activities) labelled for **Plantations** and **'Other exotics'**.

Of the 2,515,700 hectares of lands vested, or proposed to be vested in the Conservation Commission under this plan, 1,311,600 hectares are in existing or proposed formal reserves or forest conservation areas (see Table 1). In addition, under this plan there are approximately 194,000 hectares of informal reserves and 48,400 hectares of FHZs. In total, under this plan, there are approximately 1,554,000 hectares of protected areas, representing 62 per cent of lands vested in the Conservation Commission within the plan area. The remaining 961,700 hectares are State forests and timber reserves.

More detailed requirements for management activities on these land categories may flow from:

- the requirements of the CALM Act, the WC Act, and other relevant State and Commonwealth legislation
- existing area management plans or those developed during the period of the plan applicable to the particular area (this plan will defer to existing area management plans where they exist, but also function as a management plan for areas where no specific area management plan exists)
- relevant position statements of the Conservation Commission, and policies and subsidiary guidance documents of the Department, and where applicable, those of others (see Appendix 5).

This plan has no relevance for CALM Act marine conservation reserves within the defined geographic area, as these are not vested in the Conservation Commission.

The pricing and allocation of harvested forest products is outside the scope of the plan.

Table 1: Area of land categories covered by the plan (as at June 2013)

State forest (ha)	Timber reserve[1] (ha)	Existing and proposed nature reserves, national parks, conservation parks, CALM Act section 5(1)(g) and 5(1)(h) lands, and State forest classified as forest conservation area (ha)
1,159,600	44,500	1,311,600[2]
1,204,100		

Notes:

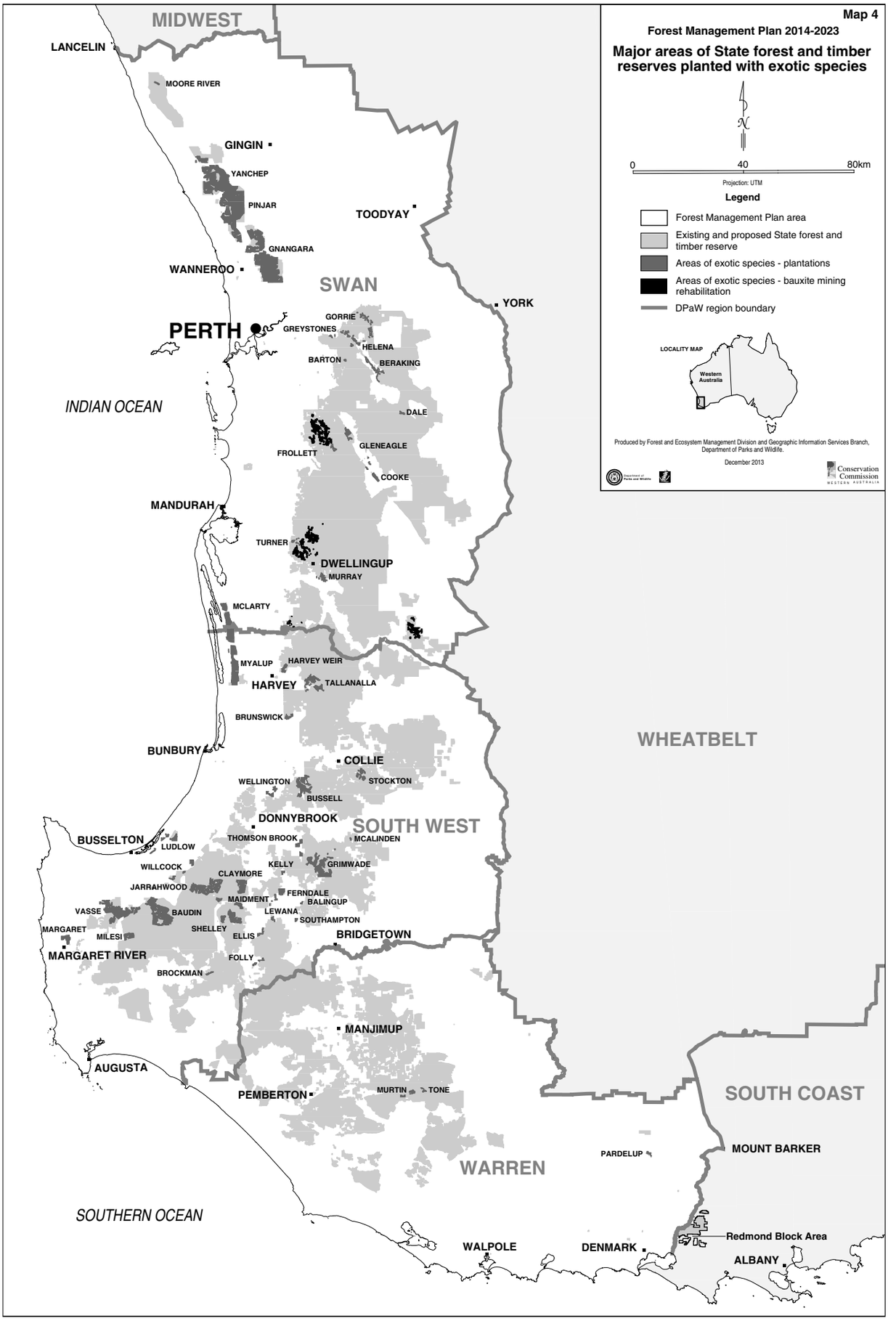
1. Areas of State forest and timber reserve are exclusive of those areas proposed for addition to reserves.
2. The area of these reserves includes 4,040 hectares for which the land category is yet to be determined.
3. There are 50,500 hectares set aside as pine plantation and 3,400 hectares of forest dominated by exotic eucalypt species on State forest and timber reserves on State forest and timber reserve (covered by this plan and included in Table 1). The exotic eucalypts are mainly within rehabilitated mining areas.
4. There are a further 12,000 hectares of pine plantation and 5,200 hectares of native forest on freehold land held in the name of the Conservation and Land Management Executive Body (not covered by this plan) within the Department's Swan, South West and Warren regions. Approximately 3,000 hectares of this native forest are available for timber harvesting and contribute to the sustained yield from native forests.

Purposes for reservation of indigenous State forest and timber reserves

Section 55(1a) of the CALM Act requires the plan to specify the purpose, or combination of purposes, for which an indigenous State forest or timber reserve is reserved, being one or more of the purposes identified in that subsection.

Existing areas of State forest and timber reserves are shown on Map 5. All areas of indigenous State forest and timber reserves within the Swan, South West and Warren regions, other than those identified in Appendix 1, are reserved for the purposes of conservation, recreation, timber production on a sustained yield basis, water catchment protection or other purposes, being a purpose prescribed by the regulations. In 2004, a Conservation and Land Management Regulation (CALM Regulation) was gazetted that allowed State forest and timber reserves to be used for the storage and taking of water (dam sites) and in 2008, the same regulation was amended by the inclusion of an additional use, being the location of infrastructure, and other similar facilities, that serve the public interest, to the extent to which locating such infrastructure and facilities would not be inconsistent with achieving the other purposes for which the area is reserved.

However, this plan proposes that some areas (such as unallocated Crown land) be reserved as State forest, and that some State forest and timber reserves be reclassified as national park, conservation park, nature reserve or forest conservation area (as carried forward from the previous FMP and as proposed in this plan, mainly for the Whicher Scarp area – see the 'Biological diversity' chapter). These areas are identified in Map 2 and Appendix 1. It is proposed that where possible, areas vested in the Conservation Commission be managed consistent with their intended future purpose, until they have been formally reclassified as proposed by this plan. The purpose for reservation of proposed forest conservation areas is as per other areas of State forest and timber reserves, except that timber production on a sustained yield basis is not included.


Map 4
Forest Management Plan 2014-2023
Major areas of State forest and timber reserves planted with exotic species
N
0
40
80km
Projection: UTM
Legend
Forest Management Plan area
Existing and proposed State forest and timber reserve
Areas of exotic species - plantations
Areas of exotic species - bauxite mining rehabilitation
DPaW region boundary
LOCALITY MAP
Western Australia
Produced by Forest and Ecosystem Management Division and Geographic Information Services Branch, Department of Parks and Wildlife.
December 2013
Conservation Commission
WESTERN AUSTRALIA
MIDWEST
LANCELIN
MOORE RIVER
GINGIN
YANCHEP
PINJAR
GNANGARA
WANNEROO
TOODYAY
SWAN
YORK
PERTH
GORRIE
GREYSTONES
HELENA
BARTON
BERAKING
INDIAN OCEAN
DALE
GLENEAGLE
FROLLETT
COOKE
MANDURAH
TURNER
DWELLINGUP
MURRAY
MCLARTY
MYALUP
HARVEY WEIR
HARVEY
TALLANALLA
BRUNSWICK
BUNBURY
WHEATBELT
COLLIE
WELLINGTON
STOCKTON
BUSSELL
DONNYBROOK
SOUTH WEST
BUSSELTON
THOMSON BROOK
MCALINDEN
LUDLOW
WILLCOCK
KELLY
GRIMWADE
CLAYMORE
JARRAHWOOD
MAIDMENT
FERNDALE
BALINGUP
VASSE
BAUDIN
LEWANA
SOUTHAMPTON
MARGARET
MILESI
SHELLEY
ELLIS
BRIDGETOWN
MARGARET RIVER
FOLLY
BROCKMAN
MANJIMUP
AUGUSTA
PEMBERTON
MURTIN
TONE
SOUTH COAST
PARDELUP
MOUNT BARKER
WARREN
SOUTHERN OCEAN
Redmond Block Area
WALPOLE
DENMARK
ALBANY

Operation of the plan

This plan comes into operation on 1 January 2014 and continues to operate until 31 December 2023 and revokes the previous FMP. As many of the requirements of the plan are complex, the various parts of the plan will be implemented progressively according to available resources. Reports on the plan's implementation will make clear which activities are not being progressed or fully implemented due to resource constraints.

The previous FMP had certain Ministerial conditions and commitments attached to its implementation pursuant to the EP Act. The previous FMP has been revoked, so that those Ministerial conditions and commitments attached to its implementation will no longer be in force. However, issues to which those Ministerial conditions relate that have ongoing relevance to forest management have been addressed in this plan. This plan is a separate proposal which following public consultation, was assessed by the EPA under the EP Act and as a consequence a new Ministerial Statement is applicable (see page 205).

In the following parts of this plan, reference is made to various existing or proposed policies and guidelines of the Department[7] (also see Appendix 5). These may be revised from time to time, or be replaced during the period of the plan. Other relevant policies and guidelines may be developed during the term of the plan that the Department (and others, where required) may also need to have regard to when undertaking particular proposed operations (management activities). It is intended that the Department's key documents will be prepared and/or reviewed in accordance with the Department's Policy Statement 1: *Department of Environment and Conservation – Key documents*.

Note there is a considerable range of other regional, State and national policies and strategies that may be relevant to the plan, and where required, and otherwise where appropriate, the Conservation Commission and Department endeavour to ensure they align their activities with these. These other documents are not necessarily identified within this plan.

[7] and in some cases, where relevant, those of others, endorsed by the Department.

2 Biological diversity

Background

Biological diversity (biodiversity) refers to the variability in structure and function of living organisms and the ecosystems of which they are a part. The south-west of Western Australia, from Shark Bay to the western edge of the Great Australian Bight, is an internationally recognised megadiverse 'hotspot' (Mittermeier *et al.* 1999) and the conservation of biodiversity is a driving factor in shaping the proposals in this plan. Conserving biodiversity requires maintenance of a diversity of habitats and ecological processes at various spatial scales, from entire forested landscapes to specific localised habitats. It also includes sustaining populations and maintaining their genetic diversity. Noongar knowledge of plants, animals, ecosystems and seasons has developed over thousands of years and contributes to biodiversity conservation, just as the protection of biodiversity conserves and protects Noongar cultural values.

Biodiversity and biodiversity components are defined in Part I, section 3 of the CALM Act as follows:

> *'Biodiversity' means the variability among living biological entities and the ecosystems and ecological complexes of which those entities are a part and includes –*
>
> *(a) diversity within native species and between native species*
>
> *(b) diversity of ecosystems*
>
> *(c) diversity of other biodiversity components.*
>
> *'Biodiversity components' includes habitats, ecological communities, genes and ecological processes.*

Lindenmayer *et al*. (2006) propose five general principles as follows for conservation of biodiversity in forested landscapes and a range of strategies that may assist in providing for these principles, with the overall goal being to prevent habitat loss.

1. *Maintenance of connectivity*. The linkage of habitats, communities and ecological processes influences population persistence and recovery after disturbance. This is addressed through the establishment and management of formal reserves and forest conservation areas which serve to provide large areas of structurally complex patches of native vegetation; by the protection of riparian areas, other corridors and sensitive habitats in informal reserves; and by vegetation retention requirements in areas subject to timber harvesting.
2. *Maintenance of landscape heterogeneity*. Landscape heterogeneity is a feature of natural forests as a result of natural environmental gradients and natural disturbance processes, which create differing habitat patches of importance for many species. This is addressed through the establishment and management of smaller formal reserves and forest conservation areas; the protection of riparian areas, other corridors and sensitive habitats in informal reserves; and by dispersion in space and time of areas subject to disturbance by timber harvesting and prescribed fire. Consideration of natural disturbance regimes also contributes to maintenance of landscape heterogeneity.
3. *Maintenance of stand structural complexity*. This is a feature of natural forests and creates habitat patches of importance for some species, but at a much finer scale than the landscape. This is addressed in silviculture guidelines through retention of structures and organisms in timber harvesting or by their reintroduction following mining. Natural disturbance regimes and rotation lengths also contribute.

4. *Maintenance of intact aquatic ecosystems*. Streams, rivers, wetlands, lakes and other water bodies are critically important to biodiversity and ecosystem function, particularly given the relatively dry climate experienced in the plan area and predicted impacts of future climate change. This is addressed through the establishment and management of informal reserves, as described below, and in the 'Soil and water' chapter.
5. *Knowledge of natural disturbance regimes to inform human disturbance regimes*. This recognises that timber harvesting regimes and fire regimes should be informed by natural disturbance regimes. Timber harvesting is described below and silviculture is described further in the 'Productive capacity' chapter. Fire management is described in the 'Ecosystem health and vitality' chapter.

Additionally, Fischer *et al*. (2006) proposed broad strategies for the conservation of biodiversity, many of which are covered above. However, they also identified some additional strategies, being to:

- control aggressive, over-abundant, and invasive species – this is addressed through the management of weeds, pests and diseases in the 'Ecosystem health and vitality' chapter
- minimise threatening ecosystem-specific processes – this is addressed through the management of mining and infrastructure development and maintenance sections below
- protect species of particular concern – this is addressed through the management of threatened species and communities section below.

Conserving environmental heterogeneity and biodiversity helps ensure that ecosystems remain productive and resilient to disturbance. Resilience of natural areas and ecosystems is related to their biological and structural diversity, size, connectivity and the nature of disturbances within and around them. Conserving broad genetic variability within populations retains greater scope for tolerance to a wider range of environmental conditions. In this respect, the possible impacts of climate change are of particular importance to biodiversity management (for example, see Climate Commission 2011; *National Biodiversity and Climate Change Action Plan 2004-2007*, Commonwealth of Australia 2004).

In areas expected to be subject to warmer temperatures and further drying of the climate, such as south-west Western Australia (see the 'Climate change and carbon cycles' chapter), topographically restricted and/or hydrologically defined micro-habitats may provide refuge for certain water-dependent flora and fauna, and/or more reliable sources of water to assist the persistence of other fauna resident in the wider landscape. However, Dunlop *et al.* (2012) warn that there is a limit to the buffering capacity that refuges can provide to enduring environmental stress (such as from ongoing drying of the climate), noting there will probably be some unavoidable loss of biodiversity in some places. Some wetter areas may dry out and lose their value as habitat and refugia for some species.

The Department continues work on modelling biodiversity responses to investigate the potential vulnerability of native flora and fauna to climate change, to inform the development and review of a 'climate-biodiversity' strategy. Nevertheless, a network of protected areas has long been recognised as a core component of strategies to conserve biodiversity. Thompson *et al*. (2009) also reiterate the importance of maintaining connectivity across landscapes, by minimising fragmentation and retaining (or re-establishing) ecological corridors to allow movement of species. Within the plan area, there is a network of informal reserves that helps serve this purpose and provides additional refuges, complemented by other measures to maintain habitat and minimise the impacts from disturbance operations in other areas (see 'Integrating biodiversity management across the plan area', below, and the 'Productive capacity' chapter; and activities to manage fire, weeds, pests and diseases outlined in the 'Ecosystem health and vitality' chapter). Together, these measures seek to promote resilience and the effective conservation of biodiversity at the whole of forest level and across the plan area.

Monitoring will also be important, and in this plan, it is intended that the Department's key forest biodiversity monitoring program, *FORESTCHECK*, which was conducted during the previous FMP, be continued. To date, *FORESTCHECK* has been applied within the jarrah forest (and comments on key findings are included later, under 'Integrating biodiversity management across the plan area'). In the end-of-term audit of the previous FMP (Conservation Commission 2012a), it was suggested that *FORESTCHECK* be reviewed to fill gaps, including for example, extending it to cover areas where survey effort has been relatively low so far, and to provide a basis for monitoring the impacts of climate change on biodiversity. In its assessment of the Proposed FMP, the EPA (2013), recommended that monitoring programs (including *FORESTCHECK*) be extended to include key climate change indicators, a greater diversity of forest types, a full range of threats to the forest and possibly other parameters such as microorganisms, and a greater focus on the impacts of soil compaction. Further comments in relation to monitoring are included in the 'Plan implementation and management' chapter.

In addition to the measures described in this plan, there are a number of other initiatives and activities occurring within the geographic area covered by the plan that contribute to a broader effort to conserve biodiversity (for example, work carried out through regional natural resource management groups and by volunteer organisations).

Description of reserves and proposed additions and changes

Formal conservation reserves

Formal conservation reserves include national parks, nature reserves, conservation parks and CALM Act section 5(1)(g) and 5(1)(h) areas. Timber harvesting and a range of other disturbance activities are not permitted in these areas (although some restricted harvesting may be allowed on certain tenures with Ministerial approval, Conservation Commission endorsement and under permit, for example, for removal of smaller pine trial plots and other exotics).

As explained in the 'Background' section of this plan, the establishment and maintenance of a CAR reserve system is fundamental to the conservation of biodiversity in the plan area. This plan carries forward proposals from the previous FMP as listed in Appendix 1 and shown on Map 2, and includes some areas not currently vested in the Conservation Commission. Consultation with relevant agencies on these earlier proposals is progressing and it may take some time to conclude the remaining administrative steps in the processes involved. Appendix 6 and 7 provide the area and percentage reservation levels respectively for forest ecosystems within the RFA area[8], and Appendix 8 provides similar statistics for the reservation level of old-growth forest. Since the scope of the plan extends beyond the area covered by the RFA, Appendix 9 and 10 provide data for Beard-Hopkins vegetation associations (Hopkins *et al*. 1996) within and outside the RFA area.

Significant additions to the reserve system are a feature of the previous FMP. When fully implemented, this will result in a reserve system that generally exceeds the minimum standards set under the *Nationally Agreed Criteria for the Establishment of a Comprehensive, Adequate and Representative Reserve System* (CAR) *for Forests in Australia* (Commonwealth of Australia 1997). This plan includes limited proposals for some further additions to the formal reserve system, beyond those identified by the previous FMP, for areas within the Whicher Scarp, as indicated in Map 2, and discussed next.

[8] The design of the reserve system has been addressed in two separate parts because of the different levels of vegetation mapping available. Map 1 shows the RFA boundary.

Proposed additions to Whicher National Park

Results from *FORESTCHECK* show that the pattern of occurrence of a broad range of biodiversity is strongly related to vegetation systems, which formed the basis for design of the existing formal reserve system. Additional information gathered since the commencement of the previous FMP supports recognition of the flora and vegetation complexes associated with the Whicher Scarp (see Map 2) as a separate 'forest ecosystem' (see the glossary for a definition of this). In summary, the biodiversity values of the Whicher Scarp forest ecosystem include a diverse and rich flora that includes many rare species, endemic species, species at the end of their range, restricted and rare wetland communities, and a diverse suite of woodland communities. As a consequence of the recognition of the Whicher Scarp as a separate forest ecosystem, additional formal reserves are required in this area if the reservation targets are to be achieved. It is proposed that the areas be reclassified as national park, subject to legislative and government policy requirements, including consultation with the Department of Mines and Petroleum and the Minister for Mines and Petroleum.

Table 2 provides a summary of reservation of forest ecosystem types in formal conservation reserves, including the proposed additions to the Whicher National Park.

Table 2: Reservation levels of forest ecosystem categories (within the extended RFA area)

Forest ecosystem category	**Total pre-1750 extent (ha)**	**Present extent within the plan area (ha)**	**Formal conservation reserves**				**Forest Conservation Areas (proposed) (ha)**
			Existing reserves (Proposed additions and changes in land category) (ha)				
			National park	**Nature reserve**	**Conservation park**	**5(1)(g) & (h)**	
Jarrah dominant	2,780,250	1,809,040	380,830 (86,100)	63,200 (9,830)	16,140 (47,100)	13,890 (250)	(27,970)
Karri dominant	231,600	190,160	89,930 (940)	270 (100)	10 (410)	40 (0)	(1,690)
Wandoo dominant	526,200	218,680	37,620 (14,630)	12,690 (1,130)	8,010 (24,250)	20 (0)	(50)
Other	625,800	425,590	274,740 (16,500)	16,260 (2,410)	610 (1,310)	990 (0)	(10,750)
TOTAL	**4,163,850**	**2,643,470**	**901,290**	**105,890**	**97,840**	**15,190**	**40,460**

Notes:

1. The RFA area has been extended to include the full extent of the Darling Scarp and Whicher Scarp ecosystems. This has resulted in an increase in the 'Total pre-1750 extent' total figure being higher than the previous FMP.
2. The figures for 'Present extent within the plan area' are for all land tenures, including private property, within the area covered by the plan (Map 1) and the proposed additions to Whicher National Park.
3. The table shows the full extent of forest ecosystems reported in Appendix 6. It does not show the total of each tenure category which may also include reservoirs, exotic species, and cleared land.

Forest conservation areas

This plan identifies some areas that are proposed for classification as forest conservation areas under section 62(1) of the CALM Act (see Map 2), which are based on those proposed under the previous FMP (i.e. they are carried forward to this plan). Forest conservation areas are proposed to provide a higher level of security of classification than informal reserves for areas that have some impediment (for example, mineral resources) to being considered for a formal reserve category. The priority for the management of these areas is the maintenance of biodiversity and they will not be available for timber harvesting, but may be available for other uses such as wildflower picking, apiculture, craftwood, and possibly firewood collection. The latter would be considered on an area by area basis. Otherwise, where an approved area management plan exists, whatever it sets out for particular forest conservation areas within its boundaries would apply.

Informal reserves

Informal reserves provide a network of relatively undisturbed areas that are distributed across State forest and timber reserves within the plan area and protect aquatic ecosystems, provide connectivity, landscape heterogeneity and stand structural complexity, thereby making an important contribution to conservation outcomes. Appendix 11 describes the types and purpose of informal reserves.

In this plan, there are some changes to certain informal reserve types compared to the previous FMP, as outlined next. There are no changes to the purpose, location or aggregate area of other informal reserve types, *other than* those listed below.

Old-growth forest

In June 2013, there was a total of 334,231[9] hectares of old-growth forest recognised in formal or informal reserves (up from 331,370 hectares at the commencement of the previous FMP).

The previous FMP included a category referred to as 'old-growth forest under review'. The Conservation Commission progressively checked the status of these areas, which were reclassified from old-growth forest to non old-growth forest by the Department prior to the previous FMP, because of updates to harvest history, forest ecosystem and *Phytophthora* dieback records. The Conservation Commission's review of about one quarter of the 9,400 hectares of this category, which was mainly in areas of karri forest recorded as being clearfelled and regenerated, confirmed that over 94 per cent of the patches were not old-growth forest. In turn, the Department's data have been confirmed as valid and unbiased and the category of 'old-growth forest under review' is no longer applicable. The Department will continue its routine field inspection process, as described in the *Guidelines for Protection of the Values of Informal Reserves and Fauna Habitat Zones* (DEC 2009a), to update data, as required. This process is to include checking of areas in the previous category referred to as 'old-growth forest under review'.

In the previous FMP, some small areas were designated as 'Areas previously classified as old-growth forest' as a type of informal reserve. These are areas in the corporate database classified as old-growth forest at the start of the previous FMP that were subsequently determined not to be old-growth forest or any other type of informal reserve. This category is a legacy, 'default' category that does not provide protection to areas with any special conservation values that warrant protection as an informal reserve and accordingly, this category will no longer be recognised. Additionally, when areas mapped as old-growth forest are found not to be old-growth forest or any other type of informal reserve, they will no longer be recognised as an informal reserve. Of the 334,231 hectares of old-growth forest at June 2013, 93 per cent occurs in existing or proposed formal reserves and forest conservation areas

[9] 356 hectares of the additional old-growth forest arises from the inclusion of 'Redmond' forest block in this plan.

(Appendix 8). The seven per cent remaining, or 22,904 hectares, occurs in the various categories of informal reserves on State forest, including the 16,050 hectares that are in the old-growth forest informal reserve type. Categorisation of these 16,050 hectares may be progressively reviewed as part of the planning for disturbance operations.

The definition of old-growth forest under this plan remains the same as for the previous FMP. As noted in the end-of-term audit report (Conservation Commission 2012a), the Department has been developing a procedure to refine the methods for identification and demarcation of old-growth forest, and intends to finalise this procedure in consultation with the Conservation Commission. Once finalised, the Department's *Guidelines for Protection of the Values of Informal Reserves and Fauna Habitat Zones* (DEC 2009a) are to be updated to refer to this procedure.

This plan acknowledges that the total extent of old-growth forest can change over the long term as a consequence of events (for example, altered spread and extent of dieback in jarrah forests, stand changing bushfire in karri) and as datasets are refined or updated (for example, the incorporation of previously unmapped areas of old-growth forest or the exclusion of areas found not to be old-growth forest). It is important to maintain corporate datasets that reflect the field reality as closely as possible. Continuous improvement in datasets, mapping techniques and field survey will generate relatively small changes. To record this, it is intended that the Department publish a map on its website each year, depicting the status and extent of the old-growth forest at the end of the previous year, which identifies and explains any variations that have occurred during the previous year. Map 6 depicts the extent of old-growth forest as recorded in the Department's databases at June 2013.

Assessment of the old-growth forest status of areas subject to proposed timber harvesting is a routine requirement on State forest and timber reserves. However, the checking for old-growth forest as part of planning for other operations has not been as systematic and those planning processes are to be revised to seek to ensure a consistent approach to all disturbance operations on all land categories.

- Nomination and assessment of previously unmapped old-growth forest

During the previous FMP, an additional 2,260 hectares of previously unmapped old-growth forest were set aside in informal reserves following review of areas by the FPC, the Department and the Conservation Commission. Management options for nominating and reviewing areas as previously unmapped old-growth forest were presented in the Draft FMP and for this plan, the following approach is to be used.

As noted above, the Department intends to finalise a procedure to refine the methods for identification and demarcation of old-growth forest in consultation with the Conservation Commission. Prior to this being completed, the current system, whereby public nominations are received and assessed by the Conservation Commission using its assessment process and field assessment criteria, will be maintained. It is intended that following the finalisation of the Department's procedure, the system for nomination and assessment of old-growth forest be managed by the Department.

Travel routes

These informal reserves provide linkages between other formal and informal reserves, thereby making an important contribution to conservation outcomes, while also providing socio-economic benefits (particularly for recreation and tourism). Travel routes along certain roads within the Department's Warren Region were established in the previous FMP, along with a travel route for the Bibbulmun Track where it occurs in State forest or timber reserve in areas covered by this plan (for which there are *no* proposed changes in this plan).

As a result of changing patterns of usage, the Department conducted a review of travel routes in the Warren Region. The review aimed to identify those travel routes that would provide most benefit in

terms of managing scenic quality and considered among other things, changes in land category, the levels and nature of use of the road network, and the effect of application of silvicultural practice (for example, with respect to visual amenity). Appendix 11 lists the travel routes that are to be recognised as informal reserves.

The Department also evaluated the use of the Munda Biddi Trail by off-road cyclists and the management issues associated with user safety and enjoyment, given disturbance operations that may occur within State forest and timber reserves. In addition to conditions imposed on disturbance activities for the majority of the length of the trail, conditions will be established on a case by case basis with the objective that the amenity and integrity of the trail be maintained as much as practicable. For example, timber harvesting activities such as establishment of log landings and creation of gaps adjacent to the trail would be considered inappropriate in many cases.

The travel route zone will include a:

- 200 metre zone around Munda Biddi Trail campsites (i.e. 400 metre diameter zone)
- 50 metre zone around bridges and crossings that form part of its designated route (i.e. 100 metre total width of zone)
- 50 metre zone around sections of constructed 'single' trail (i.e. 100 metre total width of zone).

Integrating biodiversity management across the plan area

Landscape heterogeneity promotes resilience and provides multiple opportunities to support the range of natural biodiversity that exists. In addition to the establishment of formal reserves, a network of informal reserves, and areas temporarily unavailable for timber harvesting, the plan seeks to maintain connectivity at a landscape and whole of forest scale, and achieve stand structural complexity and understorey vegetation diversity at the local and landscape scale, through a range of other complementary measures, as outlined in this part.

Protecting threatened and priority species and communities

Populations of threatened and priority flora and fauna, and threatened and priority ecological communities occur within the plan area and need to be protected. Their continued survival and ability to recover is potentially affected by a range of processes, such as inappropriate fire regimes, predation by feral animals, salinity and introduced plant pathogens, and potentially, climate change. In addition, activities associated with land use and management have the potential to impact them, including, for example, road construction and infrastructure development, mining, timber harvesting, wildflower picking (see 'Other forest produce' in the 'Productive capacity' chapter), prescribed burning, recreational facility development and public use and access.

Populations are identified in planning processes associated with proposed disturbance activities, and any particular measures necessary to protect them are determined and included in conditions, if approval is granted by the Department. Others require special management attention, which is described in a series of recovery plans that identify threats and planned remedial actions. Appendix 13 outlines recovery plans relevant to the plan area.

The management procedures and systems that contribute to the protection of these populations include:

- Maintaining databases of the locations of threatened species and ecological communities, conducting searches where high impact disturbance such as road making is proposed, and maintaining licensing systems and compliance checking programs where any threatened flora is proposed to be 'taken'.

- The development of the Forest Vertebrate Fauna Distribution Information System (Christensen *et al.* 2001), which is reviewed periodically. The system combines the vegetation complexes mapped for the RFA into fauna habitats and correlates those habitats with the likely presence in them of particular vertebrate fauna species. It can then be used to predict the likely occurrence of sensitive species, relative to planned management activities.

Strategies for the maintenance of biodiversity continue to evolve as knowledge increases. The continuation of research and other processes to increase the knowledge base is an essential part of management. For example, recovery plans can be revised as required to take into account changing circumstances, such as the expected impacts of climate change. Recovery plans are in place for black cockatoo species and include actions to remove feral honeybees from nesting hollows, managing nest hollows to increase recruitment of cockatoos, and identification and management of feeding and breeding habitat critical to survival of important populations.

In addition, in some LMUs (see Map 3), there are relatively fewer 'legacy' habitat elements (such as tree hollows and fallen, hollow logs), and accordingly, in those areas, additional management emphasis is applied to help ensure this habitat is protected, wherever practicable. For example, this includes greater retention of marri habitat trees in these LMUs for those areas subject to timber harvesting, through inclusion of this requirement in silviculture guidelines, and reviewing fire management guidance documents to reflect the importance of legacy elements in these areas (see below and activity 16).

Managing key disturbance activities

Different types of disturbance activities have different impacts, varying in scale and duration. Key disturbances with potential impacts on biodiversity are mining activities, infrastructure development and maintenance, work carried out on boundaries of prescribed burns and bushfires, and timber harvesting.

Mining

While most mined areas are rehabilitated with native species, there are enduring impacts on habitat and biodiversity, soils, water, carbon, production of wood and other forest produce, and recreation values. Exploration, extraction and rehabilitation activities are approved and largely governed by processes managed by other government agencies under legislation such as the EP Act, Mining Act and State Agreements (see Appendix 2). However, there is still considerable input required from the Conservation Commission and the Department in relation to processes associated with approvals, oversight of current operations, development of rehabilitation requirements and post hand-back management of rehabilitated sites (see 'Developing self-sustaining ecosystems' in the 'Ecosystem health and vitality' chapter).

Each year, about 1,000 hectares of State forests and timber reserves are subject to mining operations that include clearing, principally for extraction of bauxite (Darling Scarp north and east from Collie), coal (east of Collie) and gold (near Boddington). This could increase if other mining proposals are approved. Given the potential cumulative, long-term impacts from mining, this plan includes a number of proposed mitigating activities (see the 'Operations proposed to be undertaken (management activities)', later in this chapter).

Infrastructure development and maintenance

There is a considerable network of roads, tracks and railways (some no longer in use), communications, water, power, gas and other utility structures and corridors throughout the plan area that service and support metropolitan and rural communities and a wide range of industries, provide access for people for tourism and recreation, and are critical for routine functioning of the economy.

However, many of these corridors are cleared and further fragment areas of native vegetation and habitat, and provide opportunities for the spread of invasive species and disease-causing agents. Management of weeds, pests and diseases is addressed in the 'Ecosystem health and vitality' chapter. The other potential impacts are addressed in the 'Operations proposed to be undertaken (management activities)', later in this chapter.

Prescribed burning and bushfires

Prescribed burning has a range of potential impacts, particularly for understorey vegetation and fauna habitats, which are assessed as part of the planning and post-burn monitoring process, as described in the 'Ecosystem health and vitality' chapter. Departmental guidelines address a range of issues, including work associated with preparation of prescribed burn boundaries.

Timber harvesting

Native forest timber harvesting involves varying degrees of removal of overstorey trees and disturbance of understorey by machinery, with potential impacts on soil and water (see the 'Soil and water' chapter) and other values. Within the plan area, harvesting is dispersed in space and time across the available area.

Silviculture guidelines include measures designed to minimise the potential impacts of timber harvesting on other values, which focus on maintaining stand complexity and structural diversity, and defining the type and extent of habitat elements and future 'crop' trees that must be retained. Habitat requirements (for example, for nesting, roosting and foraging) for fauna are considered in determining the criteria for selection and retention of habitat trees and coarse woody debris (for example, hollow logs) on the ground.

Silviculture guidelines are revised from time to time to incorporate new knowledge. As required by the previous FMP, an expert panel completed a review of silvicultural practices (in 2011) and found:

> *In summary, the Panel identified a number of relatively minor issues of potential concern… regarding biodiversity conservation and silvicultural prescriptions that require attention, but overall, existing and proposed practices should sustain biodiversity and forest productivity at the local forest scale.*

Proposed changes to silviculture guidelines arising from the review were outlined in the Draft FMP. The Draft FMP also noted that the conservation status of some black cockatoo species had declined in recent decades, and the end-of-term audit of performance report for the previous FMP (Conservation Commission 2012a) noted the need to reconsider applicable conservation strategies. Significant threats to cockatoo populations include illegal culling and competition for nest sites with native and introduced species, most notably feral bees. Silviculture guidance will continue to require the retention of mature trees to maintain the availability of shelter and nest sites for hollow dependent fauna including black cockatoos. As black cockatoos have shown a preference for nesting in marri and marri represents an important food source for cockatoos, it is intended that, where practicable, large senescing marri trees be retained in the jarrah forest, in addition to the existing requirement for habitat tree retention. Furthermore, in areas of the jarrah forest where large marri are relatively low in abundance[10], additional marri trees will be retained. The marri retention requirements are detailed in the jarrah silviculture guidance documents. Consideration will also be given to recording the location of habitat trees and logs marked for retention, to aid their protection during subsequent operations. However, the feasibility of this requires evaluation.

[10] in the LMUs Darkin Towering, Eastern Blackwood, Eastern Dissection, Eastern Murray, Monadnocks Uplands Valleys, North Eastern Dissection, Northern Sandy Depression, Northern Upper Plateau, North Western Dissection, North Western Jarrah, Redmond Siltstone Plain – see Map 3 (Appendix 3).

Long-term research and monitoring, including that conducted through the Department's major monitoring project, *FORESTCHECK*, show that forest biodiversity is resilient to disturbance from silvicultural operations. Comparison of biodiversity at sites where timber harvesting has occurred in the jarrah forest at a range of intensities, and at reference sites, shows that '*few significant impacts were evident and most species groups were resilient to the disturbance imposed*' (Abbott and Williams 2011). Species assemblages in harvested forest return to those typical of unharvested forest as the structure of the forest, and specific habitats, re-establish. The length of time required for this process may vary from a few years to several decades, depending on the intensity of disturbance and the requirements of particular species. Some structural elements of the forest such as tree hollows and large coarse woody debris can take many decades to form and must therefore be retained in-situ during silvicultural operations. *FORESTCHECK* monitoring showed that in the jarrah forest '*for all species groups studied*' (vascular flora, macrofungi, lichens bryophytes mosses, macroinvertebrates birds and terrestrial vertebrates) '*the imprint of harvesting 40 or more years earlier on species composition had become indistinguishable from that on grids never harvested*' (Abbott and Williams 2011).

Biodiversity can be conserved by a forest management regime that embeds silvicultural operations in a mosaic of connected areas where no harvesting occurs, and where specific measures are applied to conserve important habitat elements at the local scale in areas where harvesting does occur. Conservation of some species may require specific measures, such as controlling feral predators. Accordingly, in addition to the requirements set by the silviculture, soil and water protection and other relevant guidelines, further conditions may be set for individual timber harvesting operations through the Department's approval processes, to minimise potential impacts on any specific site-level values.

Conservation of flora

The previous FMP included actions to protect significant flora species and the end-of-term audit (Conservation Commission 2012a) found that not all of these actions had been fully implemented. It is intended that these be implemented progressively as resources permit.

Fauna habitat zones

Fauna habitat zones (FHZs) were introduced in the previous FMP as a mechanism at the landscape scale to provide a rotating source of fauna to recolonise disturbed areas as they regenerate or recover from timber harvesting (as explained in the previous FMP, areas identified as FHZs can be rotated over time as alternative areas of regenerating forest are able to replace the purpose of established FHZs). Indicative zones of about 200 hectares in size were located systematically across State forest and timber reserves, to provide a separation distance of about three kilometres between FHZs and areas of mature forest located within formal reserves. This design resulted in a net area of 52,033 hectares of State forest and timber reserves being set aside from timber production.

FHZs have been noted as an important element in the forest matrix that contributes to the maintenance of biodiversity values in these landscapes (Burrows *et al.* 2011). In this plan, the network of FHZs has been refined so that it better complements formal and informal reserves and provides improved biodiversity conservation outcomes. The refined network has the following characteristics:

- A reweighting of the area allocated to FHZs to forest ecosystems with lower levels of representation in the conservation reserve system. This has resulted in an increased area of FHZs in the Jarrah North West, Jarrah North East and Wandoo Forest and Woodland forest ecosystems, and a lesser area of FHZs in the Jarrah Sandy Basins, Jarrah Blackwood, Jarrah South and Karri Main Belt forest ecosystems.
- A slightly greater area of mature forest and a greater proportion of the area in FHZs being mature forest.

- A lesser area of regrowth forest in FHZs.
- A lesser total area in FHZs (a net area of approximately 48,400 hectares).
- A greater range of size of FHZs in recognition of the characteristics of the landscape in which they are located. For example, some FHZs as small as 50 hectares are located in areas affected by bauxite mining to more effectively sample the mature forest in these areas. Larger FHZs are located in other areas (see next).
- Larger FHZs are located in Batalling forest block (a recognised area for fauna values), portions of Molloy and Rapids forest blocks adjacent to the upper reaches of the Margaret River (areas of highly prospective habitat for threatened fauna, including invertebrates and quokka), Topanup forest block (to consolidate a poorly represented vegetation complex), together with the consolidated FHZ included in the previous FMP in portions of Kingston, Mersea and Warrup forest blocks.

Goals

An overall goal of the plan is to seek to conserve biodiversity and self-sustaining populations of native species and communities, and to allow for the recovery of biodiversity from disturbance operations. This overarching goal is supported by a number of subsidiary goals below, for which the plan proposes a range of corresponding activities, as set out under 'Operations proposed to be undertaken (management activities)', commencing on page 41.

CAR formal reserve system
The plan proposes activities at the whole of forest scale for the purpose of seeking to conserve biodiversity and ecological integrity in all native forest ecosystems through the establishment and management of a system of reserves that is comprehensive, adequate and representative.

Forest conservation areas and informal reserves
The plan proposes activities at the whole of forest scale for the purpose of seeking to complement the function of the formal reserve system in the conservation of biodiversity.

The plan establishes informal reserves referred to in Appendix 11 and proposes activities at the local scale for the purpose of seeking to conserve biodiversity outside of formal reserves and forest conservation areas.

Integrating biodiversity management across the plan area
The plan proposes activities at the whole of forest, landscape and/or local scales, for the purpose of promoting resilient ecosystems, including by seeking to:

- maintain the net area and connectivity of native vegetation and reduce the impact of mineral and petroleum operations, State development and infrastructure projects on biodiversity and land to which the plan applies
- maintain habitat elements and vegetation diversity across spatial and temporal scales
- protect, and assist the recovery of, threatened and priority species of flora and fauna and ecological communities.

Increasing knowledge
The plan proposes activities at the whole of forest scale for the purpose of seeking to develop an improved understanding of the biodiversity of forest regions and the response of forest ecosystems to natural and human induced disturbance, with a view to improving forest management practices.

Identified values and threats[11]

The plan seeks to protect and maintain the following values:

- threatened species and ecological communities and the habitats on which they depend
- natural biodiversity and ecological integrity
- ecosystem services, structure and function.

Threats to these values include:

- further degradation, fragmentation and loss of habitat connectivity
- disturbance activities including mineral extraction, inappropriate fire regimes, construction or maintenance of facilities and infrastructure, timber harvesting, inappropriate recreation use, and uncontrolled vehicular access
- climate change
- inadequate procedures or ineffective operational application of current procedures.

(Note fire, pests, weeds and diseases are addressed in the 'Ecosystem health and vitality' chapter.)

Relevant policies and guidelines of the Department

When undertaking the proposed operations (management activities) outlined below, the Department will have regard to:

Policy Statement 3: *Management of* Phytophthora *and disease caused by it*

Policy Statement 9: *Conservation of threatened flora in the wild*

Policy Statement 13: *Commercial flora harvesting*

Policy Statement 19: *Fire management*

Policy Statement 27: *CALM's role in the management of native vegetation in rural areas*

Policy Statement 29: *Translocation of threatened flora and fauna*

Policy Statement 31: *Management of reserves for the conservation of nature*

Policy Statement 33: *Conservation of endangered and specially protected fauna in the wild*

Policy Statement 44: *Wildlife management programs*

Policy Statement 50: *Setting priorities for the conservation of Western Australia's threatened flora and fauna*

Policy Statement 62: *Identification and management of wilderness and surrounding areas*

Policy Statement 88: *Prescribed burning*

Code of Practice for Fire Management

Guidelines for Management of Phytophthora cinnamomi *and disease caused by it – Vol. 1*

Silvicultural Practice in the Jarrah Forest

Silvicultural Practice in Wandoo Forest and Woodland

Silvicultural Practice in the Karri Forest

Guidelines for Protection of the Values of Informal Reserves and Fauna Habitat Zones

Guidelines for the Selection of Fauna Habitat Zones

[11] Note there are other values and threats that are relevant and these are dealt with in other chapters.

Management of Commercial Harvesting of Protected Flora in Western Australia 2008–2013

Guidelines for Conservation Management Plans Relating to Mineral Exploration on Lands Managed by DEC

Proponents undertaking other disturbance operations will also have regard to these documents where required by the Department.

Operations proposed to be undertaken (management activities)

CAR formal reserve system

1 The Department will initiate and/or progress the processes required for the land category changes proposed by this plan by:

1.1 undertaking fine scale reserve design for the formal reserves proposed in this plan

1.2 consulting with relevant agencies and the Conservation Commission, then advising the Minister for Environment on final reserve boundaries.

(Note minor amendments to the boundaries of reserves shown on Map 2 and Map 5 may result from the fine scale reserve design and consultation processes required to establish these reserves.)

2 The Department will manage the areas proposed by Appendix 1 for inclusion in a national park, nature reserve or conservation park and vested in the Conservation Commission, consistent with their proposed land category and purpose and relevant Department policies until such time as they are formally created.

3 The Department will cooperate with relevant agencies in relation to the establishment of a comprehensive, adequate and representative reserve system outside the RFA area, through relevant programs.

Forest conservation areas and informal reserves

4 The Department will manage the areas proposed by Appendix 1 to be classified as forest conservation areas and vested in the Conservation Commission, consistent with their proposed classification and purpose and relevant Department policies until such time as they are formally classified. Timber production in these areas will not be permitted, but other productive activities, such as firewood collection, may be allowed, on an area by area basis, unless an area management plan expressly precludes it.

5 The Department, FPC and other proponents where required by the Department, will conduct their operations within the informal reserve types shown in Appendix 11, in accordance with the Department's *Guidelines for the Protection of Values of Informal Reserves and Fauna Habitat Zones*.

6 The Department will:

6.1 publish a map each year on its website depicting the extent and status of old-growth forest, which identifies and explains any changes arising during the previous year

6.2 review planning processes for disturbance activities on all land categories for uniformity of approach for assessment of old-growth forest status, consistent with that used in areas subject to proposed timber harvesting

6.3 develop a procedure to identify and demarcate old-growth forest by 30 June 2016, in consultation with the Conservation Commission.

7 The Conservation Commission will maintain the system of public nominations and assessment of unmapped old-growth forest until the procedure referred to in activity 6.3 is finalised. Following finalisation of the procedure referred to in activity 6.3, the Department will manage the system of public nominations and assessment of unmapped old-growth forest.

Integrating biodiversity management across the plan area

8 The Conservation Commission and the Department will make submissions in relation to development proposals (including, but not limited to, proposals for infrastructure development, extraction of minerals and petroleum resources, development of geothermal energy and the geological storage of greenhouse gases) forwarded to them for comment or advice, with a view to:

8.1 seeking to minimise the permanent loss of native vegetation and/or impacts on its integrity as a result of development

8.2 otherwise, seeking to offset losses of native ecosystems arising from development, in line with the *WA Environmental Offsets Policy*

8.3 promoting the construction of infrastructure such as roads, pipelines and other utilities at common locations, such as infrastructure corridors, while minimising construction in sensitive areas.

9 The Conservation Commission and the Department will:

9.1 liaise with the Departments of Mines and Petroleum and State Development and relevant mining, petroleum and other companies in relation to land management and encourage them to act in a manner that is consistent with the plan

9.2 seek to minimise the impact of mining and petroleum operations on important areas, such as key habitat for threatened species, and those with a high productive capacity for timber production, and key recreation sites

9.3 provide advice and, where appropriate, assistance to industry and government agencies in relation to the effects of mining and petroleum operations on native ecosystems, the means by which those effects may be reduced (including through retention of ecological linkages between unmined areas throughout mine envelopes, to link with adjacent native vegetation areas outside mine envelopes) and the appropriate rehabilitation of native vegetation as those operations are completed (including through appropriate mine closure plans)

9.4 explore with the relevant agency mechanisms to recover the costs of providing that advice and assistance, other costs incurred as a result of proponents' operations, and any additional costs that may be associated with post hand-back management.

10 The Department will maintain a list identifying threatened and priority species of flora and fauna, and threatened and priority ecological communities.

11 The Department will where practicable, develop, review and implement recovery plans for selected threatened species and ecological communities.

12 The Department, FPC and other proponents where required by the Department, will undertake prescribed burning and timber harvesting having regard to the Fauna Distribution Information System.

13 **(Plantations):** The FPC will advise the Department of its planned harvesting and management activities within plantations, and where those activities may impact on threatened species and threatened or priority ecological communities, the FPC will propose and the Department will approve the conditions for access (also see activity 76 in the 'Productive capacity' chapter).

14 The Department will:

14.1 seek to maintain a broad range of forest ages, structures and compositional diversity at the landscape scale to provide resilience, flexibility to respond through adaptive management and a basis for the expression of variable and relative impacts of climate-related changes

14.2 conduct its operations having regard to *Goals for Understorey Structural Diversity*, which are to be prepared by the Department by 30 June 2016, in consultation with the Conservation Commission

14.3 as required, identify and, following consultation with the Conservation Commission, implement at relevant scales, management strategies that are designed to promote the adaptation of forest ecosystems, processes and individual biota to climate-related changes, consistent with biodiversity conservation and the maintenance of, or minimisation of impact on, other forest values

14.4 review the conservation reserve system, as necessary, to seek to ensure ongoing comprehensiveness, adequacy and representativeness, depending on the extent of any further significant changes to, or fragmentation of, forest ecosystems.

15 The Department, FPC and other proponents where required by the Department, will:

15.1 include reference to requirements for the protection of key habitat for listed threatened species in their relevant codes of practice and other guidelines

15.2 apply agency procedures so that the presence and type of biodiversity values are appropriately recorded, accessible to staff and considered prior to operations taking place

15.3 apply procedures and set appropriate conditions to seek to ensure that biodiversity values are effectively protected during permitted disturbance activities

15.4 promote awareness and understanding of the importance of protection and appreciation of the value of biodiversity among staff, proponents, operators and visitors.

16 The Department will revise relevant documents pertaining to fire management to seek to ensure that where practicable, its prescribed burning and bushfire operations consider appropriate measures to minimise loss of legacy habitat elements.

17 The Department will:

17.1 revise the *Guidelines for Selection of Fauna Habitat Zones* by 30 June 2016, in consultation with the Conservation Commission, to be consistent with the settings included in this plan

17.2 finalise the location of fauna habitat zones according to the *Guidelines for Selection of Fauna Habitat Zones*

17.3 publish a map each year on its website depicting the status of all fauna habitat zones, which identifies and explains any changes arising during the previous year.

18 The Department, and other proponents where required by the Department, will conduct their operations in indicative fauna habitat zones, and in fauna habitat zones, in accordance with the *Guidelines for Protection of the Values of Informal Reserves and Fauna Habitat Zones*.

Increasing knowledge

19 The Department will undertake biological surveys, which will be:

19.1 of priority areas determined in consultation with the Conservation Commission

19.2 used, where appropriate, to assist in evaluating the extent to which biodiversity is being conserved and the need for any review of the reserve system

19.3 recorded in relevant databases that are accessible as appropriate, to other users.

20 The Department will seek to:

20.1 maintain, review in consultation with the Conservation Commission and as appropriate, modify, the species, community and process monitoring program, *FORESTCHECK*, and seek to extend it

20.2 maintain a research program on ESFM.

Key performance indicators

Key performance indicators will be used to track the implementation of the plan. Five indicators have been selected to provide a broad cross-section of achievement of the activities related to conserving biodiversity.

Key performance indicator 1	Whole of forest condition comprising a mosaic of healthy ecosystems including wetlands, riparian zones, diverse ecotones, old-growth forests, protected areas and regionally significant vegetation within the Interim Biogeographic Regionalisation for Australia sub-regions/bioregion that comprise the Swan, South West and Warren regions.
Performance measure	1. Measurement and analysis of changes in spatial extent of healthy ecosystems and spatial extent of lower condition ecosystems from a current state. 2. Measurement and analysis of the increase in area of regionally significant vegetation within the formal reserve system from a current state.
Performance target(s)	1. No decline in the condition of identified healthy ecosystems listed across the whole of forest. 2. An increase in the formal protection of regionally significant vegetation as identified within the applicable regional nature conservation plans.

Key performance indicator 2	Threatened Ecological Communities (TECs) and Priority Ecological Communities (PECs) listed in the Swan, South West and Warren regional nature conservation plans.
Performance measure	Measurement and analysis of changes in spatial extent and species richness, composition and abundance and vegetation structure as a function of time and defined by the relevant regional nature conservation plans.
Performance target(s)	The target condition of TECs and PECs identified as priorities for management in the relevant regional nature conservation plans.

Key performance indicator 3	Ramsar and nationally listed wetlands identified in the Swan, South West and Warren regional nature conservation plans.
Performance measure	Measurement and analysis of changes in spatial extent, vegetation condition, fauna communities and water quality of the wetlands as a function of time and as defined by the relevant regional nature conservation plans.
Performance target(s)	The target condition of Ramsar and nationally listed wetlands as identified in the relevant regional nature conservation plans.

Key performance indicator 4	Threatened flora listed in the Swan, South West and Warren regional nature conservation plans.
Performance measure	Measurement and analysis of changes in population number and/or size as a function of time and as defined by the relevant regional nature conservation plans.
Performance target(s)	As defined in the relevant regional nature conservation plans.

Key performance indicator 5	Threatened fauna listed in the Swan, South West and Warren regional nature conservation plans.
Performance measure	Measurement and analysis of changes in population number and/or size as a function of time and as defined by the relevant regional nature conservation plans.
Performance target(s)	As defined in the relevant regional nature conservation plans.

3 Ecosystem health and vitality

Background

Maintenance of ecosystem health and vitality is important for sustaining the various values and uses of natural areas, including the value of the land to the culture and heritage of Noongar people. It has become increasingly complex given the combined influences of climate change, the global mobility of people, plants, animals and materials, and the demands placed on natural areas by a growing local population and other visitors. Management approaches and responses are knowledge, funding and resource dependent.

Issues that can affect ecosystem health and vitality can be divided broadly into abiotic factors (such as bushfires, frosts, storms and climate change), biotic factors (such as weeds, pests and disease-causing pathogens) and human disturbance factors (such as prescribed fire, timber harvesting, and land clearing for mining and infrastructure projects). It is important to note that impacts from these factors can be cumulative and/or may interact in ways that are not always well understood. For example, a combination of more frequent hot days and severe drought stress may cause higher rates of mortality and/or facilitate insect attack on jarrah, and conversely, may disfavour *Phytophthora* introduction and/or spread of dieback disease (see the 'Climate change and carbon cycles' chapter). The scale of impact can range from small, periodic events (for example, isolated tree falls and mortality; infrequent tornadoes) to broader-scale events that may have longer-term impacts (for example, insect infestations; large, high intensity bushfire). Some of these events can assist the recovery and maintenance of ecosystems, while others can have adverse impacts and impede recovery. Others may induce enduring changes (for example, infection by *Phytophthora cinnamomi*, persistent drought) that may not become fully evident for some time and which are difficult, if not impossible, to reverse. For example, the reduction in rainfall across the south-west over recent decades presents particular issues for water values, which is covered in the 'Soil and water' chapter.

There have been some concerns raised about the vulnerability and health of the eastern and northern jarrah forests since the Conservation Commission's mid-term audit of the previous FMP (Conservation Commission 2008b), particularly in the face of future climate change (for example see Maher *et al*. 2010). While it is recognised that regeneration in lower rainfall areas is slow but effective and that these areas can contribute to wood yields, this may remain a concern and will be reviewed as further monitoring and information becomes available (see also the 'Productive capacity' chapter).

Monitoring of forest and vegetation condition within the plan area is undertaken by the Department, through various activities including biological surveys and *FORESTCHECK*, *P. cinnamomi* mapping, evaluation of prescribed burns, inventory, operational monitoring, and assessments undertaken related to performance indicators. Other monitoring is undertaken by other entities, such as the Water Corporation (ground and surface water resources) and various research bodies, which together with information gathered by the Department, helps provide an overview of the health and vitality of areas covered by the plan. Where appropriate, such as for mapping the extent of episodic drought, frost and insect pest impacts on the condition of the forest canopy, remote sensing can be used. The Land Monitor project used remote sensing to map trends in vegetation cover index for the period 1990-2012 across the south-west of Western Australia (Furby *et al.* 2012). This indicated that in relative terms, there had been some decrease in vegetation cover index in the northern jarrah forest, particularly the more eastern parts. Further analysis by the Department of the information relating to the period 2004 to 2011 excluded areas subject to bauxite mining, fire and timber harvesting during this period, so as to better understand changes in vegetation condition independent of these specific disturbances. This analysis showed that the vegetation cover index has remained stable for most areas during the period

of the previous FMP. Some areas of small decrease in the vegetation cover index were generally more prevalent in lower rainfall areas and in the southern forest associated with an outbreak of gum leaf skeletoniser (also see 'Pests', below). Relatively small areas of increase in the vegetation cover index were associated with recovery of vegetation in areas that had been subject to disturbance prior to 2004.

The Department has certain statutory obligations under the *Biosecurity and Agriculture Management Act 2007* (BAM Act) concerning biosecurity matters generally, and particularly with respect to the management of pathogens that cause forest diseases, through the CALM Act. However, organisms and natural processes transcend land tenure boundaries and ultimately, success is more likely where there is a holistic and coordinated approach by all land managers, including government agencies, local governments, private landholders, and all land users, including the mining and timber industries and the broader community who use and visit the forest.

The end-of-term audit of the previous FMP (Conservation Commission 2012a) noted the potential for increased impacts from weeds, pests and disease associated with climate change. In its assessment of the Proposed FMP, the EPA (2013) stated that monitoring and public reporting of key trends in forest health, including through remote sensing programs and *FORESTCHECK*, and initiating relevant research over the life of this plan, is an important step to developing an understanding of the impact of climate change on ecosystem health and the likely future state of the forest as a result of climate change. As healthy ecosystems are more resilient to climate change, it will become increasingly important to manage the effects of pests, weeds and disease through a prioritised, flexible and adaptive approach to research and management.

A species-led approach focuses on invasive species which are considered to be high impact, rapidly invasive and still at a population size that might be possible to eradicate, or feasible to contain to a defined control area. An asset-based protection approach focuses on identifying high-value biodiversity assets, the particular invasive species that pose a threat to these assets and the sites where control will most likely have the greatest benefit. These two processes can be used to inform regional priorities and hence target the allocation of available resources and funds for the best return on investment and improved outcomes in the long term.

Goal

An overall goal of the plan is to seek to maintain ecosystem health and vitality.

Identified values and threats[12]

Values and threats relevant to fire are identified in the following section.

In other sections of this chapter, the plan seeks to protect and maintain the following values:

- 'naturalness' of areas
- ecosystem functions and processes.

Threats to these values include:

- uncontrolled weeds, pests and diseases
- rehabilitation that is not self-sustaining.

[12] Note there are other values and threats that are relevant and these are dealt with in other chapters.

Fire

Background

Noongar people have long used fire as a key tool in forest management and fire remains a naturally occurring disturbance in the forest ecosystems of the south-west. Burning by Noongar people with a fire regime appropriate to seasons and forest type was used to lower the risk of bushfire, encourage the growth of bush tucker and medicines, and provide forage for native fauna.

Fire regimes that are sympathetic to the ecological requirements of ecosystems are essential for their effective functioning. For example, fire can assist in the regeneration of native vegetation and promote the germination of seed, the maintenance or modification of habitats, and release and cycling of nutrients required for plant growth. Fire has a role in a range of other ecosystem processes, including hydrology, and can in some cases be used to manage certain weeds, pests and diseases. Fire regimes that are characterised by an appropriate range and diversity of fire intensities, seasonality, frequency (return intervals) and spatial heterogeneity will facilitate biodiversity and therefore promote ecosystem health and vitality, thereby providing greater resilience to climate change. Fire regimes must also accommodate requirements for bushfire risk mitigation and facilitate the provision of various values, such as water and forest products.

In most vegetated ecosystems, and particularly in Western Australia's fire-prone south-west, it is difficult to prevent fire for long periods over large areas. Attempts to exclude fire over large areas can result in the gradual build-up of a flammable layer of litter, twigs, bark and understorey vegetation, leading to high fuel loads. This will increase the probability of large-scale, high-intensity bushfires, which are costly and dangerous to suppress, pose a great risk to life and property and which may result in significant loss of economic and environmental assets. Landscape-scale analysis of fire history in the south-west shows that the extent of planned fire has a strong inverse relationship to the extent of bushfire (Boer *et al*. 2009), and that the biota of south-west forest and shrubland ecosystems is resilient to a wide range of fire frequency (Wittkuhn *et al*. 2011). However, longer fire return intervals may be required in some situations for certain plants and animals with specific fire regime requirements.

The Department's fire management approach is underpinned by legislation and guided by Policy Statement 19: *Fire management* and other guidance documents. One of the most effective tools available to achieve desired land management outcomes is the judicious application of fire under prescribed conditions. Typically, prescribed fire will be applied to land to which the plan applies for purposes including:

- biodiversity conservation (on all land categories)
- life and asset protection (on all land categories)
- silvicultural management (on State forest and timber reserve land categories only).

In many cases a single application of fire will be for more than one of the above purposes.

The Department has a framework and process for planning, implementing and reviewing its prescribed burning program, which is reviewed from time to time. This 'fire management plan' approach considers biogeography, land use, community protection and other factors, such as the available workforce, plant and equipment, and establishes management objectives, burn strategies and success criteria. When fully implemented, it is intended to include five components, as follows:

i) Preparation of 'Regional Fire Management Plans' that consider these matters, covering a five-year period and updated as required.

ii) The 'Master Burn Planning process' that transforms the settings from the 'Regional Fire Management Plan' into a three-year (six season) indicative plan and an annual (two season) prescribed burn program.

iii) The 'Three-year (six season) indicative burn plan', which utilises GIS technology in an interactive environment to develop 'best fit' options for achieving biodiversity outcomes, and any burning that is required to achieve particular land management objectives, such as those for silviculture and catchment protection. This potential prescribed burn program is then assessed for its effectiveness in mitigating bushfire risk. If necessary, modifications are made to seek to ensure that strategic protection outcomes are satisfied.

iv) The 'Annual burn program' that is derived from the first two seasons of the three-year (six season) indicative burn plan, and which constitutes the planned works program for the year. Three-year (six season) indicative burn plans, together with the forthcoming season burn programs for each region, are integrated into a statewide program, which is submitted to the Department's Corporate Executive group twice each year for approval. The Office of Bushfire Risk Management attached to the Department of Fire and Emergency Services now has oversight of the process.

v) 'Prescribed Fire Plans', which are then developed for each planned burn. These include key requirements such as fire and land management objectives, fuel assessments, acceptable weather and fuel moisture conditions for ignition, and pre-burn checklists. 'Prescribed Fire Plans' identify remaining activities required to prepare the burn area and address any related environmental issues (such as boundary track maintenance and burn security treatments (for example, boundary fuel modification and dangerous tree treatment), and dieback hygiene). They also identify any particular values that need special consideration, including granite outcrops, wetlands and organic-rich soils (for example, peat swamps), and recreation sites. Adjoining land uses, neighbours and values at risk beyond the burn are also identified for any required management action. Each burn is then scheduled, approved and implemented as suitable weather and fuel moisture conditions occur for safe and effective burning.

The frequency distribution of fuel age (i.e. time since fire, which is also a proxy for fuel load) gives a broad indication of the diversity of fuel ages and in turn, the structural diversity of understorey and thus, habitat diversity. The target distribution is a theoretical negative exponential function that is based on inputs relating to the life history attributes and ecological requirements of native vegetation (McArthy *et al.* 2001). The degree to which the fuel age distribution conforms to the theoretical negative exponential curve gives an indication as to how well the Department's fire management program is achieving biodiversity goals of the plan. This was identified in the end-of-term audit of the previous FMP (Conservation Commission 2012a) and the Department will continue to endeavour to achieve the target distribution during the period of this plan. However, variations are inevitable due to the random occurrence of bushfire and/or arise from the need to manage fuels to mitigate the risk of bushfire to protect communities and high value community assets.

Goal

The plan proposes the following activities at the whole of forest, landscape and/or local scales, for the purpose of seeking to use and respond to fire in a manner that promotes the maintenance of ecosystem health and vitality, the conservation of biodiversity, and mitigates the risk of adverse impacts of bushfire.

Identified values and threats

The plan seeks to protect and maintain the following values:

- ecosystem health and vitality, through maintaining biodiversity, including structural complexity and heterogeneity
- life and property, including community and neighbour assets, which includes built infrastructure, and native and plantation timber resources
- places and objects of spiritual and cultural significance to Noongar people
- places of other Australian historic and cultural significance
- soil, water, productive capacity of forests and carbon cycles.

Threats to these values include:

- fire regimes inappropriate for the maintenance of ecosystem health and vitality, and biodiversity
- areas with high fuel loads that present a high risk to life, biodiversity, property, heritage and other values in the event of a bushfire.

Relevant policies and guidelines of the Department

When undertaking the proposed operations (management activities) outlined below, the Department will have regard to:

Policy Statement 19: *Fire management*

Policy Statement 65: *Good neighbour policy*

Policy Statement 88: *Prescribed burning*

Code of Practice for Fire Management

Proponents undertaking other disturbance operations will also have regard to these documents where required by the Department.

Operations proposed to be undertaken (management activities)

21 The Department will:

21.1 maintain a competent and sufficient capability in fire management, including prescribed fire, bushfire risk mitigation, detection and suppression

21.2 seek to maintain a fire science capability and work collaboratively with other agencies and institutions on matters of mutual interest

21.3 consult with stakeholders and the community, including Noongar representatives, on the planning and implementation of prescribed burning and other fire management programs to:

a) develop community understanding of, support for and collaboration in, fire management

b) enable constructive discussions and deliberations on fire management approaches

21.4 undertake an annual prescribed burning program in a manner that:

a) seeks to address the risk presented by bushfire to the ecological, social, cultural and economic values occurring on lands managed by the Department, and the risk presented by bushfire emanating from land it manages moving into surrounding land

b) considers any specific ecological, silvicultural, social, cultural and other identified management objectives in areas subject to planned burning

c) seeks to minimise emissions of greenhouse gases while achieving fuel reduction objectives so as to avoid major emissions arising from periodic catastrophic bushfires

d) maintains or enhances the conservation of biodiversity by maintaining or enhancing the diversity of understorey vegetation structure and composition that facilitates a diversity of habitat opportunities

e) creates and utilises new knowledge in an adaptive management framework

f) is assessed against stated objectives for the program and stated objective(s) and success criteria for individual burns

21.5 undertake bushfire suppression and recovery operations in a manner that has regard to fire operations guidelines

21.6 through training programs, where appropriate, develop staff and contractor competency to assist with management of environmental issues associated with bushfire suppression and recovery operations.

22 The FPC will:

22.1 collaborate with the Department in determining appropriate bushfire risk mitigation strategies to be applied to land managed by the Department, and in particular, the State's native and plantation timber resources

22.2 as agreed between the agencies, make provision for funding to the Department to enable the Department to control the risk to acceptable levels, so far as is reasonable and practicable.

Key performance indicators

Key performance indicators will be used to track the implementation of the plan. Two indicators have been selected related to fire management.

Key performance indicator 6	Resilient and healthy forest ecosystems that have an appropriate distribution of fire age that maintains ecosystem condition.
Performance measure	The area of forest by fuel age classification.
Performance target(s)	Conformance to the theoretical distribution of time since fire for the whole of forest and major LMUs.

Key performance indicator 7	The effectiveness of fire planning and management in meeting objectives for prescribed burning.
Performance measure	1. The percentage of completed prescribed burns that meet their stated objectives. 2. Development of the relevant regional fire management plans.
Performance target(s)	1. 90 per cent of prescribed burns that meet their stated objective. 2. Completion of the relevant regional fire management plans by mid-term. Note: This KPI will be reviewed following the mid-term review and performance measures and targets may change to be consistent with regional fire management plans if established at that stage.

Weeds

Background

The management and control of weeds in Western Australia is guided by the BAM Act, which is administered by the Department of Agriculture and Food WA (note the BAM Act replaced the Agriculture and Related Resources Protection Act and some other Acts from 1 December 2012).

In addition to those declared noxious, there are certain other weeds which may have little impact on agricultural production, or may be relatively easily controlled in those situations, but which may present major threats to ecosystem health and vitality, and the Department seeks to identify, monitor and manage these species where possible. Many of these environmental weeds are successfully invading natural areas, where they can modify natural processes. Many of these weeds are adversely impacting biological diversity and ecosystem health and vitality at genetic, species and community levels. Competition from weeds is a threatening process affecting many threatened flora and ecological communities, particularly those restricted to small, disturbed areas highly vulnerable to invasion. Weeds also have an adverse effect on the value of the land to the culture and heritage of Noongar people.

Goals

The plan proposes the following activities at the whole of forest, landscape and/or local scales, for the purpose of seeking, as far as is reasonable and practicable, to:

- minimise the impact of weeds on ecosystem health and vitality, including plantations
- minimise the risk of introduction or naturalisation of weeds and protect those areas currently free of infestation.

Relevant policies and guidelines of the Department

When undertaking the proposed operations (management activities) outlined below, the Department will have regard to:

Policy Statement 14: *Weeds on CALM lands*

Policy Statement 45: *Environmental monitoring of pesticides used by CALM*

Policy Statement 65: *Good neighbour policy*

Proponents undertaking other disturbance operations will also have regard to these documents where required by the Department.

Operations proposed to be undertaken (management activities)

23 The Department, and other proponents where required by the Department, will:

23.1 maintain surveillance and recording systems for weeds that are known to have a significant impact on ecosystem health and vitality

23.2 work collaboratively with other agencies and land managers, as appropriate, to identify priority weeds using risk-based procedures for determining their relative importance

23.3 work collaboratively with other agencies and land managers, as appropriate, to prepare incursion management plans for priority weeds which are not yet present

23.4 use planning procedures to identify the relative importance of areas for protection, and operational controls to minimise the risk of spread and impacts from priority weeds already present

23.5 where reasonable and practicable, implement control programs for priority weeds, and encourage the coordinated involvement of Government, industry, the community and other land managers in addressing these, including through facilitating knowledge transfer, awareness raising and capacity building.

24 The Department will seek to maintain a weed science capability and work collaboratively with other agencies and institutions on matters of mutual interest.

25 The FPC will take appropriate steps to minimise the risk that seedlings it obtains from its own and other nurseries could transport unwanted weeds into the forest.

26 **(Plantations):** The FPC will:

26.1 maintain surveillance and recording systems for priority weeds, compatible with those of the Department

26.2 use planning procedures and operational controls to minimise the risk of introduction, spread and impacts from priority weeds, and where reasonable and practicable, implement control programs for priority weeds

26.3 take appropriate steps to control the spread of plantation species beyond plantation boundaries into adjacent native vegetation

26.4 take appropriate steps to minimise the risk that seedlings it obtains from its own and other nurseries could transport unwanted weeds into the forest.

Pests

Background

Certain vertebrate and invertebrate species can become pests and present major threats to ecosystem health and vitality, biological diversity, productive capacity, or the value of the land to the culture and heritage of Noongar people. Each of these types of pest species needs to be considered separately and the management and control activities varied to address the extent and significance of the impact.

These pest species are often exotic species (such as foxes, cats, pigs, *Sirex* wood wasp, European house borer), but may also be introduced native Australian animals (such as kookaburras, rainbow lorikeets or corellas) or endemic species that can have an undesirable impact on the ecosystem or particular forest values (for example, grazing marsupials and insect pests). The two most notable insect pests of forest trees in the area covered by the plan are endemic species, being jarrah leafminer (*Perthida glyphopa*) and gum leaf skeletoniser (*Uraba lugens*), which can cause quite widespread, temporary canopy defoliation. For example, a 2010 outbreak of gum leaf skeletoniser affected about 300,000 hectares of the southern jarrah forest, with subsequent recovery. Research by the Department suggests that drier, warmer winters expected with climate change may lead to more frequent outbreaks of gum leaf skeletoniser, but may result in reduced impacts from jarrah leaf miner.

Western Shield is the biggest wildlife conservation program ever undertaken in Australia, focused on introduced predators impacting 'critical weight range' native fauna, with most emphasis being on the fox, and increasingly, cats. While it is undertaken across lands covered by the plan, it is a statewide program. Its main tool is the use of baits containing the naturally occurring poison 1080, found in native plants called *Gastrolobiums* or 'poison peas', to which native animals are tolerant.

Sometimes, populations of native fauna, plants and plantation trees may display resistance to pests (and diseases). Where identified and practicable, various measures are used in an effort to protect these resistant individuals and populations from disturbance, and they may be used as breeding stock for re-population of affected areas.

Goals

The plan proposes the following activities at the whole of forest, landscape and/or local scales, for the purpose of seeking, as far as is reasonable and practicable, to:

- minimise the impact of pests on ecosystem health and vitality, including plantations
- minimise the risk of introduction or naturalisation of exotic pest species and protect those areas currently free of infestation.

Relevant policies and guidelines of the Department

When undertaking the proposed operations (management activities) outlined below, the Department will have regard to:

Policy Statement 45: *Environmental monitoring of pesticides used by CALM*

Policy Statement 47: *Control of Sirex wood wasp in plantations*

Policy Statement 65: *Good neighbour policy*

Proponents undertaking other disturbance operations will also have regard to these documents where required by the Department.

Operations proposed to be undertaken (management activities)

27 The Department, and other proponents where required by the Department, will:

27.1 maintain surveillance and recording systems, including where appropriate remote sensing, for monitoring pests that are known to have a significant impact on ecosystem health and vitality

27.2 work collaboratively with other agencies and land managers, as appropriate, to identify priority pests using risk-based procedures for determining their relative importance

27.3 work collaboratively with other agencies and land managers, as appropriate, to prepare incursion management plans for priority pests which are not yet present

27.4 use planning procedures to identify the relative importance of areas for protection, and operational controls to minimise the risk of spread and impacts from priority pests already present

27.5 seek to identify and protect, including through use of planning procedures and operational controls, individuals and populations of native flora and fauna that show resistance to pests

27.6 where reasonable and practicable, implement control programs for priority pests, and encourage the coordinated involvement of Government, industry, the community and other land managers in addressing these pest species, including through facilitating knowledge transfer, awareness raising and capacity building.

28 The Department will seek to maintain the *Western Shield* program so as to reduce predation pressure on threatened and priority species of fauna.

29 The Department will seek to maintain a pest science capability and work collaboratively with other agencies and institutions on matters of mutual interest.

30 The FPC will take appropriate steps to minimise the risk that seedlings it obtains from its own and other nurseries could transport unwanted pests into the forest.

31 (**Plantations**): The FPC will:

- 31.1 in conjunction with other agencies, maintain surveillance and recording systems for the presence of *Sirex* wood wasp, European house borer and other priority pests, compatible with those of the Department
- 31.2 use planning procedures and operational controls to minimise the risk of introduction, spread and impacts from priority pests, and where reasonable and practicable, implement control programs for priority pests
- 31.3 seek to identify and protect, including through use of planning procedures and operational controls, individuals and populations that show resistance to pests
- 31.4 take appropriate steps to minimise the risk that seedlings it obtains from its own and other nurseries could transport unwanted pests into the forest.

Diseases

Background

Certain forest diseases and 'syndromes' (sometimes referred to as 'tree declines') present a major threat to the health and vitality of south-west forest ecosystems. Often these are recognised by the causal agent (for example, the pathogen *Phytophthora cinnamomi*), but in some other cases, where the cause is less clear or the result of a combination of factors, they are recognised by their outcome, which is referred to as a particular syndrome (such as Mundulla Yellows), or 'tree decline' (such as 'tuart decline').

Dieback disease caused by *P. cinnamomi* continues to spread and affect the distribution and abundance of many native south-west plant species and their associated fauna. This plant pathogen and a number of related *Phytophthora* species (such as *P. multivora*) present a significant threat to the health and vitality of many ecosystems in and outside of the plan area and as such, it remains a high priority to minimise the risk of new infections in areas that are not yet infected. *P. cinnamomi* can alter species composition and ecosystem functioning by impacting susceptible species and vegetation types, some of which may be rare or threatened, and by increasing the vulnerability of impacted areas to invasion by weeds. It can adversely affect a range of other forest values, including productive capacity and the value of areas for recreation.

Subsidiary documents, which are periodically reviewed, detail the planning and approval process used by the Department and other proponents to minimise the risk of introduction and spread of *P. cinnamomi* (and other damaging agents, including weeds and pests). Key tools in this approach include field demarcation of known infected areas and the preparation of hygiene management plans for proposed disturbance activities. Additional requirements are imposed for harvesting under moist soil conditions, given the elevated risk of spreading *Phytophthora*.

The impact of other *Phytophthora* species is not as well understood, however they have been associated with deaths of a number of important native plant species (such as *P. multivora* in tuart woodlands). Further research is required to ascertain the importance of these and to develop appropriate management responses.

There are also other fungal or microbial agents that cause damage or have potential health impacts on native forests, as well as plantations. Some pathogens are endemic to south-west Western Australia, such as *Quambalaria coyrecup* which is having an impact on the health of marri trees throughout its range. Others are not yet present in Western Australia, but could have major consequences for the environment if introduced (for example, Myrtle or Eucalypt Rust). Preventing the introduction and/or slowing the spread and reducing the impact of these and other species, require a coordinated focus on biosecurity measures.

Goals

The plan proposes the following activities at the whole of forest, landscape and/or local scales, for the purpose of seeking, as far as is reasonable and practicable, to:

- minimise the impact of forest pathogens, and syndromes, on the health and vitality of forest ecosystems, including plantations
- minimise the risk of introduction or naturalisation of exotic pathogens and protect from infection those areas currently free from disease symptoms.

Relevant policies and guidelines of the Department

When undertaking the proposed operations (management activities) outlined below, the Department will have regard to:

Policy Statement 3: *Management of* Phytophthora *and disease caused by it*

Guidelines for Management of Phytophthora cinnamomi *and disease caused by it – Vol. 1*

Proponents undertaking other disturbance operations will also have regard to these documents where required by the Department.

Operations proposed to be undertaken (management activities)

32 The Department, and other proponents where required by the Department, will:

32.1 maintain surveillance and recording systems, including where appropriate remote sensing, for monitoring forest diseases and syndromes that are known to have a significant impact on ecosystem health and vitality

32.2 work collaboratively with other agencies and land managers, as appropriate, to identify priority forest diseases and syndromes using risk-based procedures for determining their relative importance

32.3 work collaboratively with other agencies and land managers, as appropriate, to prepare incursion management plans for identified causal agents which are not yet present

32.4 use planning procedures to identify the relative importance of areas for protection, and operational controls to minimise the risk of spread and impacts from priority forest diseases and syndromes already present

32.5 seek to identify and protect, including through use of planning procedures and operational controls, individuals and populations of native flora and fauna that show resistance to disease

32.6 where reasonable and practicable, implement control programs for priority diseases, and encourage the coordinated involvement of Government, industry, the community and other land managers in addressing these, including through facilitating knowledge transfer, awareness raising and capacity building

32.7 undertake targeted training programs and implement an accreditation process for staff, contractors and operators involved in disturbance activities, to support consistent and effective implementation of guidelines, standards and procedures for mapping, planning, supervision and operational controls for management of *Phytophthora* dieback disease.

33 The Department will seek to maintain a diseases and syndromes science capability and work collaboratively with other agencies and institutions on matters of mutual interest.

34 The FPC will take appropriate steps to minimise the risk that seedlings it obtains from its own and other nurseries could transport unwanted pathogens into the forest.

35 (**Plantations**): The FPC will:

35.1 in conjunction with other agencies, maintain surveillance and recording systems for priority forest diseases and syndromes, compatible with those of the Department

35.2 use planning procedures and operational controls to minimise the risk of priority disease introduction, spread and impacts, and where reasonable and practicable, implement control programs for priority diseases

35.3 seek to identify and protect, including through use of planning procedures and operational controls, individuals and populations that show resistance to disease

35.4 take appropriate steps to minimise the risk that seedlings it obtains from its own and other nurseries could transport unwanted pathogens into the forest.

Key performance indicator

Key performance indicators will be used to track the implementation of the plan. One indicator has been selected related to the management of pests, weeds and diseases.

Key performance indicator 8	Resilient and healthy forest ecosystems that are not degraded by weeds, pests or disease pathogens.
Performance measure	1. Distribution or density of priority weeds. 2. Distribution or density of priority pests. 3. Distribution or density of priority diseases. 4. The number of sampled areas uninfested by *P. cinnamomi* that remain uninfested following an operation and the proportion of operations undertaken with an approved hygiene management plan.
Performance target(s)	1. As defined in the relevant regional nature conservation plans. 2. As defined in the relevant regional nature conservation plans. 3. As defined in the relevant regional nature conservation plans. 4. No planned operations undertaken without an approved hygiene management plan, and less than three per cent of uninfested protectable area to become infested as a result of management activities.

Developing self-sustaining ecosystems

Background

Regeneration and rehabilitation of disturbed forest areas is undertaken to maintain a wide range of forest values, including ecosystem health and vitality. Regeneration of native forest is required in those areas subject to timber harvesting, and statements relating to regeneration are included in the 'Productive capacity' chapter. This section is focused on rehabilitation of areas of native vegetation that are cleared during other planned disturbance operations, such as mining or extraction of basic raw materials.

Where other planned disturbance occurs, the impacts are minimised when there is capacity for the area to be self-sustaining and, after time, provide for as many of the former values as possible. This can be achieved where propagules of local native species are sourced from within an area surrounding the target site for rehabilitation, which has been conservatively defined here as the same LMU. However, flexibility may be required in some cases in order to achieve successful rehabilitation that is self-sustaining. For example, where disease is present, or rainfall has become limiting, it may be appropriate to consider the use of disease and/or drought resistant varieties of those same species. In this case, the best source of seed or seedlings of some species may be from another area. Alternatively, if disease or drought resistant varieties are unavailable or unknown, then using mixed seed sources to maximise genetic diversity might be an appropriate alternative strategy. This would provide a broader source of variation which would allow greater potential to adapt to new perturbations such as disease or environmental change. Accordingly, the plan includes a mechanism to accommodate this (see activity 37.4).

While it remains the aim, rehabilitation to achieve the former 'natural state' and provide the same suite of values is difficult to achieve. In comparison to the native vegetation rehabilitated areas have replaced, the utility of these areas is somewhat limited, with relatively lower value for nature conservation and recreation. However, with appropriate design and management intervention, their capacity to provide wood products and contribute more effectively to water supply for the environment and human use can be restored, and this will often be the intended management emphasis for areas of rehabilitation.

The rehabilitation of areas affected by mining and petroleum activities is a formal requirement under the Mining Act, *Petroleum and Geothermal Energy Act 1967*, *Petroleum Pipelines Act 1969*, and EP Act. Requirements for rehabilitation and 'completion' are set in the approval process, and relevant to this are the joint Department of Mines and Petroleum and Office of the EPA *Guidelines for Preparing Mine Closure Plans* (June 2011).

Goals

The plan proposes the following activities at the whole of forest, landscape and/or local scales, for the purpose of seeking to develop and maintain self-sustaining ecosystems of native species from rehabilitation operations in areas of native vegetation, and ameliorating the impacts of other threats, including the impacts of climate change.

Relevant policies and guidelines of the Department

When undertaking the proposed operations (management activities) outlined below, the Department will have regard to:

Policy Statement 10: *Rehabilitation of disturbed land*

Guidelines for management and rehabilitation of basic raw material pits

Proponents undertaking other disturbance operations will also have regard to these documents where required by the Department.

Operations proposed to be undertaken (management activities)

36 The Department will work with industry and relevant government agencies regarding the rehabilitation of areas subject to petroleum and mining activities, including extraction of basic raw materials, by:

36.1 for State Agreement operations, working with the Department of State Development, other relevant agencies and industry proponents, and otherwise, working with the Department of Mines and Petroleum, the Office of the EPA and industry proponents, to develop agreed rehabilitation standards and completion criteria, that are subject to review and reflect the intended future management emphasis (also see activity 39)

36.2 seeking confirmation from the relevant agency, either directly or through independent verification by suitable parties, that rehabilitated areas meet agreed completion criteria

36.3 exploring mechanisms for payment by proponents of appropriate environmental performance bonds that would be refundable on satisfactory 'hand-back', on a pro-rata basis.

37 The Department, and other proponents where required by the relevant agency, as appropriate, will undertake their rehabilitation operations by:

37.1 using natural regeneration where reasonable and practicable, or

37.2 where natural regeneration is not reasonable and practicable, and where data are available on the underlying genetic diversity within rehabilitation species through genetic analysis and an understanding of life history traits, use this information to inform choice of areas from which seed is sourced, or

37.3 where natural regeneration is not reasonable and practicable, and where the information referred to in activity 37.2 is not available, using as the first preference seed or plants propagated from seed collected from the same LMU as the area to be rehabilitated, or where seed is not readily available from this LMU, then using seed from adjacent LMUs, or

37.4 otherwise, subject to a process of approval by the Department, based on assessment criteria agreed between the Department and the Conservation Commission, using other seed sources, including mixed seed sources, where climate change, impact from damaging agents or some other identified management need requires it.

38 The Department, and other proponents via the Department, will report to the Conservation Commission annually as to the circumstances where seed sources other than those referred to in activities 37.2 and 37.3 have been used in their rehabilitation operations.

39 The Conservation Commission and the Department expect that consistent with the intended management emphasis, rehabilitation standards and completion criteria for areas subject to mining and petroleum activities, including extraction of basic raw materials, will, among other things:

a) be revised from time to time to be consistent with contemporary 'good practice'

b) specify species composition, with the aim of ensuring 'representativeness', and state overstorey stocking and stand density levels to be achieved prior to 'hand-back'

c) specify where necessary, after giving due regard to the habitat values in adjoining unmined areas, that important (missing) habitat elements are returned to the site (appropriately defined in terms of characteristics and spacing/numbers per unit area)

d) include, in addition to current flora and fauna surveys and other routine measurements carried out by proponents, a requirement for forest inventory and data provision that meets the Department's standards

e) define agreed access conditions, including any road closures, taking into account future management requirements, including ongoing fire management.

40 The Department will:

40.1 develop guidelines for the appropriate ongoing management of mine site rehabilitation

40.2 in the interim, consider and, as appropriate, recommend or approve the use of management intervention within mine site rehabilitation, to ameliorate the impacts of a changing climate on a range of forest values

40.3 encourage an active adaptive management approach to the management of mine site rehabilitation.

4 Soil and water

Background

The conservation of soil and water is intimately linked to the conservation of biological diversity, the value of the land to the culture and heritage of the Noongar, and to sustaining the productive capacity and health and vitality of ecosystems. Water is also an essential commodity for people, communities and various industries, and the quality of water determines its utility for various end-uses.

Streams within the forest estate are the least disturbed in the south-west and the water quality of streams wholly contained within the forest remains largely undiminished. Nevertheless, forest disturbance activities such as mining, prescribed burning, timber harvesting and access construction and maintenance can be detrimental to soil and water resources if not properly managed. The extent of impact from these operations can be controlled using appropriate management techniques, such as the establishment of riparian zones to protect streams, minimising the extent of compaction and the use of techniques to remedy the consequences of compaction. On the other hand, certain types of soil disturbance assist the regeneration of some plant species.

Goal

An overall goal of the plan is to seek to protect soil and water resources on land to which the plan applies.

Soil

Background

Soils, and the organic matter they contain, provide the physical, chemical and biological foundation necessary to support plant and animal life and sustain ecological processes. Soils provide the basis for the growth potential of native plants and consequently the habitats necessary for native fauna. For example, soils store and regulate the supply of nutrients and water essential for plant growth and development. Soils contain micro-organisms which regulate the supply of nutrients essential for the maintenance of healthy ecosystems, and uncultivated soils make positive contributions to global carbon cycles.

Soil disturbance, erosion, compaction and salinisation impact adversely on soil carbon and fertility, and ecosystem and hydrologic processes. Disturbance to vegetation from mining, prescribed burning, roading, timber harvesting, pest animals and grazing can cause soil erosion and may result in lower soil fertility and increased sediment delivery to streams and rivers. Even incremental losses of soil are important and the risk should be minimised by the application of contemporary operating standards in codes of practice and guidelines.

Soil bulk density is a measure of the soil's physical properties that is important for fertility and hydrologic processes. Soil-bound organic matter and above-ground organic debris are important to soil fertility in that they contribute to the physical, chemical and biological properties of soil.

The impact of vehicles on the physical characteristics of soils is immediate, generally obvious and is a function of the soil type, its moisture content and the loading pressure, duration and frequency.

The protection of soil during timber harvesting and other disturbance operations has been an area of considerable development during the previous FMP, as noted in the mid-term audit of performance (Conservation Commission 2008b; EPA 2010) and end-of-term audit of performance reports (Conservation Commission 2012a). The key to minimising the level of soil disturbance is to focus vehicle movements associated with timber harvesting (for example) on to the minimum amount of a well-structured set of extraction tracks that are only accessed under appropriate soil moisture conditions, have vehicles that are appropriate to the characteristics of the area being accessed, maintain the emphasis on planning and supervision of operations, and on the training of staff and contractors to aid consistency of understanding and achievement of desired outcomes (see the *Soil and Water Conservation Guideline,* DEC 2009b).

Additionally, the *Manual of Procedures for the Management of Soils Associated with Timber Harvesting in Native Forests* (DEC 2010b) includes a trafficability index that defines soil management risk periods and permissible activities in relation to soil moisture. The manual also specifies the additional planning and approval requirements for operations during the wetter part of the year, definitions of soil disturbance categories and procedures for assessing and monitoring soil disturbance.

Also, the *Manual for the Management of Surface Water* (DEC 2009c) provides operational guidance for use in the establishment and maintenance of structures to manage surface water so as to prevent erosion associated with extraction tracks, landings, gravel pits and in-forest access tracks carrying relatively low volumes of traffic.

Unlike the physical effects on soil from disturbance, the effect on some chemical properties is subtle, long term and poorly understood. For example, fire regimes can affect nitrogen balance and nitrogen availability (Raison *et al*. 1993). However, Adams *et al*. (2003) could find no evidence that prescribed fire regimes caused significant sustained losses of nutrients or a decline in nutrient availability in jarrah or karri forests. While adverse impacts on the physical properties of soils can be addressed in day-to-day management, the impact on chemical properties requires long-term research and monitoring to detect changes and identify causes.

In certain soil types, activities that alter groundwater levels have the potential to cause soil acidification. Acid sulfate soils are soils and sediments that contain iron sulfides. Activities within this plan that may activate acid sulfate soils include road construction, and excavation to create water points for fire management or extract basic raw materials. Potential risk areas are identified in planning for disturbance activities, and guidance on acid sulfate soil management is provided through *Identification and Investigation of Acid Sulfate Soils and Acidic Landscapes* (DEC 2009d) and *Treatment and Management of Soils and Water in Acid Sulfate Soil Landscapes* (DEC 2011).

The contamination of soil can have negative impacts on terrestrial and aquatic ecosystems. The types of contamination with the highest potential impacts are hydrocarbons such as diesel, oil and lubricants as well as pesticides. Effective measures to control the risk of contamination include that relevant operators are equipped with and trained in the use of required materials, and have predefined strategies for the prevention, containment and cleanup of spills.

Goal

The plan proposes the following activities at the whole of forest, landscape and/or local scales, for the purpose of seeking to minimise unnecessary adverse soil disturbance.

Identified values and threats

The plan seeks to protect and maintain the following values:

- soil physical properties
- soil chemical properties, including soil organic matter
- soil biological properties.

Threats to these values include**:**

- compaction and rutting of soils as a result of use of heavy vehicles
- erosion associated with disturbance to soils and vegetation
- acidification as a result of exposure, drainage or excavation of acid sulfate soils
- loss of soil nutrients as a result of management activities
- soil contamination as a result of use of pesticides or hydrocarbon spills
- inadequate rehabilitation of damaged soil.

Relevant policies and guidelines of the Department

When undertaking the proposed operations (management activities) outlined below, the Department and the FPC will have regard to:

Policy Statement 19: *Fire management*

Policy Statement 88: *Prescribed burning*

Code of Practice for Fire Management

Soil and Water Conservation Guideline

Silvicultural Practice in the Jarrah Forest

Silvicultural Practice in Wandoo Forest and Woodland

Silvicultural Practice in the Karri Forest

Manual of Procedures for the Management of Soils Associated with Timber Harvesting in Native Forests

Manual for the Management of Surface Water

Proponents undertaking other disturbance operations will also have regard to these documents where required by the Department.

Operations proposed to be undertaken (management activities)

41 The Department, FPC and other proponents where required by the Department, will conduct their operations involving the use of heavy vehicles in a manner that is in accordance with the *Soil and Water Conservation Guideline*, the *Manual of Procedures for the Management of Soils Associated with Timber Harvesting in Native Forests* and the *Manual for the Management of Surface Water*.

42 The Department will revise relevant subsidiary documents pertaining to rehabilitation requirements for major extraction tracks and landings, and roads and tracks no longer required, to seek to ensure these issues are adequately addressed.

43 The Department will revise relevant documents pertaining to fire management to seek to ensure that its bushfire recovery planning considers appropriate measures to minimise erosion from fire containment lines and exposed burnt, steep ground.

44 The Department, FPC and other proponents where required by the Department, will review subsidiary documents and training programs to seek to ensure that procedures for containment of spills are adequately addressed.

45 **(Plantations):** The FPC will:

45.1 conduct its operations:

45.1.1 in a manner having regard to the guidelines for soil protection in the *Code of Practice for Timber Plantations* (2006)

45.1.2 in accordance with Department requirements where the Department establishes these, and which are to prevail over those referred to in activity 45.1.1

45.2 rehabilitate damaged soil resulting from plantation operations:

45.2.1 in a manner having regard to the *Code of Practice for Timber Plantations* (2006)

45.2.2 in accordance with new requirements where the Department establishes these, and which are to prevail over those referred to in activity 45.2.1.

Key performance indicator

Key performance indicators will be used to track the implementation of the plan. One indicator has been selected related to protecting soil values.

Key performance indicator 9	The level of soil damage resulting from timber harvesting.
Performance measure	Soil damage as measured by survey, which is to be based on a stratified random sample of harvest cells each year.
Performance target(s)	Soil damage not to exceed prescribed maximum levels for 95 per cent of harvest cells surveyed, except where the prescribed levels cannot be achieved with the application of good harvest practices.

Water

Background

Water is essential to ecosystem processes and people. Within the plan area, there are important surface water and groundwater resources that the majority of Western Australia's population depends on for water supply. Traditionally, harnessed surface water catchments and groundwater source areas, collectively known as public drinking water source areas, have supplied the majority of drinking water for the Perth metropolitan area, Great Southern and Goldfields regions. Much of the catchment area for these surface and groundwater resources occurs within land covered by the plan. Accordingly, the way in which the land is managed and permitted disturbance activities are undertaken have important consequences for both the quantity and quality of these water supplies.

In addition to their importance to Noongar people as drinking water and food sources, rivers, streams and wetlands possess a cultural value. Dreaming trails often encompass entire rivers and their

tributaries, which also provide recreation and camping sites along their banks. Management activities in this chapter are intended to support the protection and conservation of these values.

Both the mid-term audit of performance and end-of-term audit of performance reports (Conservation Commission 2008b and 2012) and the EPA reports in response to these (EPA 2010 and 2012) identified implications of climate change as an important issue. The end-of-term audit report noted that annual streamflow in forests over the period 2004-2009 declined by 12 to 50 per cent, compared to the 1975-2003 average, and the decline was greatest in the northern jarrah forest (Conservation Commission 2012a). The report also noted that aquatic biodiversity at many sample sites was in poorer condition than the reference standard, and concluded this was due to the lower than average rainfall experienced during the previous FMP (Conservation Commission 2012a).

Management of water quantity

Ecological impacts from changing forest hydrology

A decline in rainfall in the south-west of Western Australia has been widely reported since the early 1970s (Bates *et al*. 2008). In recent decades, the cumulative effect over time from this change has been reported in terms of reduced streamflow, reduced flow into harnessed catchments and impacts on water dependent ecosystems. CSIRO (2009) indicated that under the median future climate, runoff is expected to decrease by a further 20 to 30 per cent relative to the period from 1975 to 2007, which would especially affect surface water dependent ecosystems and particularly those that depend on high flows. In addition, a number of groundwater dependent ecosystems including Ramsar Convention wetlands, river base flow and cave systems and their associated flora and fauna are potentially at risk. There are still many knowledge gaps and uncertainties in determination of ecological water requirements for groundwater dependent ecosystems. In addition to the potential impacts of a decline in rainfall on streams and wetlands, there is potentially a more broadscale impact on ecosystem health. The *Review of Silviculture in Forests of South-west Western Australia* (Burrows *et al.* 2011) made the following comments.

> *It is the Panel's view that forest management to achieve a better water balance in a drying climate is a most critical issue facing forest managers now and in the future. As a consequence of a drying and warming trend since the 1970s, and a legacy of predominantly heavily stocked regrowth forests, these ecosystems are experiencing acute water stress.*
>
> *If this issue is not addressed as a matter of priority, then the consequences will be undesirable, probably irreversible, and will likely compromise efforts to achieve ESFM. Silviculture has a pivotal role in addressing this issue.*

- 'Silviculture for ecosystem health'

A management response that is available and potentially effective for the maintenance of water to ecosystems is the development and application of silvicultural practices to provide for ecosystem health, hereafter called 'silviculture for ecosystem health'. This involves the use of silvicultural treatments to enhance water availability to identified areas, such as surface water dependent ecosystems, groundwater dependent ecosystems or over-stocked regrowth forest, in order to improve the resilience of these ecosystems. The practice of managing vegetation density to enhance ecosystem health is only expected to be operationally or economically feasible over a very small proportion of the area covered by the plan.

Areas that could be targeted for treatment include:

- areas with a high stand density that are subject to damage by insects or disease (except dieback) and where a reduction in stand density is likely to reduce damage by insects or disease

- catchments where a reduction in stand density is likely to maintain groundwater levels and streamflows so that these catchments can act as refuges from the hydrologic impacts of climate change
- the protection of granite outcrops from the impacts of high intensity bushfire through stand density management and prescribed burning of surrounding areas
- specific refugia, threatened flora communities and ecological communities that are at risk from the hydrologic effects of climate change.

Increased demand for extraction of water

Over the period of this plan, population growth, mining, agriculture and horticulture are expected to drive increased demand for water (CSIRO 2009), and there are a number of future supply options, possibly including more desalination plants.

The main State legislation that governs water resource management is the *Rights in Water and Irrigation Act 1914*, which is administered by the Department of Water. The Department's primary role in this aspect of water resource management is to provide input and advice into water allocation planning and licensing processes associated with the taking of water from land vested in the Conservation Commission.

- 'Silviculture for water production'

The use of silvicultural treatments to increase the flow of water to surface and groundwater reservoirs was foreshadowed in the previous FMP. Furthermore, the *Soil and Water Conservation Guideline* (DEC 2009b) includes a guiding principle that silvicultural treatments and fire regimes may be used to enhance the quantity of water for surface and groundwater reservoirs. While the primary driver may be the maintenance of or increase in water yield, any treatments will first provide an increase in the availability of water to the environment, with benefits for ecosystem health and vitality.

The development and application of silvicultural practices to provide for water production is hereafter called 'silviculture for water production'. In native forests, this may include a mix of silvicultural treatments such as thinning, shelterwood, gaps, selective and selection cuts, each of which may be adapted from standard silvicultural settings so as to achieve the desired outcome. It may also include management of vegetation density within mine rehabilitation (also see 'Developing self-sustaining ecosystems' in the 'Ecosystem health and vitality' chapter).

'Silviculture for water production' proposals would necessarily consider the results of relevant research and trials. In this plan, where the proposed silvicultural treatments are within the parameters of silviculture guidance prepared by the Department in consultation with the Conservation Commission, implementation requires development of catchment management plans. Catchment management plans would also be required where the Department considers that a proposal will result in an excessive proportion of the forest in the catchment being in the juvenile and immature stages of development, which may have greater water demand than older stages of development. Approved catchment management plans will specify any additional operational controls that might be required to address other forest values, and monitoring and reporting. Where proposed silvicultural treatments are outside of parameters provided for in silvicultural guidance, proponents will also need to prepare and have approved by the Department, specific silviculture guidance.

'Silviculture for water production' might involve treating selected portions of water source areas, such as those supplying metropolitan Perth, rural towns and irrigation schemes. The actual area treated during the term of the plan would be subject to consideration and approval of individual catchment management plans (see activity 48). Approved catchment management plans will specify any additional operational controls that might be required to address other forest values, and monitoring

and reporting. In its assessment of the Proposed FMP, the EPA (2013) stated that proposals for 'silviculture for water production' should include adequate monitoring requirements to prove both the benefits of the proposal and to monitor ecological uncertainties.

Management of water quality

Historically, the main risk to water quality has been from groundwater rise dissolving and transporting salt stored in the unsaturated zone of the soil profile. The two primary controls over the risk of causing salinity in forested areas are the phased harvesting requirement for 'salt sensitive' areas (carried over from Ministerial Condition 12 on the FMP 1994-2003) and the 'high salt risk' requirement (carried over from Ministerial Condition 16 on the FMP 1994-2003).

As a result of the decline in groundwater levels over recent decades, in this plan, land vested in the Conservation Commission in the Department's Swan and South West regions and parts of the Warren Region are classified as low salt sensitivity and other parts of the Warren Region are classified as moderate salt sensitivity (see Map 7). Accordingly, the phased harvesting requirement no longer applies in the Department's Swan and South West regions and parts of the Warren Region. However, the phased harvesting requirement is retained for the moderate salt sensitivity part of the Warren Region, as groundwater levels have not fallen to the same extent in this area.

The changes have been subject to review by an expert panel (Burrows *et al.* 2011), which has supported them and recommended that ongoing monitoring of groundwater should continue, so that management can respond should there be a return to a wetter climate. The continuation of this monitoring is supported. In addition to the phased harvesting requirement in the moderate salt sensitivity part of the Warren Region (see Map 7), the planning process for timber harvesting is to be revised so that in partially cleared catchments categorised by the Department of Agriculture and Food WA as having a high salinity risk (Blake *et al.* in prep), there is a requirement to address the potential for adverse effects on salinity of streams. It is considered that silvicultural practices as outlined in the Draft FMP will be appropriate in most circumstances, but there may be cases where groundwater is close to the surface because of clearing for agriculture, the groundwater is saline and areas available for timber harvesting occur in parts of the landscape that could lead to a small increase in groundwater level in the vicinity of the stream. In such cases, phased harvesting or other modified practices may be required.

In addition, the use of stream reserves is a measure prescribed by the previous FMP and the *Guidelines for Protection of the Values of Informal Reserves and Fauna Habitat Zones* (DEC 2009a) for the protection of water quality (see Appendix 11). Stream zones also play an important role in the conservation of biodiversity and other values. In addition to salt risk, poor drainage or surface water management can also potentially increase risks to water values through erosion, sedimentation and contamination. These aspects are dealt with in the *Soil and Water Conservation Guideline* (DEC 2009b) and its subsidiary documents.

The *Manual for the Management of Surface Water* (DEC 2009c) provides operational guidance for use in the establishment and maintenance of structures to manage surface water to help avoid erosion, waterlogging, turbidity and contamination associated with extraction tracks, landings, gravel pits and in-forest access tracks carrying relatively low volumes of traffic. While the Department works to finalise its own policies and guidelines, the design, construction and maintenance of unsealed roads that carry most traffic on lands to which the plan applies will continue to be guided by the *Unsealed Roads Manual – Guidelines to Good Practice*, issued by the Australian Roads Research Board (2009) (also see activity 108 specific to access infrastructure, included in the 'Socio-economic benefits' chapter).

Also to help protect water quality, the use of certain products, practices or activities may be limited or controlled in some areas like Reservoir Protection Zones established by the Department of Water,

where additional safeguards are applied to further minimise the risk of sediment movement. Similarly, the type of recreational activities that are permitted in drinking water source areas may be restricted, and Department of Water requirements and Department of Health regulations also control pesticide use in these areas. The *Code of Practice for the use of Agricultural and Veterinary Chemicals in Western Australia* (DAFWA 2007) also provides guidance on the safe storage, handling and responsible use of these products.

Goals

The plan proposes the following activities at the whole of forest, landscape and/or local scales, for the purpose of seeking, as far as is reasonable and practicable, to protect:

- the ecological integrity and water quality of groundwater, streams and wetlands and their associated vegetation
- the water quality and flow of water to surface and groundwater reservoirs.

Identified values and threats

The plan seeks to protect and maintain the following values:

- water quality, water quantity and ecological integrity of groundwater, streams and wetlands and their associated flora and fauna.

Threats to these values include**:**

- stream salinity as a result of rising groundwater tables
- turbidity of surface water as a result of erosion
- bacterial contamination (for example, as a result of waste and faecal matter)
- contamination from hydrocarbons and pesticides
- excessive extraction of water for human use
- declining rainfall and consequent reductions in groundwater levels and streamflows
- excessive use of water by native vegetation and plantations
- damage to stream beds and banks
- changes to flow regimes
- changes in composition, structure and density of riparian vegetation.

Relevant policies and guidelines of the Department

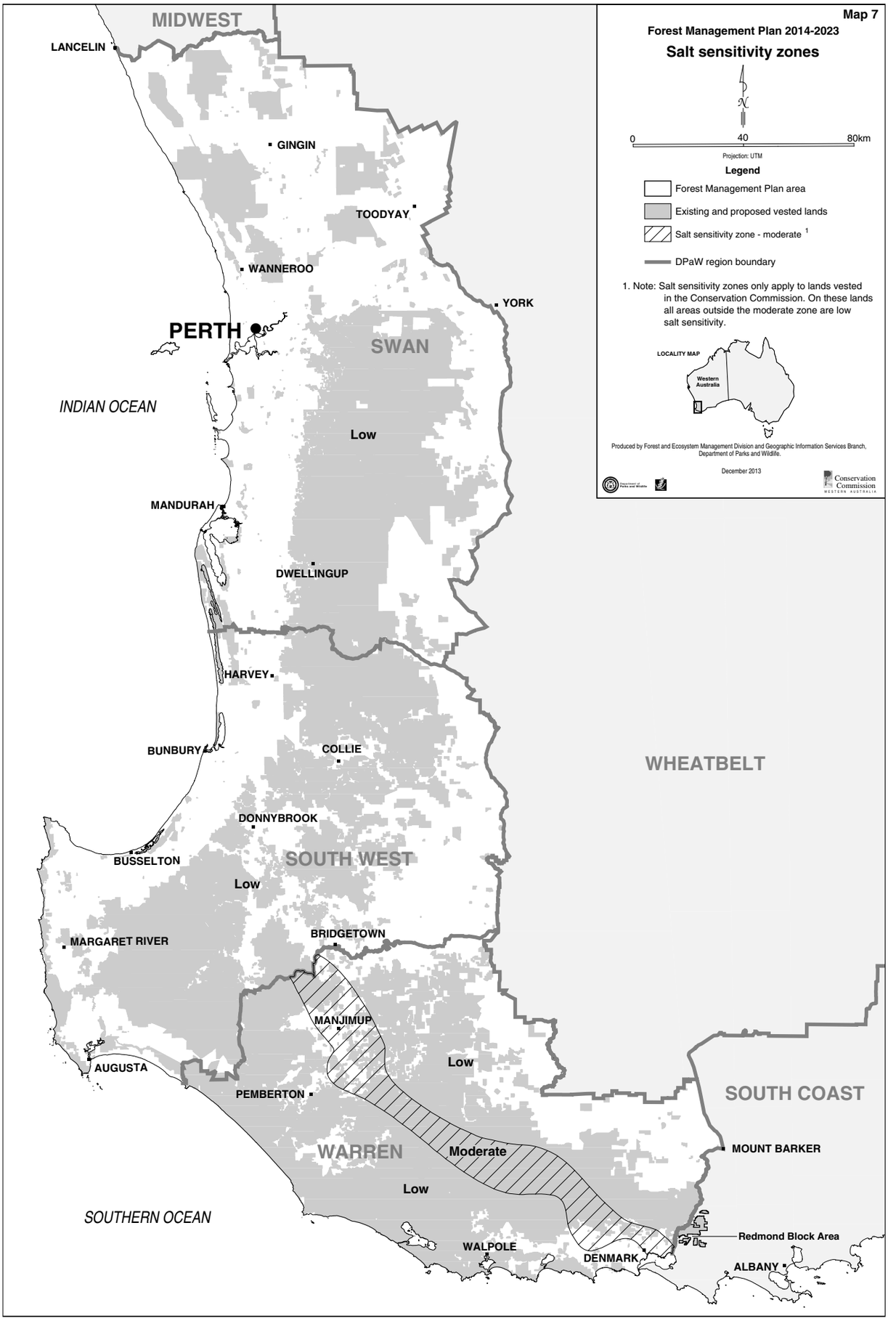
When undertaking the proposed operations (management activities) outlined below, the Department and the FPC will have regard to:

Policy Statement 9: *Conservation of threatened flora in the wild*

Policy Statement 18: *Recreation, tourism and visitor services*

Policy Statement 19: *Fire management*

Policy Statement 33: *Conservation of endangered and specially protected fauna in the wild*


Map 7
Forest Management Plan 2014-2023
Salt sensitivity zones
N
0
40
80km
Projection: UTM
Legend
Forest Management Plan area
Existing and proposed vested lands
Salt sensitivity zone - moderate 1
DPaW region boundary
1. Note: Salt sensitivity zones only apply to lands vested in the Conservation Commission. On these lands all areas outside the moderate zone are low salt sensitivity.
LOCALITY MAP
Western Australia
Produced by Forest and Ecosystem Management Division and Geographic Information Services Branch, Department of Parks and Wildlife.
December 2013
Conservation Commission
WESTERN AUSTRALIA
MIDWEST
LANCELIN
GINGIN
TOODYAY
WANNEROO
YORK
PERTH
SWAN
INDIAN OCEAN
Low
MANDURAH
DWELLINGUP
HARVEY
BUNBURY
COLLIE
WHEATBELT
DONNYBROOK
BUSSELTON
SOUTH WEST
Low
MARGARET RIVER
BRIDGETOWN
MANJIMUP
Low
AUGUSTA
PEMBERTON
SOUTH COAST
WARREN
Moderate
MOUNT BARKER
Low
SOUTHERN OCEAN
Redmond Block Area
WALPOLE
DENMARK
ALBANY

Policy Statement 44: *Wildlife management programs*

Policy Statement 50: *Setting priorities for the conservation of Western Australia's threatened flora and fauna*

Policy Statement 88: *Prescribed burning*

Code of Practice for Fire Management

Soil and Water Conservation Guideline

Silvicultural Practice in the Jarrah Forest

Silvicultural Practice in Wandoo Forest and Woodland

Silvicultural Practice in the Karri Forest

Guidelines for Protection of the Values of Informal Reserves and Fauna Habitat Zones

Manual for the Management of Surface Water

Proponents undertaking other disturbance operations will also have regard to these documents where required by the Department.

Operations proposed to be undertaken (management activities)

46 The Department, FPC and other proponents where required by the Department, will conduct their operations in accordance with silviculture guidelines, the *Guidelines for the Protection of the Values of Informal Reserves and Fauna Habitat Zones*, and the *Soil and Water Conservation Guideline*.

47 The Department may undertake or approve 'silviculture for ecosystem health' to enhance water availability to identified areas, such as surface water dependent ecosystems, groundwater dependent ecosystems or over-stocked regrowth native forest, in order to improve the resilience of these areas.

48 The Department will consider proposals for 'silviculture for water production' on the following basis:

48.1 Where proposed silvicultural treatments are outside of parameters provided for in the Department's silviculture guidance, proponents will need to prepare and have approved by the Department, specific silviculture guidance.

48.2 The Department will require the preparation of a catchment management plan where proponents seek to apply such silvicultural practices, or where it is considered by the Department that an excessive proportion of the forest in the catchment may be left in the juvenile and immature stages of development as a result of a proposal. The catchment management plan(s) will require approval by the Department, which will consult with the Conservation Commission and Department of Water, and where applicable, the relevant water utility. Approved catchment management plans will be made publicly available.

49 The Conservation Commission, in consultation with the Department, will develop a position statement to provide guidance when proposals to take water from land to which the plan applies are considered.

50 The Department:

50.1 will provide advice and assistance to organisations seeking access to the potential sub-surface aquifers and surface reservoirs located on land to which the plan applies

50.2 will facilitate access to land to which the plan applies for the purposes of water extraction and the development of associated infrastructure for public water supply purposes where this is consistent with the CALM Act

50.3 will take and use water sustainably from land to which the plan applies

50.4 may issue permits, after consultation with the Conservation Commission, for the sustainable taking of water from land to which the plan applies.

51 The Department, FPC and other proponents where required by the Department, will conduct their operations in accordance with phased harvesting requirements for the moderate salt sensitivity part of the Department's Warren Region (see Map 7).

52 The Department will revise the planning process for timber harvesting, so that in partially cleared catchments there is a requirement to address potential effects on salinity of streams on other land that is categorised by the Department of Agriculture and Food WA as having a high salinity risk, so as to avoid potential adverse impacts.

53 **(Plantations):** The FPC will conduct its plantation operations in a manner having regard to the guidelines for water protection in the *Code of Practice for Timber Plantations* (2006).

54 **(Plantations):** The Department may require the preparation of catchment management plans where proponents seek to apply silvicultural or other practices that, in the view of the Department, could result over time, in a significant reduction in flow to surface or groundwater reservoirs. Catchment management plans require approval by the Department, which will consult with the Conservation Commission and Department of Water, and where applicable, the relevant water utility. Approved catchment management plans will be made publicly available.

Key performance indicators

Key performance indicators will be used to track the implementation of the plan. Two indicators have been selected related to maintaining water values.

Key performance indicator 10	Stream condition and groundwater level within fully forested catchments.
Performance measure	1. The annual flow weighted mean salinity and the trend for selected gauging stations. 2. Annual streamflow and the trend for selected gauging stations. 3. Depth to groundwater and the trend for selected groundwater monitoring boreholes.
Performance target(s)	1. No gauging stations with annual flow weighted mean salinity that is not fresh as a result of management activities. 2. No sites with a decline in streamflow as a result of management activities. 3. No decline in groundwater level as a result of management activities. No rise in groundwater level to the extent that it could lead to annual stream salinity not remaining fresh, as a result of management activities.

Key performance indicator 11	Effectiveness of silviculture for water production.
Performance measure	1. Catchment management planning considers all relevant values in the catchment to be treated. 2. Compliance of treemarking, harvesting and related treatments with requirements specified in the relevant guidance documents. 3. Hydrologic response assessed against untreated catchments and model predictions using a combination of data sources including remotely sensed imagery, stream gauging stations and groundwater monitoring boreholes where these are available.
Performance target(s)	1. Catchment management plans are prepared and approved for areas to be treated. 2. Compliance of treemarking, harvesting and related treatments with targets specified in the relevant guidance documents. 3. Streamflow is at least maintained or the rate of decline is reduced as a result of treatment.

5 Climate change and carbon cycles

Background

Carbon dioxide is one of the gases naturally found in the Earth's atmosphere. It is widely accepted and well documented that atmospheric levels of carbon dioxide have increased dramatically over the past 100 years. Many scientists believe the greenhouse effect from increased levels of atmospheric carbon dioxide, methane and other greenhouse gases (GHG) is increasing the Earth's temperatures to the point of undesirably changing the Earth's climate – often referred to as 'global warming' and 'climate change'. South-west Western Australia is considered to be particularly vulnerable to climate change (Climate Commission 2011).

Predicted climate change in south-west Western Australia

In Western Australia's south-west, the impact of climate change has been most apparent in a substantial drying trend, with significant decreases in rainfall, streamflow and groundwater levels recorded in the last 40 years. The latter has been particularly evident in the northern jarrah forest and has been associated with a 15 per cent reduction in rainfall since the mid-1970s (Climate Commission 2011).

Projections by the Indian Ocean Climate Initiative (see Bates *et al.* 2008) indicate that, relative to the period 1960-1990:

- rainfall may decrease by between two to 20 per cent by 2030, and by between five to 60 per cent by 2070
- summer temperatures may increase by between 0.5 to 2.1 degrees Celcius (C) by 2030, and by between 1.0 to 6.5 degrees C by 2070
- winter temperatures may increase by between 0.5 to 2.0 degrees C by 2030, and by between 1.0 to 5.5 degrees C by 2070.

Further details are provided in other reports by the Indian Ocean Climate Initiative (for example, IOCI 2012).

For calculating sustained yield, projections of future mean monthly temperature, rainfall and evapotranspiration to the years 2030, 2050 and 2070 were used to predict the likely variation in tree and stand growth (see the 'Productive capacity' chapter).

Given current knowledge and uncertainties of the likely magnitude and result of changes to climate from increases in atmospheric levels of GHGs, it is considered the management activities proposed throughout this plan encompass an appropriate range of broad precautionary actions. While the impact of climate change may not be obvious in the 10-year period of this plan, it is important that it be monitored and its impact on productive capacity, biological diversity, hydrology and ecosystem health, in particular, be considered in ongoing strategic planning and operational practices. Adaptive management to enhance resilience will likely be of increasing importance and there needs to be flexibility to respond as new information becomes available.

Potential consequences of climate change

The extent of possible impacts on native vegetation ecosystems is not well understood, but climate change is believed to be having, and is expected to have further important but variable consequences for a range of values, as noted in the mid-term audit of performance (Conservation Commission 2008b; EPA 2010) and end-of-term audit of performance reports (Conservation Commission 2012a; EPA 2012), and by Dunlop *et al.* (2012). For example, as mentioned above, groundwater decline has been observed and is a result of declining rainfall since the mid-1970s. These issues have been given particular emphasis in the 2011 review of silviculture (Burrows *et al.* 2011) and were covered in several chapters in the Draft FMP (in particular, see the chapters 'Biological diversity', 'Ecosystem health and vitality' and 'Productive capacity', and Appendix 14 of that document) and addressed in the revision of silviculture guidelines. Some summary comments follow in relation to each chapter, as relevant.

Biological diversity – it is possible that changes in flowering cycles, seed production and species distribution will result from the change in environmental conditions induced by a change in climate. Because some indigenous biota is restricted to narrow ranges, climate change is an important threatening process affecting their survival. A CAR conservation reserve system provides an important base from which to manage any adverse impacts on the biota that may arise from climate change. Maintaining connectivity in fragmented landscapes is an important strategy that provides for stepping stones or contiguous habitat, which facilitates the maintenance of ecological processes and movement of organisms across landscapes. In a relatively intact landscape like the south-west forests, consideration of habitat connectivity is nevertheless still important and is contributed to through the network of informal reserves, FHZs and other protected areas, the retention of key habitat elements in areas subject to timber harvesting, and the dispersion in space and time of areas subject to disturbance (see 'Integrating biodiversity management across the plan area', in the 'Biological diversity' chapter). These approaches serve to provide connectivity across areas of State forest and also connectivity between formal conservation reserves. In future, additional corridors may be required on other lands not covered by this plan, as the importance of retaining ecological linkages between remaining remnants of native vegetation in cleared landscapes is well recognised (for example, see the EPA 2009 – Environment Protection Bulletin No 8).

Ecosystem health and vitality – climate change presents a very complex situation for ecosystem health and vitality, potentially favouring some and disfavouring other weeds, pests and diseases. Rainfall decline and associated water stress are important factors in the health of native forests and plantations. For further information on climate change and its potential effects on south-west native forest types see Maher *et al.* 2010.

To sustain the ability of vegetation to sequester (absorb) carbon and to minimise the impact on biodiversity, it is important to seek to control priority pests and diseases to maintain healthy leaf area. In the south-west forests, pests such as the jarrah leaf miner, gum leaf skeletoniser and the tuart borer have caused infestations at a scale that have sometimes impacted biodiversity and reduced growth and carbon sequestration. The greenhouse implications of these outbreaks have not been quantified and no broadscale cost-effective, environmentally-acceptable control has been found to date. Dieback disease caused by *Phytophthora cinnamomi* is recognised as a significant threat to biodiversity and has resulted in places in some losses from the carbon pool. Measurements by the Department show its autonomous rate of spread has slowed with reduced rainfall of the last decade. Nevertheless, various approaches are used to limit its spread (see the 'Ecosystem health and vitality' chapter).

Climate change will affect fire regimes through the effects of changes to temperature, rainfall, humidity, wind and other components of fire weather, including possible extreme events such as ex-tropical cyclones impacting the south-west. Changes are also anticipated as a result of increases in atmospheric carbon dioxide and the effect of changed moisture regimes on vegetation and fuels. Future fire regimes may also be affected by other agents of change, such as invasive species that may

affect the amount and continuity of fuels. With continued drying and warmer conditions predicted in the area covered by the plan, it can be expected that a higher proportion of the landscape and fuels will remain drier for longer, extending the bushfire season and increasing the likelihood of more frequent, extensive, high-intensity bushfires. GHGs, including carbon dioxide, methane and nitrous oxide are released by prescribed burning and in bushfires. Emissions levels depend on the frequency and scale of fires, and on the amount of fuel consumed, and in some forest types, emissions of GHGs from intense bushfires may be up to three times as high as those from fires of low to moderate intensity (Irvine *et al.* 2007). It has also been proposed that low intensity fires may result in a significant increase in the amount of soil carbon over time, as a result of storage in inert forms such as charcoal (see Adams and Attiwill 2011). Scientific opinion is divided as to the extent to which planned burning may contribute to minimising the net emission of GHGs from fire. Some studies suggest that replacing high intensity bushfire with planned fire may reduce overall emissions (Wiedinmayer and Hurteau 2010), but others argue that planned burning is unlikely to yield a net reduction in carbon emissions in temperate forests, because of the extent and frequency of burning necessary to significantly reduce the scale of high intensity bushfires (Bradstock *et al.* 2012). Resolution of this issue will require a better understanding of the dynamics of combustible forms of carbon, particularly carbon stored in coarse woody debris and soil.

Fire is a natural part of south-west forest ecosystems and is intimately connected to regeneration and forest health, both of which promote the sequestration of carbon from carbon dioxide released by fire. Climate change has implications for biodiversity and ecosystem processes, with direct impacts through changed levels of moisture, temperature and carbon dioxide potentially affecting the biota through possible changes in regeneration, growth and reproduction, and indirectly through the interaction with changing fire frequency, fire scale, fire intensity and fuel dynamics (as noted above). A preliminary assessment of interactions between climate change, fire regimes and biodiversity was undertaken by Williams *et al.* (2009), with an overview published by the Department of Climate Change and Energy Efficiency (2011). Management of prescribed fire regimes includes monitoring the effects on biodiversity, which will continue, to provide for a system that facilitates adaptation to the effects of climate change. A well-planned, proactive prescribed burning program will play a vital role in protecting a range of forest values, including biodiversity, communities, and managing greenhouse emissions (see the 'Ecosystem health and vitality' chapter).

Soil and water – groundwater levels and streamflow from forested catchments will continue to decline if rainfall declines further, and this could threaten certain flora and fauna, particularly that associated with streams and wetlands. The protection of water dependent ecosystems as centres of biological activity will become increasingly important. Any effects on soil will largely be on its chemical and biological features. Soil carbon and nutrient cycling may be affected by changes in vegetation associations, fire regimes (see above) and soil disturbance. Measures to protect soils from unnecessary disturbance are included in planning processes and guidance documents. Some additional comments in relation to soil carbon pools are included below under 'Global carbon cycles and carbon stocks' (see '*Low impact practices*').

Productive capacity – impacts on plant growth and biomass accumulation will vary depending on the species. Increasing atmospheric carbon dioxide concentrations and increasing winter temperatures may assist plant growth, as will any increase in summer rain. However, a decrease in overall rainfall, higher summer temperatures and increased occurrence of droughts will shorten the growing season for many plants and may impact survival in some places, leading to reduced biomass production and thus reduced sequestration potential in affected areas. Consequently, the carbon carrying capacity of both native forests and plantations is likely to reduce as a result of predicted climate change. These changes may also negatively impact productive capacity of native forests and plantations (see further comments in relation to work by Allen *et al.* 2010, below). This has been factored into the calculations of sustained yield, as explained in the 'Productive capacity' chapter.

Heritage – since natural heritage is based on the same values as those important for the conservation of biological diversity, it has the potential to be similarly affected. Measures to ameliorate the impact on biodiversity therefore also apply to natural heritage and contribute to maintaining the connection of Aboriginal people to country.

In many places the variability of the landscape and its key elements are important to heritage values. The potential for increased bushfire size and intensity may result in an increased rate of loss of historic structures and buildings, particularly where timber is a key structural component (for example, bridges, stock yards, wells). The possible decrease in water levels in streams and swamps could mean some indigenous artefacts, such as fish traps, are at greater risk of damage or loss. The impact of rising sea levels may result in brackish or fresh areas becoming true estuarine environments, and also in the inundation of heritage sites in estuarine systems. It is also possible that climate change may lead to extremes of weather which may accelerate weathering processes impacting important objects, places and buildings.

Socio-economic benefits – social benefits based on the use of biomass will be affected to the extent that biomass production and condition are affected. As mentioned above, for timber harvesting, the expected impacts have been explicitly factored into the calculations of sustained yield. Climate change may impact other socio-economic values in unexpected ways – for example, if flowering cycles or relative abundance are affected, there may be impacts on wildflower and honey production; and adverse impacts on water bodies will affect their appeal and utility for recreational activities.

Adaptation and mitigation

The vulnerability of systems to a changing climate is a function of the likelihood and magnitude of change, the sensitivity of the system to that change, and the capacity to adapt to the change being experienced. A system that will be exposed to a large change, is sensitive to change, and has a limited capacity to adapt, is most vulnerable. The environmental, economic and social risks associated with change to systems vulnerable to the effects of climate change can be managed by seeking to reduce the likelihood and magnitude of change through a reduction in greenhouse gas emissions (mitigation), or by reducing the consequences of a change by increasing the ability of a system to cope with that change (adaptation).

Mitigation requires global cooperation to be achieved effectively (Pittock 2009) and such efforts are therefore most relevant at a whole of forest (or greater) scale. In contrast, adaptation strategies may be relevant at all scales, although Pittock (2009) considers it as essentially a local challenge. Allen *et al*. (2010) have conducted analysis of recent tree deaths observed in many forest types across the globe. The study included parts of eastern Australia but did not include Australia's south-west. However, during 2011 drought deaths were observed in places across the south-west, particularly in parts of the northern jarrah forest and the Swan Coastal Plain, with most impacts in the northern jarrah forest being associated with rocky outcrops, areas of shallow soils and/or dense regrowth (including some areas of dense mine site rehabilitation). Allen *et al*. (2010) suggest that the increase in the frequency, duration and/or severity of drought, combined with more heat stress associated with climate change, could fundamentally alter composition, structure and composition of forests in many regions, and note that mortality functions used in forest modelling may need to be revised, which has been considered in calculations for sustained yield in this plan. The authors state:

> *…given the potential risks of climate-induced die-off, forest managers need to develop adaptation strategies to improve the resistance and resilience of forests to projected increases in climate stress. Options might include thinning stands to reduce competition, selection of appropriate genotypes (for example improved drought resistance), and even translocation of species to match expected climate changes*.

Accordingly, this plan provides for 'silviculture for ecosystem health' and 'silviculture for water production', as outlined in the 'Soil and water' chapter. The FPC continues to explore markets for smaller diameter, lower quality logs, to enable timely thinning of regenerating native forest, and statements related to selection of appropriate genotypes are included in the section 'Developing self-sustaining ecosystems' of the 'Ecosystem health and vitality' chapter, and the 'Regeneration and management of harvested native forest' section of the 'Productive capacity' chapter.

Global carbon cycles and forest carbon stocks

The total amount of carbon stored in forests and plantations within the plan area may change over time for various reasons, with the key ones being:

- Variation in climate, affecting growth and mortality rates in the short term, and potentially over the longer term, the native vegetation and forest types that occur, and plantations that can be grown.
- Increases and decreases in the area of native vegetation, particularly forests – for example, the establishment of new plantations resulting in new carbon stores, or clearing resulting in a permanent loss of native forests or plantations and stored carbon.
- Disturbance-induced dynamics, particularly in forests. These disturbances can be natural and human-induced – for example, timber harvesting affects age and size class distribution of native forests and plantation stands and thus local carbon stocks at a point in time. Natural disturbances include events such as storms and outbreaks and spread of pests and disease. Fire can be both natural and human-induced.

Carbon management objectives can be incorporated into policies and management guidelines to increase carbon accumulation or conserve existing carbon pools. The end-of-term audit of the previous FMP (Conservation Commission 2012a) identified losses of forest area resulting from fire, drought, land use change and infrastructure development, and it is possible this will continue in the period of this plan, resulting in consequent reductions in carbon storage. Statements that seek to address this are included elsewhere in this plan (see the 'Biological diversity' and 'Productive capacity' chapters).

As explained by Canadell and Raupach (2008), there are four strategies available to mitigate carbon emissions that are related to forest management, being to:

i) increase forested land through revegetation

ii) reduce emissions from deforestation and degradation

iii) increase the carbon density of forests at both stand and landscape scales

iv) expand the use of wood products that sustainably replace fossil-fuel emissions.

In other words, carbon storage can be *increased* by revegetating cleared land, rehabilitating deforested and degraded vegetation, managing the density and improving the growth rates of standing vegetation, and encouraging the use of wood products that are produced sustainably. Some comments on each follow.

i) Revegetation within the area of the plan will be limited, as there is little cleared land vested in the Conservation Commission.

ii) Rehabilitation following disturbance of native vegetation through mining or other activities is actively pursued to return habitat, biodiversity, carbon and other forest values (see 'Developing self-sustaining ecosystems' in the 'Ecosystem health and vitality' chapter).

iii) Fully stocked forest in the mature and senescent stages of growth is generally at its maximum carbon storage potential and is no longer accumulating carbon. Silvicultural management of

forests in younger stages of growth, such as thinning, generally redistributes carbon accumulation onto fewer trees (per unit area) rather than increasing overall carbon accumulation. If other factors (for example, water availability) are not limiting, fertilisation can increase the rate of carbon gain and is often used to establish seedlings and after thinning to boost productivity in tree plantations, but is not widely used in native forests, except in replanting of karri following harvest. Some fertiliser is also used to help seedlings establish in rehabilitated sites (for example, closed mine sites and basic raw material pits).

iv) Promotion of the use of wood products, particularly in end-uses with a long 'service life' (for example, construction, flooring and furniture products), and as a substitute for high embodied-energy, greenhouse-intensive products (with higher life cycle GHG emissions), has long been recognised as a way to sustain the contribution of forests to global carbon cycles (Kirschbaum 2001; Moroni 2011). This is acknowledged by the Intergovernmental Panel on Climate Change, which states: *In the long term, a sustainable forest management strategy aimed at maintaining or increasing forest carbon stocks, while producing an annual sustained yield of timber, fibre or energy from the forest, will generate the largest sustained mitigation benefit.* (Nabuurs *et al.* 2007). While the end use of forest products is outside the scope of this plan, ongoing efforts by the FPC that promote the use of available wood resources for end products which have a long life in service, and can substitute for high-embodied energy building alternatives, and reduce fossil fuel use, will contribute to mitigation.

In native forests subject to cycles of harvest and subsequent regrowth, and plantations similarly subject to harvest and subsequent replanting, the impact of practices implemented at a stand scale contributes to both the rate of accumulation of carbon and the quantity of carbon emitted or stored. These include (also see Sampson and Scholes 2000):

- *Quantity and timing of timber harvests:* the extent to which carbon stocks are modified at a point in time through harvesting practices is related to the proportion of area harvested, proportion of trees removed and the harvest interval (or rotation length, in plantations). Effective regeneration and replanting mean that the area of forest available to store carbon is not reduced, and subsequent regrowth restores site carbon stores over time.
- *Low-impact practices:* reducing the disturbance of soil and remaining vegetation during harvesting will help conserve soil carbon and the productive capacity and sequestration potential of the site. Soil carbon is mostly held in organic matter and measures to protect soils from disturbance are covered in the 'Soil and water' chapter. However in terms of carbon stocks, as noted in Australia's *State of the Forests Report 2008* (Montreal Process Implementation Group for Australia 2008), in native forests subject to cycles of harvest and subsequent regrowth, change in soil carbon is believed to be insignificant since emissions caused by disturbance of soils during harvesting: *are balanced in a given inventory period by re-accumulation through regrowth. This reasoning is also used in accounting rules set out by the UNFCCC*. The report goes on to note that for plantations*: there is typically a long-term increase in soil carbon after some possible (initial) losses.* (The) *effects are dependent upon the pre-establishment condition and establishment technique* (Polglase *et al.* 2000).

Effect on native forest carbon stocks associated with this plan

Indicative estimates of the above- and below-ground carbon stocks in live standing trees within the major native forest types were provided in the Draft FMP, based on stated assumptions and the range of management options and scenarios for sustained yield presented. In that analysis, it was projected that at the whole of forest scale, the quantity of carbon stored in live trees in the forests would increase by between three and five per cent during the plan's 10-year period.

Given the allowable cuts set for this plan, it is estimated that the quantity of carbon stored in live trees in native forests will be within the mid to upper end of this range. Overall, this component of the

carbon stock is comparatively stable at the whole of forest scale, given the large area of forest set aside in reserves, and the comparatively small area subject to timber harvesting each year.

However as explained in the Draft FMP, in terms of the total carbon cycle, the analysis was somewhat incomplete, since over the plan period, the soil carbon pool was assumed not to change (consistent with many other similar analyses), the effect of fire events was not directly modelled, and both the above-ground dead biomass component and the carbon removed from the forest but stored in wood products were not considered. Irrespective of any imprecision in the estimate, management activities proposed through this plan seek to minimise unnecessary emissions and maximise biosequestration (subject to the other goals identified in this plan).

Goal

Within the constraints of a changing climate, the plan proposes the following activities at the whole of forest scale, for the purpose of adapting to climate change and seeking to sustain the contribution of the areas covered by the plan to global carbon cycles, consistent with relevant legislation and the achievement of other goals.

Identified values and threats

The plan seeks to protect and maintain the following values:

- the land base and extent of native vegetation and forest cover
- the land base, extent and type of plantations
- site attributes that determine the carbon density and capacity of areas to sequester carbon.

Threats to these values include:

- conversion of native vegetation and plantations to other land uses
- degradation of areas from damaging agents (including weeds, pests and diseases), droughts and inappropriate fire regimes
- climate change impacts on survival and growth
- excessive soil disturbance and compaction and loss of soil organic matter
- harvest and removal of wood products in excess of sustainable limits
- unsuccessful regeneration, replanting or rehabilitation.

Note that the capacity of areas covered by the plan to contribute to global carbon cycles is strongly linked to productive capacity, hence there is considerable similarity between the values and threats identified here, and those in the 'Productive capacity' chapter.

Operations proposed to be undertaken (management activities)

Note there are a number of other management activities proposed in other chapters that will also contribute to achieving the goal identified in this chapter.

55 The Department will:

55.1 remain abreast of current knowledge and contemporary management approaches in relation to climate change and its possible impacts on native ecosystems and sustained yield

55.2 seek to identify climate-impact refugia and implement strategies to maintain their values, where practicable

55.3 seek to maintain a forest carbon science capability and contribute to the understanding of strategic climate change information and its impact on ESFM, and work collaboratively with other agencies and institutions on matters of mutual interest

55.4 report on carbon stores in the next draft forest management plan

55.5 incorporate climate change prediction into future planning for the management of land to which the plan applies, where reasonable and practicable

55.6 contribute to State and national policy development on climate change adaptation and mitigation

55.7 investigate opportunities that may arise from an emerging carbon economy

55.8 periodically review guidelines for silviculture and fire management with a view to incorporating techniques that recognise the contribution of the areas covered by the plan to global carbon cycles, consistent with other mitigation and adaptation strategies and achievement of other silvicultural objectives and goals for forest management.

56 The FPC will:

56.1 **(Plantations):** remain abreast of current knowledge and contemporary management approaches in relation to climate change and its possible impacts on plantations

56.2 seek to encourage the use of wood harvested from native forests and plantations to maximise greenhouse mitigation benefits.

Key performance indicators

Key performance indicators will be used to track the implementation of the plan. Three indicators have been selected related to climate change and carbon cycles.

Key performance indicator 12	Increased knowledge of trends in climate.
Performance measure	1. Collation of key statistics relating to trends or changes in climate over the plan area. 2. Report on new knowledge gained on the impact of changing climate on values identified in this plan.
Performance target(s)	Trend and knowledge report compiled at mid- and end-of-term and used to inform reporting on achievement of KPI targets.

Key performance indicator 13	Adaptive response to changing climate.
Performance measure	Report on actions taken to adapt to changing climate.
Performance target(s)	Adaptive responses to be reported at mid-term and end-of-term.

Key performance indicator 14	Increased knowledge on the amount of carbon stored in forest within lands covered by the plan.
Performance measure	Application of standard carbon measurement protocols within vegetation associations for which there are limited or no data presently available.
Performance target(s)	Twenty plots established and reported by mid-term and 40 plots by end-of-term.

6 Productive capacity

Background

Productive capacity refers to: *the relative capacity of an area to sustain a supply of goods and services in the long run* (Helms 1998). Broadly it is the capacity of natural areas to sustain ecosystem processes and provide a range of goods and services, whereas the productive capacity of a particular site refers to the total biomass that can be produced over time at that location, given the inherent resources available (such as soil, water and sunlight). Maintaining productive capacity of forests involves maintaining the land base, and from areas of State forest and timber reserves where harvest is permitted, providing for harvesting rates for timber production on a sustained yield basis.

This chapter is focused on the productive capacity of State forests and timber reserves within the plan area – including both native forests and plantations. Note that some freehold land held in the name of the Conservation and Land Management Executive Body (formerly the Department's Executive Director) contains some plantations and indigenous vegetation. While this land is not vested in the Conservation Commission, the area occupied by native forests (a component of indigenous vegetation) is taken into account in this plan, because its productive capacity contributes to the sustained yield from native forests. In the context of this chapter, the key native forest products include wood, and other forest produce such as public firewood, burls, craftwood, wildflowers and seeds and honey.

Wood products are harvested from native forests and plantations (predominantly of pine, with some areas of hardwood species) by the FPC under planning and approval processes established by the Department. For native forests, this begins with the Department preparing rolling, three-year indicative harvest plans in consultation with the FPC, and making these available for public comment. The FPC then prepares annual timber harvesting plans and also makes these publicly available. Removal of wood products from areas of clearing associated with operations on mining leases, the construction of roads or other infrastructure on State forests and timber reserves is also incorporated into these harvest plans as necessary. Subsequently, for each harvesting area (a coupe or compartment), detailed plans are prepared by the FPC and submitted to the Department for assessment. Harvesting operations are then conducted in accordance with a range of subsidiary documents and any specific site-level approval conditions imposed by the Department. It is intended that where required by the Department, relevant elements of the process applied to native forests are also to apply to plantation harvesting operations.

Several issues became more prominent during the term of the previous FMP that have a bearing on wood production from forests, which have been considered in developing this plan, including:

i) *Climate change*: it is expected that the long-term productive capacity of south-west forest ecosystems (and plantations) will be affected by the predicted higher atmospheric carbon dioxide concentrations and associated drier and warmer conditions. Accordingly, the 'high severity' climate change scenario (see Maher *et al.* 2010) based on CSIRO (2007), has been applied when modelling sustained yields for this plan. Site productive capacity is fundamentally linked to available water (rainfall, soil moisture and groundwater) and temperature changes, hence the need to:
   - explicitly account for these trends in calculations of sustained yield
   - provide for adaptive measures that can be undertaken to mitigate adverse effects
   - maintain monitoring and review processes.

The other key site attribute that contributes to productive potential is its inherent soil type. Measures to protect soils are discussed in the 'Soil and water' chapter.

ii) *Degradation of forest*: with a projected increase in bushfire frequency, intensity and scale, and prolonged droughts, it is possible that more areas of native forest and plantations will be affected. Native forests may recover but plantations often will not. Infestation by *Phytophthora* dieback can have dramatic long-term impacts on the productive capacity of areas of native vegetation, including forests. A range of management activities is proposed to mitigate these risks (see the 'Ecosystem health and vitality' chapter). Further comments in relation to salvage of wood products from native forests following major disturbance are included in the section 'Sustained yields for this plan', later in this chapter.

iii) *Forest type and log product mix*: the species composition, structure and condition of the forests available for wood production influence the capacity to produce various log types and end-products. The size and quality of sawlogs harvested altered significantly as a result of the level of reservation introduced in the previous FMP, relative to the period prior to that. There was a shift during the previous FMP toward greater reliance on regrowth forests[13] with a higher proportion of generally smaller, lower quality stems, which continues under this plan.

Several related issues identified in the mid- and end-of-term audits of the previous FMP (Conservation Commission 2008b and 2012) have also since been addressed and/or considered in developing this plan, including:

- Issues associated with timely completion of processes for harvest planning, completion of harvesting and regeneration burning associated with harvesting operations. The decline in the area of native forest as a result of infrastructure developments, and the decline in the area of plantations due to drought, fire and land use change (see 'Maintaining forest area', below).
- The dominance of regeneration establishment and selective cut outcomes, and the low proportion of thinning in jarrah forest. It was noted that the delay in thinning of jarrah stands and the relative dominance of selective cut silvicultural outcomes were a result of lack of markets for non-sawlog quality wood. Accordingly, the mid- and end-of-term reports of the previous FMP (Conservation Commission 2008b and 2012) noted that the FPC should pursue markets for this material, and ongoing work by the FPC to explore potential new industries capable of using such resources should assist in achieving silvicultural objectives.
- That sustained yield projections needed to be updated to reflect potential delays in early thinning of regrowth jarrah stands. Further work on stratification of the structure, condition and tree size of regrowth stands has been undertaken to improve scheduling of thinning and yield projections.

Goal

An overall goal of the plan is to seek to sustain the productive capacity of native forest ecosystems and plantations as they progressively adapt to changing climate conditions. This overarching goal is supported by a number of subsidiary goals for which the plan proposes a range of corresponding activities, as set out in the sections which follow.

[13] In native forests, there are three broad stand structural types, being: *old-growth forest*, which is not available for timber harvesting; *two-tiered forest*, a general term used to describe stands of mixed age and structure, comprising mature trees intermixed with younger regrowth trees that have arisen from regeneration following the death or removal of mature trees by previous harvests or other disturbances (sometimes also referred to as 'mixed species, mixed age forest' or 'mixed species, uneven-aged forest'); and *regrowth forest*, which is dominated by similar aged stems originating from previous harvest events, such as gap creation, or other disturbances, such as bushfire.

Identified values and threats

The plan seeks to protect and maintain the following values:

- the land base, extent and composition of native vegetation and forest cover
- the land base, extent and type of plantations
- site attributes that determine the capacity of areas to produce products valued by society
- a log product and wood quality mix that supports a viable industry
- the range of stand structures and age classes that contribute to a sustained yield and provide for resilient ecosystems.

Threats to these values include:

- conversion of native vegetation and plantations to other land uses
- other values taking precedence over productive activities within the land base available for productive activities
- degradation of areas from damaging agents (including weeds, pests and diseases), droughts and inappropriate fire regimes
- climate change impacts on survival, growth, flowering and seeding cycles
- excessive soil disturbance and compaction
- unsuccessful regeneration, replanting or rehabilitation
- lack of wood product markets and/or funds required to achieve silvicultural objectives
- values being impacted because of inadequate procedures or ineffective operational application of current procedures
- harvest and removal of forest produce in excess of sustainable limits.

Maintaining forest area

Background

Maintaining the land base or area of forested land is a fundamental first step toward maintaining its productive capacity, but there is a range of pressures on the remaining areas of native forest and plantations that are available for productive activities.

Native forests

Increasing population growth and mining activity within the State's south-west continue to result in further removal of native forests for utilities and infrastructure corridors. Statements on measures that will seek to maintain the overall area of indigenous vegetation are included in the 'Biological diversity' chapter, and those statements also serve to maintain the area of native forest with respect to productive capacity.

However, in order to provide stability for the dependent processing industry, it is important to seek to maintain the net area of native forest available for wood production, and to seek to ensure that productive capacity is restored through rehabilitation of cleared areas, such as mine sites and basic raw material pits. Activities that seek to achieve the latter are included in the section 'Developing self-sustaining ecosystems' of the 'Ecosystem health and vitality' chapter. Basic raw materials are also covered in the 'Socio-economic benefits' chapter.

Plantations

Plantations of pines and eucalypt species have been established within the area covered by the plan for the purpose of supplying wood products to industry. State Agreement Acts have been enacted to attract large-scale investment in processing of pine logs and the obligations embodied therein operate for the full 10-year period of the plan (unless amended or terminated).

Over the period of the previous FMP, the area of pine plantations was reduced significantly, from 59,000 hectares to 52,000 hectares. Historically this has mainly been due to land use change, and more recently also to drought and bushfire. Due to ongoing reductions in the area of these plantations, the capacity to maintain the scale of the industry and for the FPC to meet contractual obligations is becoming increasingly difficult. In the 1990s, some areas of pine plantation were converted to hardwood plantation and during the term of this plan, to help ensure there is sufficient supply for a viable pine processing industry, these areas may be replanted with pine.

Some plantation areas are also important for public recreation and provide an important food source for some native fauna (for example, for Carnaby's cockatoo). The use of plantations for recreation is generally promoted, although public access may need to be temporarily suspended during harvesting operations or for other reasons.

Goal

The plan proposes the following activities at the whole of forest and local scales for the purpose of seeking to maintain the net area of native forests and plantations available for providing forest produce.

Operations proposed to be undertaken (management activities)

As noted above, statements relevant to maintaining the overall area of indigenous vegetation, including native forests, are included in the 'Biological diversity' chapter. The following complementary statements have a focus on maintaining productive capacity.

57 The Conservation Commission, Department and FPC will make submissions in relation to development proposals (including, but not limited to, proposals for infrastructure development, extraction of minerals and petroleum resources, development of geothermal energy and, the geological storage of greenhouse gases) forwarded to them for comment or advice, with a view to:

- 57.1 seeking to minimise the permanent loss of native forests and plantations available for wood production and/or impacts on their integrity as a result of development
- 57.2 seeking the replacement of native forests and plantations not replanted or permanently lost to development, consistent with relevant legislation and government policies
- 57.3 promoting the construction of infrastructure such as roads, pipelines and other utilities at common locations, such as infrastructure corridors, while minimising construction in sensitive areas.

58 **(Plantations):** The FPC will seek to maintain the area of plantation estate required to meet State Agreement Act supply requirements by replanting pines in all suitable areas of State forest and timber reserve that have previously been planted with pines and have been clearfelled, except where not consistent with government policy, and in other areas determined consistent with the agreement ratified under the *Wood Processing (Wesfi) Agreement Act 2000*.

59 **(Plantations)**: The FPC may replant areas of clearfelled hardwood plantation to softwood plantations.

Sustained yield from native forests

Background

Sustaining the flow of goods and services from the forest is an important element in ensuring forests are managed in an ecologically sustainable manner. Section 19(1)(i) of the CALM Act specifies that the Conservation Commission is to advise the Minister on the production and harvesting, on a *sustained yield basis*, of forest produce throughout the State. This includes the production of timber from native forests, and section 55 (1a) of the CALM Act explicitly requires that *timber production* from State forests and timber reserves be managed on a *sustained yield basis*. The sustained yield of jarrah and karri sawlogs calculated for this plan informs the setting of an 'allowable cut' for those products, which in turn provides an upper limit to the quantity that the FPC can contract to supply for the period of this plan.

These upper limits are also set for the lower grade logs, or 'other bole volume', that are made available as a consequence of the harvesting of sawlogs and the silvicultural treatment of stands to promote growth, ecosystem health and/or achieve other aims of management.

The main factors which affect the sustained yield of forests include:

- the net area available for the activity
- attributes of the forests – including species, age and size classes, growth and mortality rates, which in turn are affected by soils, climate, natural disturbance, pests, diseases and management history
- the silviculture applied.

Further comments on each of these factors follow.

Net area available

Calculations of sustained yield have been modified as required to reflect the net area of forest available for timber harvesting within State forest and timber reserves. This excludes areas such as the network of informal reserves where timber harvesting is not permitted, and other areas, such as FHZs, where it is temporarily excluded (see the 'Biological diversity' chapter). Further adjustments to the net area are made during the calculation of sustained yield, to exclude unproductive or degraded forest, such as those areas mapped as drought impacted to the end of 2010, areas that are too steep to harvest safely or are used as minor roads or landings. Included in the net area are areas of jarrah-dominant mine site rehabilitation, as they contribute to future jarrah sawlog and other bole volume yields. Those areas of mine site rehabilitation planted with exotic species are also available for timber production, but do not contribute to the native forest sustained yields.

Attributes of native forests

The Department maintains inventory information about native forest species and age class distribution for State forest and timber reserves, along with information about the extent and impacts of key tree pests and diseases. In this plan, the sensitivity of sustained yield to the influence of a drying climate on forest growth has been explicitly incorporated into modelling, using the climate projections of CSIRO (CSIRO 2007). This modelling work has also incorporated:

- *Standing wood inventory* – the standing inventories of the two-tiered/mature jarrah forest, regrowth karri forest and two-tiered karri forest as updated to 2012.

- *Forest stratification and extent* – enhanced stratification of the regrowth jarrah and karri forests into areas of similar site quality or structural condition (for application of appropriate silviculture guidelines in modelling).
- *Future growth* – adjustments for the potential impact of climate change on the growth rates of jarrah and karri trees and stands have been applied when projecting future yields. The approach varied according to whether two-tiered or regrowth forests were being projected.
    - *For regrowth jarrah and karri forests*, historical tree measurements to 2010 were used in the current empirical growth models to predict future stand growth and consequent yield. Reduced future growth rates were then applied as determined from a physiological growth model for the same site qualities, using the 3PG physiological growth model developed by CSIRO (Landsberg and Waring 1997; Landsberg and Sands 2010), which was calibrated for jarrah and karri by the Department. This model was then run on a monthly time step using the relevant CSIRO (2007) climate projection datasets to 2070. The overall effect of this approach is a progressive reduction over the long term of the maximum productivity of the regrowth forest sites as the projected rainfall reduces. This trend is consistent with other analysis (for example, ABARES 2011).
    - *For the two-tiered jarrah and karri forests*, the projected yields are much less sensitive to variations in growth rates over the next few decades, because most of the available yield is already standing in larger trees of sawlog size. In these forests, the growth rates recorded in the inventory re-measurements for the period 1990 to 2012 (jarrah) and 2002 to 2012 (karri) were applied for the period of this plan, that is to the end of 2023, and from 2024, no growth on the mature trees was applied in subsequent decades (this is very conservative and allows for the potential impacts of a drying climate on future growth).
    - The tree growth and consequent yields for forest areas identified as vulnerable to climate change in the vulnerability assessment report (see Maher *et al.* 2010) were included in the adjustments described above.
    - In the eastern jarrah forest, projections included extended time for recruitment and stocking levels adjusted to reflect expected drier conditions. These provisions are specified in the revised silviculture guidelines for jarrah and its subsidiary guidance documents.
    - *Past and future disease and insect impacts* – the current and future impact on yields from some forest diseases and insect outbreaks have been incorporated in yield projections, including *Phytophthora* dieback, and in karri regrowth, *Armillaria* and *Phoracantha* borer.
- *Past and future bushfire impacts* (future bushfire and drought impacts have been provided for separately).
- Related effects on *tree mortality,* which have been incorporated through adjustments to wood yields.

Silviculture

Silviculture is '*the theory and practice of managing the establishment, composition, health, quality and growth of forests and woodlands to achieve specified management objectives*'. The Department uses a series of silviculture guidelines to outline the management principles for the various forest types, and the silvicultural treatments that can be applied to them. The guidelines seek to ensure that a wide range of forest values is catered for at a local scale, and complement a range of other measures described by the plan. They also inform decisions about the timing and duration of cutting cycles in the various forest types, and this information is used in conjunction with the outputs of forest and stand level inventories to determine sustained yield. The Department monitors application of silvicultural practices to check they are carried out in accordance with silviculture guidelines.

As required by the previous FMP, a review of silvicultural practices has been completed (see Burrows *et al.* 2011), and the report included the following comments:

> *There exists a comprehensive documentation of silvicultural policies, principles, guidelines and manuals prepared by DEC, which, based on the evidence available to the Panel, and given appropriate staff training and compliance, appears to adequately accommodate the conservation of biodiversity and other environmental values at the local forest scale.*
>
> *In summary, the Panel identified a number of relatively minor issues of potential concern (see below) regarding biodiversity conservation and silvicultural prescriptions that require attention, but overall, existing and proposed practices should sustain biodiversity and forest productivity at the local forest scale.*

Accordingly, silviculture guidelines have been amended. The revised silviculture guidelines also include timber production objectives which aim to maintain site productivity and the volume of sawlogs over time. This involves managing the density, composition and structure of stands at all stages of stand development, from regeneration establishment to senescence.

Burrows *et al.* (2011) also stated:

> *It is the Panel's view that forest management to achieve a better water balance in a drying climate is a most critical issue facing forest managers now and in the future. As a consequence of a drying and warming trend since the 1970s, and a legacy of predominantly heavily stocked regrowth forests, these ecosystems are experiencing acute water stress.*
>
> *If this issue is not addressed as a matter of priority, then the consequences will be undesirable, probably irreversible, and will likely compromise efforts to achieve ESFM. Silviculture has a pivotal role in addressing this issue.*

This issue is discussed further in the 'Water' section of the 'Soil and water' chapter.

The Conservation Commission raised concerns about regeneration in the eastern jarrah forest in its mid-term audit of the previous FMP (Conservation Commission 2008b). In its corresponding report, the EPA questioned the capacity of the jarrah forest in the low and adjacent medium rainfall areas, particularly in the northern forest' to 'contribute to the jarrah sustained yield and also be consistent with ESFM' (EPA 2010). Subsequently, a review of the vulnerability of native forest areas to climate change (see Maher *et al.* 2010) and an expert panel review of silviculture (Burrows *et al.* 2011) were undertaken. Burrows *et al.* (2011) investigated this matter and reported it was 'not aware of any evidence to support' this suggestion. The expert panel stated:

> *While growth rates in the northern and eastern jarrah forests are slow, the decline in the timber production from these forests is a consequence of a history of harvesting, and thus a reduction in the availability of sawlog, and the location of customers, who are predominantly located in the southern and western regions of the jarrah forest. Net productive capacity relies on production from the entire forest estate, and the current models accommodate low levels of production in some areas and higher levels of production in other areas. The Panel is of the view that jarrah forests in all rainfall zones have the potential to contribute to the jarrah sustained yield provided ecologically appropriate silvicultural and other management systems that support sustainable forest management are in place*.

Accordingly, those portions of the northern and eastern jarrah forests within State forests and timber reserves that are available for timber production have been included in the calculation of sustained yields. In its assessment of the Proposed FMP, the EPA (2013) stated that jarrah forests in the low and adjacent medium rainfall areas have the potential to contribute to the sustained yield, but that with the impacts of climate change expected to increase over time, monitoring and periodic review is

desirable, particularly from an ecosystem health perspective. As noted previously (see the 'Ecosystem health and vitality' chapter), monitoring will continue.

Sustained yields for this plan

The sustained yields of jarrah and karri sawlogs, and the projected availability of other bole volume has been calculated using a Woodstock™ model developed for the jarrah and karri forests. The underlying data, structure and function of the model were examined by an Independent Expert Panel (see Ferguson *et al*. 2013). The Panel concluded that, subject to some minor data adjustments and modifications to the processes involved in calculating the sustained yields, the:

- *structure, operation and outputs from the woodflow models are robust and flexible enough for computing the sustained yields and other wood availability figures included in the FMP*
- *uncertainty associated with a drying climate has been adequately factored into the sustained yield calculations*
- *level of provision for other risks and uncertainty associated with the volume estimates are appropriate*
- *calculations incorporate suitable adjustments for the operational feasibility of obtaining the strategic woodflows.*

Prior to the calculation of the sustained yields for this plan, those Panel recommendations that would make a consequential difference to the woodflows were incorporated into revisions of data or the design of the Woodstock™ model.

The Draft FMP presented two scenarios based on combinations of proposed changes and various management options, and provided associated ranges for the resultant sustained yields of sawlogs and other bole volume. Following consideration of the public submissions on the Draft FMP, and the advice of the Independent Expert Panel, the key settings adopted in the modelling for this plan are summarised in Table 3.

Table 3: Native forest sustained yield – key settings adopted

Setting influencing sustained yield	Component
ESFM/management objectives	**Silviculture**
	Expanded thinning programs[1]
	Maintain a shorter rotation length for a portion of the karri regrowth regenerated in the 1930s
Area available for wood production	**Formal reserves**
	Establish additional reserves within the Whicher Scarp ecosystem
	Informal reserves
	Not classify as informal reserve those areas previously classified as old-growth forest that are confirmed as not old-growth forest
	Incorporate revised travel route locations in Warren Region
	Incorporate a partial buffer on the Munda Biddi trail
	Fauna habitat zones
	Amended settings for FHZs
Effects of climate change	High climate change severity

Note:
1. Proposals to undertake 'Silviculture for water production' are provided for in this plan, but are subject to the preparation of catchment management plans and have therefore not been explicitly included in the sustained yield calculations or projections of other bole volume made available.

For jarrah and karri sawlog production, the objective was to calculate a sustained yield from woodflows averaged to the year 2070. Beyond this period, the absence of climate change projection datasets, together with the increasing uncertainty about such settings as land use, product requirements, inventory projections and wood processing technologies, makes detailed scheduling unrealistic (Ferguson *et al.* 2003, 2013).

There is a hierarchical relationship between the sustained yields, the annual allowable cut, and the likely level of wood available for contracts to be issued under this plan:

- the sustained yield figures are computed from strategic-level woodflows scheduled in Woodstock™ to the year 2070, and reflect the area settings, silviculture and utilisation assumptions adopted for the plan
- the annual allowable cut for the 10 years of the plan is typically equivalent to the sustained yield, but can be a lesser figure which is reduced to provide for any factors not directly provided for in the sustained yield calculation, such as any safety margins for future losses arising from catastrophic bushfires, drought, pest and disease events
- finally, the FPC may make available through contracts a lesser volume than the allowable cut.

Sawlogs

Table 4 presents the average annual allowable cut for jarrah and karri sawlogs to be made available over the period of this plan.

Table 4: Average annual allowable cut (cubic metres) of first and second grade jarrah and karri sawlogs for the period 2014-2023

	Species	
	Jarrah (m^3)	**Karri (m^3)**
Average annual allowable cut	132,000	59,000

Notes:

1. An annual sawlog sustained yield of 146,000 m^3 for jarrah and 70,000 m^3 for karri was computed from Woodstock™ woodflows, and assumes that the standard of silvicultural outcomes, sawlog utilisation and limited markets for jarrah and marri lower grade logs recorded during the previous FMP, continue indefinitely.
2. The average annual allowable cut is the sustained yield adjusted by a 'safety margin' of 10 per cent for jarrah and 15 per cent for karri, as recommended by the Independent Expert Panel. Such adjustments for risk will vary over time and may also be addressed or offset through contract or commercial arrangements.
3. For all log types, the operationally achievable component of the allowable cut is largely a matter for the FPC.

Small volumes of wandoo, blackbutt and sheoak sawlogs are also expected to become available for sale as a consequence of the harvesting of jarrah and karri sawlogs or harvesting for other purposes. The dispersed distribution and fine-scale mix of these species within the jarrah and karri forest gives rise to substantial fluctuations in the availability of these species between years. Lesser levels of sawlogs are expected to be generated than under the previous FMP, providing for a maximum allowable cut for these species of up to 1,100 cubic metres per annum of wandoo; up to 1,300 cubic metres per annum of blackbutt; and up to 1,200 cubic metres per annum of sheoak. These volumes are estimated to comprise less than one per cent of the standing inventory volume for each of these species in the area available for timber harvesting.

The availability of karri sawlog in subsequent decades is projected to progressively increase, with the potential to more than double by 2045 due to the recurring thinning of large areas of regrowth regenerated since the 1970s. The timing and scale of future 'step changes' in supply will largely depend on industry objectives, which includes the preferred relative mix of log sizes over time. In contrast, the jarrah sawlog is projected to remain at an 'even flow' level throughout the planning period.

The Draft FMP included a setting for additional thinning in the jarrah rehabilitation on minesites. The Independent Expert Panel (Ferguson *et al.* 2013) subsequently recommended that the sustained yields for jarrah should incorporate two separate scenarios for rehabilitated minesites *viz.*, one in which thinning is undertaken in a timely manner, and the other assuming no resource is generated from these stands in the absence of thinning. The modelling indicates the sustained yield of jarrah sawlogs is not highly sensitive to the sawlogs arising from rehabilitated minesites, because these areas are scheduled to contribute sawlogs well beyond the planning period to 2070. However, there is a significant amount of other bole volume projected to become available from the thinning of these rehabilitated areas that is separately identified in subsequent sections as being 'at risk' if thinning were not to proceed.

The allowable cuts for jarrah and karri sawlogs under this plan have not altered substantially from the previous FMP, despite the calculations for this plan explicitly incorporating the projected impact of 'high severity' climate change conditions on tree and stand growth (see the 'Background' section of this chapter). There are a number of reasons why the projected decreases in rainfall and rising

temperature have not resulted in a proportional reduction to the sustained yield or availability of other bole volume:

- The calculation of the sustained yields for the previous FMP already incorporated major adaptive settings and provision for future reduced yields under a drying climate. Some of these assumptions were believed to be precautionary, and monitoring to 2012 has shown this to be the case. For example, no future growth on the 1990 inventory was assumed for the two-tiered jarrah forest when calculating the sustained yields for the previous plan, whereas the remeasurement of the inventory indicated substantial growth and sawlog yield had accrued to 2012. Similarly, the revised rates of future spread of *Phytophthora* dieback across the forest indicate a marked slow-down in spread and hence modelled impact on yields relative to the previous plan calculations.

- The relative contribution of future growth to the sustained yield woodflow varies between forest categories. This moderates the potential impacts from a drying climate on overall wood availability. For example, in the jarrah two-tiered forest, most of the sawlog yield for the next few decades is already standing and available, and because no sawlog growth is assumed in the modelling beyond 2023, a drying climate has little impact. In the karri regrowth forest, the impact of reduced growth is more than offset by a substantial increase in available yields as the large areas of karri regenerated since 1970 start to contribute to sawlog yields.

- Because the sustained yield calculation for this plan assumes no net growth from jarrah two-tiered forests beyond 2023, the impact of a progressively drying, warmer climate on sawlog yields is mainly on the regrowth jarrah forests. However, while the models suggest a progressive decline in *growth rates* of trees and stands over the very long term, some growth is still maintained so that the timber *yields* (which are the sum of the accrued growth over time) are impacted at a comparatively slower rate.

Other bole volume

In the course of harvesting sawlogs, ‘other bole volume’ is obtained from the boles of trees felled to obtain the first and second grade jarrah and karri sawlogs. Other bole volume is also obtained from trees, including marri, that are removed in order to facilitate regeneration, or the growth of retained trees. Other bole volume is also available from first thinning in young stands.

Table 5 presents the average annual allowable cut of other bole volume to be made available over the period of this plan.

Table 5: Average annual allowable cut (cubic metres) of other bole volume for the period 2014-2023

	Species		
	Jarrah (m^3)	**Karri (m^3)**	**Marri (m^3)**
Average annual allowable cut	292,000	164,000	140,000

Notes:

1. The annual allowable cut is the woodflow arising as a consequence of the sawlog sustained yields, adjusted by the 'safety margins' of 10 per cent for jarrah and 15 per cent for karri as recommended by the Independent Expert Panel. However, following bushfires the other bole volume log grades can generally be either salvaged or are downgraded to lower product categories. The jarrah figures include approximately 37,000 cubic metres per year arising from the first thinning of rehabilitated minesites, which would not be generated if thinning of these areas did not proceed during the plan period.
2. The marri figure is total bole volume, which is inclusive of any sawlogs recovered from harvesting operations.
3. Other bole volume of wandoo, blackbutt and sheoak will also be made available in quantities that will vary depending on the structure and mix of forest accessed during the period of the plan.
4. For all log types, the operationally achievable component of the allowable cut is largely a matter for the FPC.

The figures in Table 5 refer to volume to a small end diameter of five centimetres in the regrowth stands, and to the crown break in the larger trees in two-tiered forests. Beyond crown break there are often additional merchantable logs within the crowns of large, mature trees. This wood is referred to as 'non-bole' logs, and it has *not* been included in the sustained yields, or the figures in Table 5. The limited data available suggest these non-bole logs can add up to an additional 10 per cent of the gross bole volume of larger individual trees.

The type and size of the markets assumed to be available for removal of the lower grades of logs (i.e. the other bole volume) has a marked effect on both the jarrah sustained yield and the projected level of jarrah and marri other bole volume made available. The levels of annual allowable cut presented in Tables 4 and 5 assume that the current markets for other bole volume, and hence the future level of sawlog utilisation and silvicultural outcomes in the field, will be the same as that recorded during the previous FMP. However, while these assumptions provide a reasonable basis for calculating yields, they fail to recognise the potential gains that may arise during the period of this plan through the development of new markets such as engineered wood products, or improvements to log segregation practices such as a shift to whole-bole log sales.

Accordingly, the sustained yields and availability of other bole volume has also been calculated using an assumption that 'full' markets and the maximum utilisation of jarrah and marri other bole volume applies from the commencement of this plan in 2014. Keeping all other assumptions the same, this woodflow modelling provides an upper limit that could be approached should new markets arise during the period of this plan. Table 6 presents the upper limits calculated in this manner.

Table 6: Upper limits for the average annual allowable cut (cubic metres) of first and second grade sawlogs and other bole volume for the period 2014-2023

Log product category	Species		
	Jarrah (m^3)	Karri (m^3)	Marri (m^3)
Sawlogs[1]	160,000	59,000	-
Other bole volume[2]	521,000	164,000	254,000

Notes:

1. An annual sawlog sustained yield of 178,000 m^3 for jarrah and 70,000 m^3 for karri was computed from Woodstock™ woodflows, and assumes that from 2014 markets become available and are maintained for all jarrah log types, that enables 'full' utilisation, the thinning of young regrowth stands (including rehabilitated minesites) and other improved silvicultural outcomes. For karri, the historical level of utilisation is expected to continue.

   The average annual allowable cut of sawlogs is the sustained yield adjusted by a 'safety margin' of 10 per cent for jarrah and 15 per cent for karri, as recommended by the Independent Expert Panel. Such adjustments for risk will vary over time and may also be addressed or offset through contract or commercial arrangements.
2. The annual allowable cut for other bole volume is the woodflow arising as a consequence of the sawlog sustained yields, adjusted by the 'safety margins' of 10 per cent for jarrah and 15 per cent for karri. The marri figure is total bole volume, adjusted by a 10 per cent safety margin and is inclusive of any sawlogs recovered from harvesting operations.
3. For all log types, the operationally achievable component of the allowable cut is largely a matter for the FPC.

In practice, progression toward 'full' markets and utilisation may take some years, and will depend on factors such as the nature, location and minimum viable intakes of any new or restructured wood processing facilities. Moreover, any major step-wise changes in markets could require variations to underlying model assumptions such as the relative proportion of the various forest types and categories cutover each year. For example, the upper limit of 521,000 cubic metres for jarrah other bole volume assumes considerable expansion of first thinning operations in young regrowth jarrah stands beyond minesite rehabilitation, as well as accessing areas currently deemed uneconomic due to the low proportion of sawlogs in the stands.

Cutover area and growing stock

The projected area of jarrah and wandoo forest that may be cutover each year will fluctuate between years according to the mix of forest structure and condition of areas included in harvest plans. The modelled woodflows in Tables 4 and 5 are associated with an average annual area cutover of approximately 13,500 hectares, inclusive of clearing for mining, thinning of minesite rehabilitation and thinning of older regrowth jarrah stands. This area is equivalent to up to 0.8 per cent of the total jarrah and wandoo forest within the plan area on lands vested in the Conservation Commission. The upper limits under 'full' markets and the maximum utilisation of jarrah and marri other bole volume (Table 6) would potentially involve an increase in the average annual area cutover to approximately 18,500 hectares (or 1.1 per cent of the total jarrah and wandoo forest), largely as a consequence of additional thinning in young regrowth jarrah stands.

Similarly, the proportion of the total karri forest area within the plan area on lands vested in the Conservation Commission that is projected to be cutover each year is approximately 1.1 per cent, comprising around 2,000 hectares per year, with over 75 per cent of the harvesting involving the thinning of regrowth stands.

The area cutover for the period of this plan is likely to be greater than for the previous FMP because there is a greater proportion of lower yielding forest types and silvicultural treatments likely to be included in areas harvested during the period of this plan. This includes the thinning of more of the young regrowth and minesite rehabilitation that now exists as a result of past management and disturbance. For subsequent plans, once regrowth stands become older and have larger standing volumes, there is likely to be a reduction in area cutover for a given sustained yield.

The proportion of the total standing volume that is harvested each year also provides a broad indicator of the maintenance of the forest productive capacity. For example, Woodstock™ projections suggest the removal of the annual levels of sawlog presented in Table 4 would constitute around 1.1 per cent for jarrah, and 1.8 per cent for karri, of the estimated standing sawlog volumes at 2014. The figures presented in Table 5 for other bole volume would constitute around 0.6 per cent for jarrah, and 1.6 per cent for karri, of the estimated standing other bole volumes at 2014.

Salvage of wood products following disturbances

Several natural disturbances (such as bushfire, drought, pest and disease outbreaks) may lead to the death of trees, and this is taken into account in the calculation of the sustained yield and thus, the allowable cut of sawlogs and other bole volume. In some cases, sizeable patches of forest may be impacted (for example, by bushfire) and there is often a significant benefit to a range of values by regenerating or rehabilitating affected areas. Salvage harvesting of these sites allows for useable wood to be recovered, and provides an opportunity to commence the process for regeneration or rehabilitation. However, as the wood of dead trees degrades quite quickly, achieving this requires that the usual assessment, planning and approval processes be undertaken in a timely fashion. Since there may be reluctance from the wood processing industry to take wood from salvage harvest areas if it might displace other better quality wood it would otherwise have been supplied with, there is a need to consider the question as to whether salvage wood, which meets log product specifications, should count towards allowable cut.

In this plan, it is intended that the decision to salvage any affected areas and determine if any salvaged wood will count towards the allowable cut, be based on a case-by-case evaluation by the Department of the likely public benefit. In doing so, the Department would consider the safety margin incorporated into the calculation of sustained yields, and the costs and ability of affected areas to successfully regenerate and/or be successfully rehabilitated and provide for a range of ESFM values, in the absence of salvage harvest, with its assessment including (but not necessarily limited to):

- the area affected and likely effects on forest structural diversity, connectivity and biodiversity values
- potential impacts and risks associated with management of fire, weeds, pests and diseases
- potential effects on water quality and quantity
- potential effects on site productivity and current and future wood supply
- potential risks to public safety and potential impacts for management of recreation and tourism, and visual amenity.

In turn, the FPC would consider the merit of harvesting such areas, based on its assessment of safety risks, and likely costs and returns.

Goals

The plan proposes the following activities at the whole of forest and local scales for the purpose of seeking to provide for production of jarrah and karri sawlogs on a sustained yield basis and to maintain the quality of the sustained yield calculations for the subsequent plan (from 2024).

Relevant policies and guidelines of the Department

When undertaking the proposed operations (management activities) outlined below, the Department and the FPC will have regard to:

Policy Statement 3: *Management of* Phytophthora *and disease caused by it*

Guidelines for Management of Phytophthora cinnamomi *and disease caused by it – Vol. 1*

Silvicultural Practice in the Jarrah Forest

Silvicultural Practice in Wandoo Forest and Woodland

Silvicultural Practice in the Karri Forest

Soil and Water Conservation Guideline

Code of Practice for Timber Harvesting in Western Australia

Manual of Management Guidelines for Timber Harvesting in Western Australia

Proponents undertaking other disturbance operations will also have regard to these documents where required by the Department.

Operations proposed to be undertaken (management activities)

60 The total quantity of logs removed by the FPC, and if applicable other proponents where approved by the Department, calculated over the 10-year life of the plan, shall not exceed 10 times the average annual allowable cut stipulated in Tables 4 and 5, and 11,000, 13,000 and 12,000 cubic metres equivalent for wandoo, blackbutt and sheoak, respectively.

61 In addition to the amount referred to in activity 60, the FPC may seek to enter into contracts to supply up to the quantities stipulated in Table 6, in order to provide for improved utilisation of available wood resources, silvicultural outcomes and socio-economic benefits. Any proposal to increase the average annual yield of logs above the quantities stipulated in Tables 4 and 5 is to be approved by the Minister for Environment, in consultation with the Department and Conservation Commission, considering whether or not the proposal remains consistent with the woodflow modelling for this plan and any revised inventory information.

62 The FPC will prepare a timber industry development strategy to align future industry opportunities with the location and log quality mix made available under this plan, and likely under future plans based on woodflow modelling.

63 The removal and sale by the FPC, and if applicable other proponents where approved by the Department, of forest products of species *other than* jarrah, karri, marri, blackbutt, wandoo and sheoak that become available in small quantities from approved operations, including timber harvesting and mine site clearing, is also permitted.

64 The Department will prepare rolling three-year indicative timber harvesting plans that are to be:

- 64.1 developed in consultation with the FPC
- 64.2 consistent with the allowable cut set by this plan and the volumes contracted by the FPC
- 64.3 approved by the Department
- 64.4 made publicly available.

65 The FPC will prepare annual timber harvesting plans that are to be:

65.1 developed in consultation with, to the requirements of, and approved by the Department

65.2 consistent with the allowable cut set by this plan and the volumes contracted by the FPC

65.3 made publicly available

65.4 varied at a coupe location or boundary level with the prior approval of the Department.

66 The FPC will prepare coupe level timber harvesting plans, using the Department's planning checklist for disturbance activities, which are to:

66.1 be consistent with annual timber harvesting plans referred to in activity 65

66.2 provide sufficient information to enable the Department to evaluate the proposed operations

66.3 be approved by the Department prior to disturbance operations commencing.

67 The FPC and the Department will:

67.1 monitor the quantity of all log categories removed from native forest in each year, separately recording for each of the commercial species the equivalent volume of first and second grade sawlogs, and other log grades

67.2 periodically monitor the grading and removal of sawlogs.

68 The FPC, and other proponents where required by the Department, will monitor and record the areas of native forest over which each different silvicultural or other treatments are applied in each year and provide suitable information on this to the Department in a format and at times required by the Department.

69 The Department will maintain a process to verify the information and retain the data referred to in activity 68.

70 When the FPC enters into a contract for the supply of wood other than first and second grade sawlogs, it will provide suitable information on this to the Department in a format and at times required by the Department, to enable the Department to calculate the equivalent volume of first and second grade sawlogs which would be derived from the quantity, if any, taken under the contract.

71 The Department may use forest produce that becomes available for use from the carrying out of operations to which section 33(1)(cb) of the CALM Act applies, for the purposes of making improvements to any land to which the CALM Act applies.

72 The Department will continue to refine the data and methodology used for the sustained yield calculations by maintaining and enhancing the quality and coverage of the datasets, and the methodology, used in sustained yield calculations.

73 The Department will:

73.1 facilitate the recovery from areas available for timber harvesting of forest produce generated by management activities the primary purpose of which is not wood production

73.2 determine, based on case-by-case proposals from the FPC, if wood arising from salvage harvests associated with unplanned disturbance events, will count toward the allowable cut. The Department will take into account the likely public benefit, considering the safety margin incorporated into the calculation of sustained yields, and the costs and ability of affected areas to successfully regenerate and/or be successfully rehabilitated and provide for a range of ESFM values, in the absence of a salvage harvest

73.3 develop a guidance document to assist with the timely planning and approval of salvage harvest operations associated with unplanned disturbance events.

Exotic species on State forest and timber reserves

Background

The major plantation species in the plan area are radiata and maritime pine, and in accordance with the CALM Act, the objective for their management is to '*achieve the optimum yield in production consistent with the satisfaction of long-term social and economic needs*.'

There are also areas of State forest and timber reserves that have been rehabilitated in the past with other exotic species, including non-local species of eucalypts (principally from the eastern states). This includes about 3,200 hectares in the Department's Swan and South West regions that have been replanted following mining for bauxite from 1966 to 1998. Along with another 390 hectares of various arboreta and trial plots, these areas provide a range of forest values, including their potential to provide wood resource, which is not part of the sustained yield for jarrah or karri. They are also *not* a part of the area base sought to be maintained to meet the plantation-based State Agreements referred to in the section 'Maintaining forest area' earlier in this chapter. However, their relatively dispersed location within native forest poses a number of long-term biodiversity and potential weed management issues, and the intention is for these areas to be rehabilitated to native species in time, so they can be more self-sustaining.

For clarification, since the ongoing management intent differs for plantations, this plan does *not* include within the definition of plantations these areas of 'Other exotics' within arboreta and trial plots, or that have resulted from past mine site rehabilitation. Map 4 shows the consolidated areas of plantations and the bauxite mining rehabilitation component of 'Other exotics' within the area covered by the plan.

Goals

The plan proposes the following activities at the whole of forest and local scale for the purpose of seeking to achieve the optimum yield in production from plantations on State forest and timber reserves, consistent with the satisfaction of long-term social and economic needs.

For the 'Other exotics', the plan proposes the following activities at the whole of forest and local scale for the purpose of seeking to rehabilitate these areas to native vegetation, while providing for optimum yield in the interim.

Relevant policies and guidelines of the Department

For plantations, when undertaking the proposed operations (management activities) outlined below, the Department and the FPC will have regard to:

Policy Statement 14: *Weeds on CALM land*

Policy Statement 19: *Fire management*

Policy Statement 45: *Environmental monitoring of pesticides used on CALM land*

Policy Statement 47: *Control of Sirex woodwasp in pine plantations*

Policy Statement 65: *Good neighbour policy*

Policy Statement 88: *Prescribed burning*

Code of Practice for Fire Management

Guidelines for the Management and Rehabilitation of Basic Raw Material Pits

For 'Other exotics', when undertaking the proposed operations (management activities) outlined below, the Department will have regard to the *Interim Guideline for the First Thinning of Bauxite Rehabilitation Areas Established Before 1988 with Exotic Species in the Wungong Catchment*.

Proponents undertaking other disturbance operations will also have regard to these documents where required by the Department.

Operations proposed to be undertaken (management activities)

74 **(Plantations):** The FPC will manage the silviculture and harvesting of forest products from plantations to optimise yield to meet legislated obligations including relevant State Agreement Acts, and other supply obligations. Where not inconsistent with this, plantations will be managed to take account of recreation use, and seek to minimise adverse impacts on this and other values when undertaking silvicultural operations and harvesting.

75 **(Plantations):** The FPC will prepare annual timber harvesting plans that are to be consistent with the supply requirement referred to in activity 74.

76 **(Plantations):** Where required by the Department, the FPC will prepare compartment level harvesting plans, having regard to the *Code of Practice for Timber Plantations* (2006), and using the Department's planning checklist for disturbance activities, that are to:

- 76.1 be consistent with annual timber harvesting plans referred to in activity 75
- 76.2 provide sufficient information to enable the Department to evaluate the proposed operations
- 76.3 be approved by the Department prior to disturbance operations commencing.

77 **(Plantations):** The FPC will:

- 77.1 monitor the volume of all log categories removed from plantations in each year, separately recording each of the main commercial species and log grade
- 77.2 periodically monitor the grading and removal of sawlogs.

78 **(Plantations):** The FPC will conduct its silvicultural operations in accordance with its Plantation Silviculture Guidelines which will be amended from time to time in consultation with the Department.

79 **(Plantations):** The FPC will monitor and record the areas over which each different silvicultural treatment is achieved in each year.

80 **(Plantations):** The FPC will continue to refine the data and methodology used for yield calculations by maintaining and enhancing the quality and coverage of the datasets, and the methodology, used in yield calculations.

81 **(Plantations):** The FPC will:

81.1 where it is consistent with government policy, replant areas of plantation that are clearfelled, in accordance with the FPC's plantation management guidelines, as may be revised from time to time

81.2 rehabilitate areas of plantation that are clearfelled and are not to remain as plantation, in accordance with *Guidelines for the Rehabilitation of Plantation Areas* that are to be developed by the Department in consultation with the FPC, the requirements of which will reflect whether or not the FPC has the option to replant.

82 **(Plantations):** The FPC will seek to ensure that appropriate tree breeding programs are maintained to achieve desired plantation outcomes.

83 **('Other exotics')**: Where operations are proposed, the FPC, and other proponents where required by the Department, will:

83.1 in consultation with the Department, develop annual programs of future silvicultural or other treatments, for stands of trees to promote stand vigour and growth rates, with a view to future rehabilitation of these areas to native vegetation

83.2 assess stand development before silvicultural or other treatments are scheduled, with a view to determining whether those treatments are then required

83.3 undertake or reschedule those proposed silvicultural or other treatments, according to the assessment referred to in activity 83.2 and prevailing and expected market conditions, where relevant.

84 **('Other exotics')**: The FPC, and other proponents where required by the Department, will monitor and record the areas of 'Other exotics' over which each different silvicultural or other treatment is applied in each year and provide suitable information on this to the Department in a format and at times required by the Department.

85 **('Other exotics')**: The Department may seek proposals to facilitate the rehabilitation of these areas to native vegetation.

Other forest produce

Background

State forest and timber reserves supply other forest produce such as public firewood, burls, craftwood, wildflowers, seeds and honey. Demand for this other forest produce is not as well understood as that for sawlogs and other log grades, and fluctuates considerably. Supply is affected by a range of factors, including seasonal and temporal variability and access constraints. The Department monitors availability and ecosystem condition and seeks to limit approved activities to a level that it deems can be maintained. Timber harvesting from native forests on private property is subject to the Environmental Protection (Clearing of Native Vegetation) Regulations under the EP Act.

The management of the native flora industry in Western Australia is undertaken by the Department through the provisions of the WC Act, using a system of licensing, area and species-specific management, and monitoring to help ensure the conservation of flora being harvested. Noongar people have expressed a desire to participate in the native flora industry.

Honey (and related products such as bee pollen, bees wax and royal jelly) is collected by apiarists who access areas covered by the plan using a system of designated apiary sites registered with the

Department. These apiary sites are assigned and managed using apiary site permits and licences, which may be issued for periods of up to seven years, and can be transferred between apiarists.

The removal of craftwood from areas on a current harvest plan is authorised using a Minor Production Contract issued by the FPC. Burls are also removed during harvesting operations and these are either sold to people holding a Contract of Sale for the product, or by purchase at an auction conducted by the FPC. On occasions, forest produce may become available as a result of other works (for example, those associated with boundary fencing or roading), and the Department may issue approval for their removal where components of this material are not sold through the FPC.

Public firewood collection

Firewood is removed by FPC contractors and sold to commercial suppliers for sale to the public, however, community demand for collection of public firewood from lands covered by the plan remains strong. There are management issues and costs (including staff time and signage) incurred by the Department for managing public firewood collection, and a range of issues arise, or can arise, from unmanaged/unauthorised activity, including rubbish dumping, spread of weeds, pests and disease (notably *Phytophthora* dieback), and felling of standing trees and/or removal of coarse woody debris, with potentially adverse biodiversity impacts, particularly in areas where there are relatively fewer 'legacy' habitat elements (see 'Biological diversity'). Sufficient resources are required for public education and enforcement activities to reduce the level of illegal removal of firewood, so as to manage the risk of environmental damage associated with this activity.

In the Swan Region and in rural areas close to larger towns, it is expected that there will be increasing difficulty in providing access to any public firewood areas within reasonable proximity, as a result of changes to land category under the previous FMP, access limitations imposed by safety requirements associated with bauxite mining (in particular) in the northern jarrah forest, and from requirements to restrict access to Disease Risk Areas to manage *Phytophthora* dieback.

In this plan, it is intended that the Department, and where appropriate in conjunction with the FPC, implement trials in selected areas, of the three management options identified in the Draft FMP, being:

- the movement of firewood from disease risk areas, protectable areas or 'clean on entry' road sections
- non-commercial thinning of selected areas and removal of non-commercial plantation plots
- firewood only to be available to the public from commercial suppliers.

Subject to the results, the Department may seek to progressively reduce public firewood areas. Even so, it is likely that some public firewood areas would still be made available during the term of this plan.

Goal

The plan proposes the following activities at the whole of forest and local scales for the purpose of seeking to manage the removal of other forest produce, in a manner that, so far as is practicable and sustainable, satisfies public demand for that produce.

Relevant policies and guidelines of the Department

When undertaking the proposed operations (management activities) outlined below, the Department and the FPC will have regard to:

Policy Statement 3: *Management of* Phytophthora *and disease caused by it*

Guidelines for Management of Phytophthora cinnamomi *and disease caused by it – Vol. 1*

Policy Statement 13: *Commercial flora harvesting*

Policy Statement 41: *Beekeeping on public land*

Policy Statement 57: *DEC Enforcement and prosecutions policy*

Management of Commercial Harvesting of Protected Flora in Western Australia 2008– 2013

Proponents undertaking other disturbance operations will also have regard to these documents where required by the Department.

Operations proposed to be undertaken (management activities)

86 The Department will:

- 86.1 regulate the supply of other forest produce through the administration of relevant licensing legislation
- 86.2 maintain and, where appropriate, prepare guidelines for the management of other forest produce
- 86.3 where reasonable and practicable, monitor supply patterns for signs of non-sustainability
- 86.4 work, where applicable in conjunction with the FPC, to implement trials in selected areas for supply of public firewood
- 86.5 facilitate the salvage of other forest produce generated by management activities the primary purpose of which is not wood production, or natural events where salvage activities can contribute to regeneration and rehabilitation and do not significantly increase the level of disturbance or the risk of environmental impacts to the forest area.

87 The FPC will, subject to it reasonably expecting to achieve commercial returns, make wood available from integrated timber harvesting operations available to small processors and craftwood artisans, by auction or other appropriate means.

Regeneration and management of harvested native forest

Background

Harvested and other disturbed areas of native forest must be regenerated and, where necessary, the regeneration needs to be managed to maintain its vigour and productive capacity. Regeneration activities aim to re-establish the site species composition within the disturbed area, using propagules, on-site seed, on-site seedlings and other established growth that has been retained, or seedlings developed from seed from the same LMU. However, flexibility may be required in some cases in order to achieve desired outcomes. For example, where disease is present, or rainfall has declined, it may be appropriate to consider the use of disease and/or drought resistant varieties of those same species. In this case, the best source of seed or seedlings of some species may be from another area. Alternatively, if disease or drought resistant varieties are unavailable or unknown, then using mixed

seed sources to maximise genetic diversity might be an appropriate alternative strategy. This would provide a broader source of variation which would allow greater potential to adapt to new perturbations such as disease or environmental change. Accordingly, the plan includes a mechanism to accommodate this (see activity 89.4 below).

In its report on the mid-term audit of the previous FMP, the EPA (EPA 2010) expressed concern about the effectiveness of regeneration in eastern parts of the jarrah forest. However, monitoring of regeneration of forest by the FPC and by the Department (including through *FORESTCHECK*) has found that regeneration was being effectively achieved across both the karri and jarrah forests. Additionally, the issue was examined by Burrows *et al.* (2011), who found that:

> *…the performance assessments of regeneration in the eastern jarrah forests carried out by DEC on behalf of the FPC clearly demonstrate that recruitment of regeneration in these forests is acceptable. Recruitment of jarrah seedlings extends over an extended period compared to some eucalypt forest types; for example in wet eucalypt forests in Tasmania recruitment has generally ceased altogether about three years after harvesting. In the jarrah forests, recruitment continues for many years, and seedlings take many years to establish. The silvicultural systems that are applied in the jarrah forests recognise this, and retain a canopy and hence a seed supply, wherever regeneration is lacking. Further, the current approach of surveying a sample of the harvested areas at appropriate intervals (for example five years) is supported, as it is clear that recruitment is rarely an issue, given that the appropriate silvicultural system is applied in the first instance*.

Goal

The plan proposes the following activities at the whole of forest and local scales for the purpose of seeking to regenerate and manage harvested forest so as to maintain the productive capacity of that forest in the long term.

Relevant policies and guidelines of the Department

When undertaking the proposed operations (management activities) outlined below, the Department and the FPC will have regard to:

Policy Statement 3: *Management of* Phytophthora *and disease caused by it*

Guidelines for Management of Phytophthora cinnamomi *and disease caused by it – Vol. 1*

Silvicultural Practice in the Jarrah Forest

Silvicultural Practice in Wandoo Forest and Woodland

Silvicultural Practice in the Karri Forest

Soil and Water Conservation Guideline

Code of Practice for Timber Harvesting in Western Australia

Manual of Management Guidelines for Timber Harvesting in Western Australia

Proponents undertaking other disturbance operations will also have regard to these documents where required by the Department.

Operations proposed to be undertaken (management activities)

88 The FPC and other proponents will conduct native forest regeneration and tending operations in a manner that is in accordance with the Department's silviculture guidelines.

89 The FPC and other proponents will undertake native forest regeneration operations by:

89.1 using natural regeneration where reasonable and practicable, or

89.2 where natural regeneration is not reasonable and practicable, and where data are available on the underlying genetic diversity within regeneration species through genetic analysis and an understanding of life history traits, use this information to inform choice of areas from which seed is sourced, or

89.3 where natural regeneration is not reasonable and practicable, and where the information referred to in activity 89.2 is not available, using as the first preference seed or plants propagated from seed collected from the same LMU as the area to be rehabilitated, or where seed is not readily available from this LMU, then using seed from adjacent LMUs, or

89.4 otherwise, subject to a process of approval by the Department, based on assessment criteria agreed between the Department and the Conservation Commission, using other seed sources, including mixed seed sources, where climate change, impact from damaging agents or some other identified management need requires it.

90 The Department, and the FPC and other proponents via the Department, will report to the Conservation Commission annually as to the circumstances where seed sources other than those referred to in activities 89.2 and 89.3 have been used in their native forest regeneration operations.

91 The FPC will seek to continue to develop markets, in particular for those log grades which are currently under-utilised, so as to facilitate the timely achievement of silvicultural objectives, as well as socio-economic outcomes.

92 The FPC and other proponents where required by the Department, in consultation with the Department will:

92.1 develop annual programs of future silvicultural treatments for stands of trees to promote stand vigour and growth rates that can be used to produce sawlogs, which are consistent with the silviculture guidelines

92.2 assess stand development when silvicultural treatments are scheduled, with a view to determining whether those treatments are then required

92.3 undertake or reschedule those proposed silvicultural treatments, according to the assessment referred to in activity 92.2 and prevailing and expected market conditions, where relevant.

Key performance indicators

Key performance indicators will be used to track the implementation of the plan. Five indicators have been selected to provide a broad cross-section of achievement of the activities related to the maintenance of productive capacity.

Key performance indicator 15	The area of native forest and plantations.
Performance measure	Change in: 1. Area of native forest and plantations. 2. Area of forest by land category, including the net area available for wood production. 3. Area of forest cleared. 4. Area of forest rehabilitated.
Performance target(s)	No permanent loss of net area of forested land due to unauthorised activities.

Key performance indicator 16	Removal of log products compared to the allowable cut set in this plan.
Performance measure	1. Cumulative removals for jarrah and karri first and second grade sawlogs compared to the average annual allowable cut. 2. Removal of other bole volume of jarrah and karri (below first and second grade). 3. Removal of logs of other species.
Performance target(s)	1. The cumulative removals of first and second grade jarrah and karri sawlogs shall not exceed the cumulative average annual allowable cut by more than 10 and five per cent at the end of years 3 and 6 respectively, and three per cent at the end of year 9 of the plan, and the total removals over the 10-year plan period shall not exceed the allowable cut. 2. No more than the allowable cut of other bole volume of jarrah and karri, and total bole volume of marri logs over the 10-year plan period. 3. No more than the allowable cut of wandoo, blackbutt and sheoak sawlogs to be removed over the 10-year plan period.

Key performance indicator 17	Silvicultural outcomes for the area of forest cutover.
Performance measure	1. Annual area of each silvicultural outcome for each forest type harvested and/or silviculturally treated. 2. Silvicultural practices assessed by monitoring surveys against the requirements as prescribed in the relevant silviculture guidelines, manuals and procedures.
Performance target(s)	Compliance level of 95 per cent against the prescribed requirements.

Key performance indicator 18	Regeneration of harvested areas.
Performance measure	1. The time between completion of native forest harvesting of a coupe for regeneration and the completion of post-harvest regeneration treatment. 2. The proportion of the sampled annual shelterwood (regeneration establishment) and gap (regeneration release) program that does not meet the acceptable stocking standard. 3. The proportion of clearfelled plantation effectively replanted.
Performance target(s)	1. For karri and planted jarrah: • achieve more than 75 per cent of areas treated to be completed within 18 months • achieve 100 per cent of areas treated to be completed within 30 months and for jarrah which has not been planted: • achieve 90 per cent of areas treated to be completed within 30 months except in circumstances accepted by the Department. 2. No more than five per cent of the area regenerated requiring remedial action. 3. No more than five per cent of the area replanted requiring remedial action.

Key performance indicator 19	Plantations are managed to meet obligations under State Agreements and production contracts.
Performance measure	The total annual volume of each log grade delivered compared to supply obligations (arising from State Agreement Act and other contracts applicable during the plan period).
Performance target(s)	As defined in State Agreements and production contracts.

7 Heritage

Background

Heritage comprises the things we value and want to protect as a community and as a culture. The focus of this chapter is cultural heritage valued by Noongar and other Australians. Noongar heritage includes: traditions, culture and spirituality.

Section 56 of the CALM Act prescribes the management objectives for each category of land to which the CALM Act applies. Management plans for lands managed by the Department may prescribe specific actions to protect, preserve, maintain or restore cultural heritage values. Section 56(2) of the CALM Act includes as an objective of management plans the protection and conservation of the value of the land to the culture and heritage of Aboriginal persons. As the plan area falls within traditional lands of the Noongar, interpretation and management of Noongar cultural and heritage values will be carried out in collaboration with the people who have ancestral connection to the land (*boodja)*.

Goal

An overall goal of the plan is to protect and maintain Noongar and other Australian cultural heritage.

Identified values and threats

The plan seeks to protect and maintain the following heritage values, which fall into the following categories:

- *Aesthetic value* such as buildings that are representative of various architectural styles or periods. While commonly significant for their aesthetic value, these places often have social or historic value as well.
- *Historic value* reflects how a place reveals information about past events, practices and people. Some places with historic value contain no physical evidence, but their name may reveal their history.
- *Scientific value* is the potential of a place to yield information about geological, environmental, cultural and historic processes. This value will largely depend on the importance of the data involved, on its rarity, quality or representativeness, and on the degree to which the place may contribute further substantial information.
- *Social (Noongar) value* is the cultural, spiritual, religious, social or other importance a place may have for Noongar people, the traditional owners of *boodja.* All Noongar *boodja* holds a high social value for the people. Significance must be determined by the relevant Noongar people, through consultation.
- *Social (other Australian) value* is a special meaning important to a community's identity, perhaps through its use of the place or association with it. Places that are associated with events that have had a great impact on a community often have high social value.

It is the relative value that a place has in terms of its aesthetic, historic, scientific or social significance for the present and future communities, which determines the significance of each place.

Threats to these values include:

- inappropriate fire regimes
- theft
- vandalism
- disturbance activities including mineral extraction, construction or maintenance of facilities and infrastructure, timber harvesting, inappropriate recreation use, and uncontrolled vehicular access
- decay or erosion of fabric caused by -
  - the elements including wind, water, flooding, salinity and soil erosion
  - animal activity including termites and insects, trampling by feral animals, burrowing and grazing
  - plant activity including revegetation, weed invasion, fungal disease and plant-caused structural decay
- identified, registered sites or values being impacted because of inadequate procedures and policies or ineffective operational application of current procedures and policies.

Noongar culture and heritage

Background

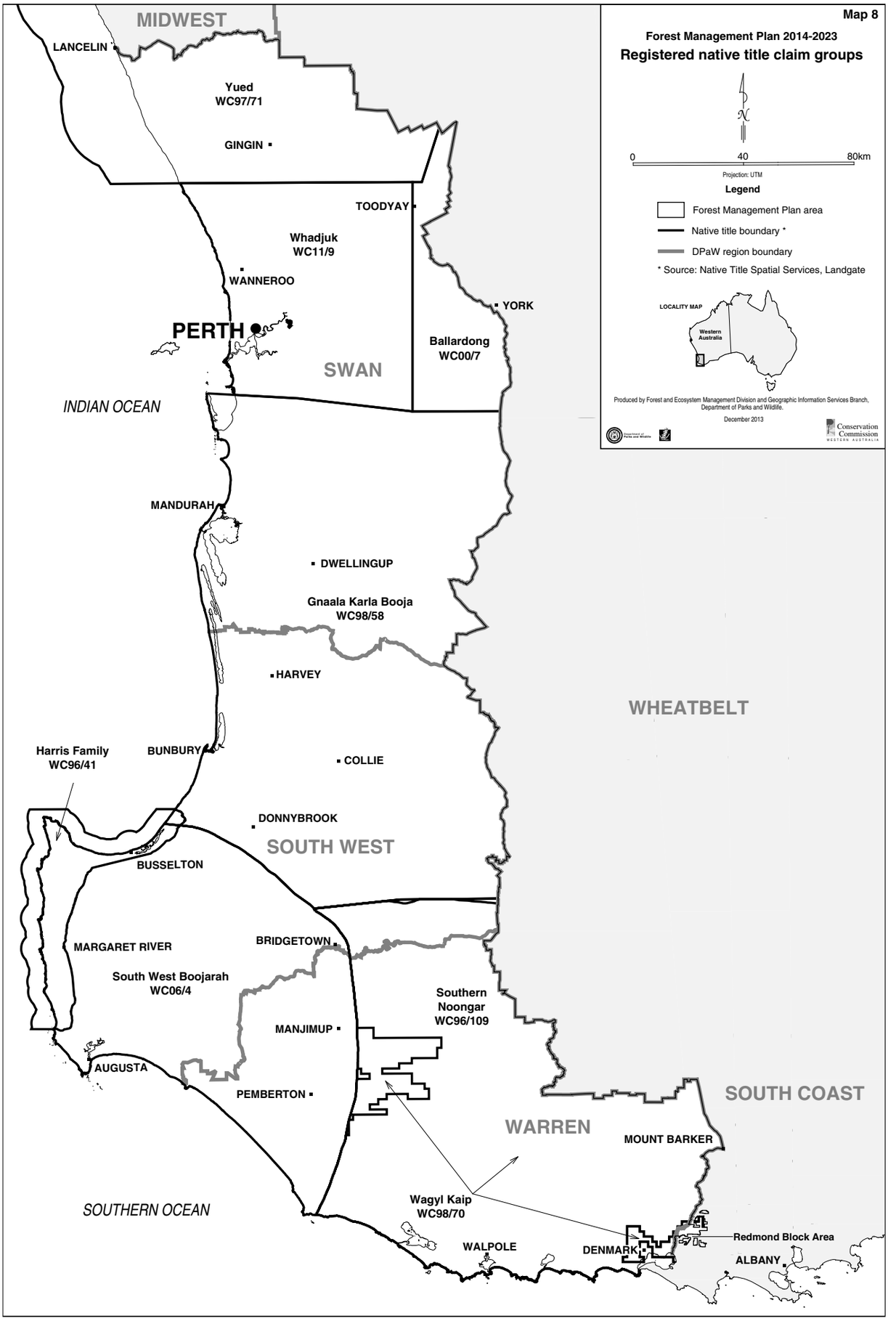
Noongar (meaning 'the people') are the traditional custodians of the south-west of Western Australia and the plan area. Noongar are one of the largest Aboriginal cultural blocks in Australia and a society that has a complex and harmonious relationship with their *boodja*. Noongar can be spelt in a number of ways: Nyungar, Nyoongar, Nyoongah or Noongah. Nyungar is not a written language – it is an oral language, hence the writing of Noongar language is somewhat difficult because of the different ways the words have been spelt over the course of time. Therefore, one spelling of a Noongar word is not necessarily more correct than another, however in this plan, Noongar is used.

There is also significant diversity among Noongar people in the plan area. They are made up of 14 different dialect (language) groups (which may be spelt in different ways): *Amangu, Yued/Yuat, Whadjuk/Wajuk, Binjareb/Pinjarup, Wardandi, Balardong/Ballardong, Nyakinyaki, Wilman, Ganeang, Bibulmun/Piblemen, Mineng, Goreng, Wudjari* and *Njunga.* Each of these language groups correlates with different geographic areas with ecological distinctions. Noongar have ownership of their own *kaartdijin* (knowledge and culture).

These dialect groups are represented through the Whadjuk, Gnaala Karla Booja, Yued, Ballardong, South West Boojarah, Wagyl Kaip and Southern Noongar native title claims. The Harris Family also has a native title claim. Map 8 shows the registered native title claims in the plan area (as current in 2013). Ethnographic and archaeological evidence attests to the dynamic relationship between the Noongar, the biota and landscapes of their *boodja*.

Noongar culture, sites and values

Noongar heritage and *boodja* are interconnected. It encompasses laws and practices, connection to lands and waterways and traditional ecological knowledge of the land and its biodiversity. Noongar heritage also involves both the archaeological records of Noongar, areas of mythological or ceremonial importance, places where traditional and cultural events took place, and the ongoing physical and spiritual involvement of the people with the *boodja*. Noongar heritage provides an essential emotional, physical and spiritual link to Noongar traditions, culture, practices and identity.


Map 8
Forest Management Plan 2014-2023
Registered native title claim groups
N
0
40
80km
Projection: UTM
Legend
Forest Management Plan area
Native title boundary *
DPaW region boundary
* Source: Native Title Spatial Services, Landgate
LOCALITY MAP
Western Australia
Produced by Forest and Ecosystem Management Division and Geographic Information Services Branch, Department of Parks and Wildlife.
December 2013
Conservation Commission
WESTERN AUSTRALIA
MIDWEST
LANCELIN
Yued
WC97/71
GINGIN
TOODYAY
Whadjuk
WC11/9
WANNEROO
PERTH
YORK
Ballardong
WC00/7
SWAN
INDIAN OCEAN
MANDURAH
DWELLINGUP
Gnaala Karla Booja
WC98/58
HARVEY
WHEATBELT
Harris Family
WC96/41
BUNBURY
COLLIE
DONNYBROOK
SOUTH WEST
BUSSELTON
MARGARET RIVER
BRIDGETOWN
South West Boojarah
WC06/4
Southern
Noongar
WC96/109
MANJIMUP
AUGUSTA
PEMBERTON
SOUTH COAST
WARREN
MOUNT BARKER
Wagyl Kaip
WC98/70
SOUTHERN OCEAN
WALPOLE
DENMARK
Redmond Block Area
ALBANY

Under their traditional laws and customs, Noongar people have responsibilities for looking after country, just as country looks after them as their 'classroom' and 'health clinic'. It is recognised that heritage places are still used today and provide a means of maintaining Noongar culture and heritage. The protection of Noongar heritage is therefore a matter of protecting Noongar cultural identity, and facilitating access to the land to look after these heritage places and values.

> *"Unless we have relationship with the land, with country, with boodja, it is very hard to love it and protect it."* (Elders Council: National Conference of the Australian Association for Environmental Education[14] (Bunbury, October 2006))

This interconnectedness is explained through traditional laws and customs, creation stories, songs, and other cultural practices transferred through generations to explain Noongar 'world view' and knowledge of country.

> *"Noongar lore is written in the land."* (South West Aboriginal Land and Sea Council)

Nyitting – Creation Times

The *Nyitting* or 'Creation Times' means 'cold', 'ice age', 'cold time' or 'ancestral times'. It is the time before time, when spirits rose from the earth and descended from the sky to create the landforms and all living things. *Nyitting* stories laid down the lore for social and moral order and established cultural patterns and customs. Noongar Elders have the ability to comprehend the knowledge and to maintain it in an unchanging way. Noongar creation stories can vary from region to region, but they are part of the interconnectedness between all living things.

The Waugal or Great Serpent-like Dreamtime Spirit

Waugal means soul, spirit or breath. The *Waugal* is the major spirit for Noongar and central to Noongar beliefs and custom. It has many different spellings, including *Waakal, Wagyl*, *Wawgal, Waugal, Woggal* and *Waagal*. The *Waugal* is a snake or rainbow serpent recognised by Noongar as the giver of life, maintaining all fresh water sources. It was the *Waugal* that made Noongar custodians of the land.

Noongar believe that the *Waugal* dominates the earth and the sky and makes the *marlga* (thunder), *barbanginy* (lightning) and *kinjarling* (rain). During the *Nyitting*, it created the fresh waterways such as the *bilya* (river), *pinjar* (swamps, lakes) and *ngamar* (waterhole). The Darling Scarp represents the body of the *Waugal*, which created the curves and contours of the hills and gullies. As the *Waugal* slithered over the land, its track shaped the sand dunes, its body scoured out the course of the rivers, where it occasionally stopped for a rest, and created bays and lakes.

Noongar belief in the *Waugal* is as relevant today as it has been since *kura kura* (long, long ago).

Noongar spirituality

Noongar spirituality lies in the belief of a cultural landscape and the interconnectedness between the human and spiritual realms. Everything in the vast landscape has meaning and purpose. Life is a web of inter-relationships where *maam* and *yok* (men and women) and nature are partners, and where *kura* (past) is always connected to *yeye* (present). Through Noongar paintings, music and *keniny* (dance) they are paying respect to their ancestral creators, and at the same time, strengthening their belief systems.

[14] See http://www.aaee.org.au/docs/2006%20conference/03_Collier_Hill_etal.pdf

Noongar spirituality is the interconnectedness with nature and *boodja*. Noongar connection to *boodja* also signifies a close relationship with spiritual beings associated with the land. Noongar express this through caring for *boodja* and observing Noongar lore through an oral tradition of story-telling, and through *keniny* and ceremony. Noongar spirituality is one of many *kaartdijin* systems within Aboriginal Australia, and like other knowledge systems, there is diversity in Noongar interpretations.

Forests – Djarlma

When the great *Waugal* created the *boodja*, he ensured that there were *wirrin* (spirits) to look after the land and all that it encompassed. Some places such as the *kaart* (hills), *ngamar* (waterholes), *boya* (rocks), *bilya* (rivers), and *boorn* (trees) were created as sacred sites and hold *wirrin*, both *warra* (bad) and *kwop* (good). Noongar believe that the spirits of their ancestors live in the forests. The ancestral spirits of their *demanggar* (grandparents) are there to give them their healing and their food. Everything in Noongar *boodja* has a purpose, and if the forests are not preserved and maintained, they will have no ancestral spirits to guide them and give them sustenance and healing; the 'forest spirits' will go to sleep forever and Noongar will become sick in both mind and body.

Protection of Noongar sites and values

The *Aboriginal Heritage Act 1972* was enacted to facilitate the protection of Aboriginal heritage within Western Australia. Under this Act, a person who excavates, destroys, damages, conceals or in any way alters any Aboriginal site (irrespective of whether it is on the 'Register of Aboriginal Sites') commits an offence, unless this is authorised under the Act.

A large number of Aboriginal sites have been recorded within the plan area. These are places of importance and significance to Noongar people and to the cultural heritage of Western Australia. They are significant because they link Noongar cultural tradition to place, land and people over time. Noongar people have a rich and intimate connection with the country within the plan area, which includes knowledge of, rights to, and responsibility for these sites and for protecting the culture and heritage values of these sites.

Aboriginal sites are a diverse range of places including archaeological sites associated with past Noongar land use, and ethnographic and historical sites of ongoing spiritual, historical and cultural importance and significance to Noongar people. As at 10 January 2013, there were 295 sites within the plan area on the State's Register of Aboriginal Sites. However, it is likely that these registered sites represent only a portion of the actual sites within the plan area, as Aboriginal sites exist that are not recorded on the Register. The Aboriginal Heritage Act protects all Aboriginal sites in Western Australia whether or not they are registered.

The registered sites and their associated values in the plan area include:

- mythological and ceremonial sites connected to the Dreaming which continue to be important and of special significance to Noongar people
- artefact and grinding patch sites where Noongar activity is identifiable by the presence of a portable object(s) utilised or modified by Noongar people in relation to traditional cultural life, past or present
- fish traps and other structures made by Noongar people out of stone, wood or other materials for ceremonial or utilitarian purposes
- repository sites where cultural or utilitarian objects are/were taken, or stored, by Noongar people
- midden sites where there is an accumulation of shell refuse that is derived from use of a mollusc resource by Noongar people
- painting and engraving sites where Noongar people have painted or engraved on surfaces such as rocks, rock walls and trees

- burial sites where Noongar skeletal material is buried and/or where mortuary practices occurred
- scarred trees modified by Noongar people by removing the bark or wood for the making of implements, tools or other materials that were used in cultural practices
- quarry sites used by Noongar people for the extraction of stone, and ochre pits used by Noongar people to source ochre for painting and ceremonial purposes
- birth, camping, rock shelters and meeting places where Noongar people were born, camped or undertook meetings and which are significant based on tradition, historical association or sentiment
- hunting places where Noongar people have hunted in association with traditional cultural life past or present
- massacre sites where a significant conflict occurred between Noongar and non-Aboriginal groups, which resulted in the deaths of Noongar people
- water sources such as *ngamar*, soaks, springs and rock holes.

Amendments to the CALM Act and WC Act effective from 2012 require that the Department's management of lands and waters includes the objective to protect and conserve the value of the land to the culture and heritage of Aboriginal persons, in a manner that does not have an adverse effect on the protection and conservation of the land's fauna and flora.

The new provisions in these Acts also enable Noongar people to undertake customary activities, such as preparing and consuming food, preparing or using medicine, and engaging in artistic, ceremonial or other customary activities on land vested in the Conservation Commission. Facilitating Noongar customary access to lands covered by the plan will assist in conserving and protecting Noongar cultural and heritage values, by enabling ceremonial and customary activities and promoting use for Noongar cultural purposes. The Department is working closely with Noongar communities to develop protocols for access for Aboriginal customary activities.

Additionally, these amendments to the CALM Act provide a statutory framework for joint management arrangements. During the term of this plan, if joint management is identified as a priority and there are sufficient resources and capacity to undertake it in particular areas, formal arrangements may be developed. Joint management is a key component of the native title settlement negotiations between the State of Western Australia, the South West Land and Sea Council and the native title claims covering the plan area. Joint management arrangements and outcomes arising out of these negotiations will affect the processes by which Noongar cultural values and input are incorporated into management decisions.

Goals

The plan proposes the following activities for the purpose of seeking to:

- at the whole of forest, landscape and/or local scales, protect and conserve the value of the land to the culture and heritage of Noongar persons, in particular from any adverse material effect caused by entry on or use of the land by other persons, or the taking and removal of the land's fauna, flora or forest produce, but in a manner that does not have an adverse effect on the protection or conservation of the land's fauna and flora
- at the local scale, protect Noongar cultural sites.

Relevant policies and guidelines of the Department

When undertaking the proposed operations (management activities) outlined below, the Department will have regard to:

Policy Statement 18: *Recreation, tourism and visitor services*

Policy Statement 69: *Acknowledgment of Aboriginal traditional* custodians

Policy Statement 86: *Aboriginal customary activities*

Proponents undertaking other disturbance operations will also have regard to these documents where required by the Department.

Operations proposed to be undertaken (management activities)

93 The Department, and other proponents where required by the Department, will seek to prevent material adverse effects on Noongar culture and heritage in the plan area by:

93.1 where required, working with appropriate and representative Noongar groups and relevant agencies to identify cultural and heritage values and sites and gain their input into the management of these

93.2 facilitating access by Noongar people for Noongar customary purposes subject to the CALM Regulations

93.3 community consultation, involvement in decision-making and surveys that are to be undertaken in accordance with Department policies and guidelines that are to be developed as required by activity 94

93.4 ensuring compliance with the provisions of the Aboriginal Heritage Act by having regard to the State Government's *Cultural Heritage Due Diligence Guidelines* and conducting operations in a manner that is in accordance with Department policies and guidelines that are to be developed as required by activity 94.

94 The Department will develop, or maintain and update policies and guidelines on joint management, customary activities and Noongar heritage, as required, and will work with appropriate and representative Noongar groups to identify appropriate opportunities for joint management of areas within the plan area.

95 The Department, and other proponents where required by the Department, will facilitate cross-cultural awareness and interpretive activities to inform and educate relevant staff, contractors and the wider community about Noongar culture and heritage values.

96 The Conservation Commission and the Department will develop a process for assessment of the plan area for importance for Noongar culture and heritage, and the Department, and other proponents where required by the Department, will undertake this assessment, as required, in consultation with relevant stakeholders and agencies.

Key performance indicator

Key performance indicators will be used to track the implementation of the plan. One indicator has been selected related to the management of Noongar culture and heritage.

Key performance indicator 20	Consultation and involvement of Noongar people in management of lands covered by the plan.
Performance measure	1. Establishment of joint management arrangements. 2. Establishment of local area arrangements and protocols for Aboriginal customary activities. 3. Consultation with appropriate and representative Noongar groups for management plans.

Performance target(s)	1. Establishment of at least six joint management arrangements under the CALM Act by 2023. 2. Local area arrangements and protocols for Aboriginal customary activities established and implemented within each district of the Department in the plan area by 2023. 3. Appropriate and representative Noongar groups are consulted and invited to provide input into all management plans.

Other Australian cultural heritage

Background

The exploration and settlement of Western Australia has brought with it a wealth of cultural heritage. In the south-west there is evidence of past activities including timber towns, sawmills, transport systems, dams and weirs, tree nurseries, buildings, structures and other sites. There are also a rich folklore, traditions and the ongoing use and care for the land and forests.

From the inception of a small export trade in 1843, jarrah and other timbers (including sandalwood) became major exports from the colony and a major focus within the expanding south-west economy, with the industry becoming largely responsible for concurrent development in the south-west (Anon. 1969). The railway system of the colony was established from 1871 to facilitate the industry access to forests and ports, and extended to increase transport facilities for the agricultural and mining industries. Many towns in the south-west were established as a result of development of the industry and railway system. Both Bunbury and Busselton harbours were developed and in addition to Fremantle, served as the main ports for wood exports (Anon. 1969).

The timber industry developed rapidly during the 1890s and reached a peak of production in 1913 (Anon. 1969). The first Conservator of Forests was appointed in 1896 and subsequently, several areas of Crown land were set aside as timber reserves. It wasn't until the passing of the (then) *Forests Act* in 1918, "an Act to provide for the better management and protection of forests", that the first State forests were dedicated, commencing with the tuart forest. Prior to the establishment of the Forests Department in 1919, there were few roads in forest areas, but this gradually improved with the need to provide access for forest management. Better access assisted the control of bushfires, which had increased in size, number and severity as a result of human activity, particularly adjacent to, but also within forests.

Through employment schemes during the depression of the 1930s, stand improvement works occurred in over 155,000 hectares of cutover jarrah and karri forests. During this period, timber harvesting levels were also aligned with a sustainable yield by the (then) Forests Department (Stewart 1969). Following bushfires in 1939, changes to legislation occurred and many aspects of rural fire management were improved, including organisation of bushfire brigades and extension of the forest fire tower detection and reporting system. After World War II, many new roads were built and trucks began to replace the locomotives that hauled logs through the extensive network of tramlines, and power saws and tractors became more widespread. From the 1950s, larger sawmills were built to produce the increasing quantities of sawn timber required for post-war development. In 1961, the Dwellingup bushfire led to further changes to bushfire legislation, more research into forest fire management and the extension of prescribed burning to reduce forest fuel loads and bushfire risk (Anon. 1969).

The timber industry has been an important part of the history of early settlement and development in the south-west. Today, there is a wide range of historic places on lands vested in the Conservation Commission, some of which are listed on the State Register of Heritage Places.

Goals

The plan proposes the following activities at the whole of forest and local scale for the purpose of seeking to identify and manage places of other Australian heritage significance on land to which the plan applies, as far as is reasonable and practicable, to:

- recognise and determine the significance of other Australian heritage values
- protect and conserve the known other Australian heritage values.

Relevant policies and guidelines of the Department

When undertaking the proposed operations (management activities) outlined below, the Department will have regard to Policy Statement 18: *Recreation, tourism and visitor services*. Proponents undertaking other disturbance operations will also have regard to this document where required by the Department.

Operations proposed to be undertaken (management activities)

97 The Department will:

97.1 develop and implement appropriate policies, guidelines, manuals or instructions for management of other Australian cultural heritage, as required, that consider and, where necessary, align with the Heritage Tourism Strategy for Western Australia, *State Cultural Heritage Policy*, Government Heritage Property Disposal Process, and the Burra Charter

97.2 use agency procedures that seek to ensure that the presence and type of heritage places are appropriately recorded, accessible to staff and considered prior to operations taking place

97.3 use agency procedures and set appropriate conditions as a part of Department approval processes to seek to ensure that heritage places are effectively protected during permitted disturbance activities

97.4 promote awareness and understanding of the importance of protection and appreciation of the value of heritage places among staff, proponents, operators and visitors.

98 The Department, FPC and other proponents where required by the Department, will:

98.1 conduct their operations in a manner that has regard to approved heritage management policies, guidelines, manuals or instructions

98.2 cooperate with Commonwealth and State agencies, local governments and non-statutory organisations in relation to other Australian cultural heritage identification and conservation.

8 Socio-economic benefits

Background

As outlined in the 'Background' chapter, socio-economic issues are an important consideration in ESFM. The area covered by this plan provides various goods and environmental services that provide a range of socio-economic benefits for the community. In terms of revenue and direct and indirect employment, the most significant industries based on lands covered by the plan, are the minerals, forest products and recreation and tourism sectors. Noongar people have expressed a desire to further participate in these industries.

Management of issues associated with some of these important goods and environmental services is covered elsewhere in this plan. Provisions relating to water are contained in the 'Soil and water' chapter, while provisions relating to production of wood and other forest produce, such as honey, wildflowers and seeds, are covered in the 'Productive capacity' chapter. Sequestration of atmospheric carbon is covered in the 'Climate change and carbon cycles' chapter.

This chapter is focused on issues related to the forest products industry, recreation and tourism, visual amenity, access infrastructure, certain basic raw materials, leases and licences, and genetic resources.

Goal

An overall goal of the plan is to seek to sustain social and economic benefits, through the provision of a range of goods and services valued by the community.

Forest products industry

State forest and timber reserves within the area covered by this plan provide both native forest hardwood and plantation-grown softwood forest products. The growing, harvesting, transport and processing sectors within the forest products industry are geographically dispersed across the south-west. Substantial socio-economic benefits accrue from the industry to the local, regional and State economies and it remains important to the social and economic wellbeing of many communities in areas covered by the plan (Schirmer 2008; Dare and Schirmer 2012).

In recent history, the native forest-based industry has been affected adversely by significant shifts in policy. The downsizing of the native forest-based industry arising from the 1999 RFA and subsequent decisions on management of karri and tingle forests, increases in the reserve system and the policy of protecting old-growth forest implemented through the previous FMP, saw the quantity of jarrah and karri sawlogs available to industry reduced from more than 700,000 cubic metres to about 190,000 cubic metres. These changes resulted in significant business closures and changes in a number of south-west towns and communities.

Hence, at the start of the previous FMP, many sawmills operated at levels that were below the capacity of their equipment and the industry was challenged by reductions in log size and log quality that resulted from these decisions. This led to rationalisation within the industry, and the FPC worked with the remaining mills to increase their intake so that they could become more efficient. New sawn timber markets were also developed and the industry was able to improve its financial viability somewhat over the course of the previous FMP.

The FPC continues to work with the existing sawmilling industry to try to improve the level of utilisation of the available sawlog resource and to help ensure that the forest products industry continues to provide important socio-economic benefits in the south-west region. The industry will need to continue to adapt to the change in log size and quality mix. Increases in costs that may be associated with accessing available logs will adversely impact the industry, and its viability as a whole will be enhanced by the diversification of processing opportunities and end-use markets, the development of new industries which match the available resources and employ state-of-the-art technology, and ongoing improvements to the efficiency of harvesting and log haulage.

As outlined in the 'Productive capacity' chapter, there has been an ongoing reduction in the area of pine plantations, and any further reductions will have flow-on effects for the processing industry and its associated socio-economic benefits.

Goals

The plan proposes the following activities at the whole of forest scale for the purpose of seeking to contribute to the viability of the forest products industry and to provide regional socio-economic benefits.

Identified values and threats

The plan seeks to maintain and enhance the value of the contribution the forest products industry to the economic and social wellbeing in the area covered by the plan.

Threats to these values include**:**

- land use decisions taken without due consideration of the effects on the forest products industry
- other values impacting productive activities within the land base available for productive activities
- access to forest areas being configured and/or unnecessarily restricted or constrained in such a way that it adversely affects the efficiency or increases the costs associated with timber harvesting.

Operations proposed to be undertaken (management activities)

99 The Conservation Commission and the Department will work with the FPC as appropriate and provide input into decision-making processes that may result in a reduced land base or restricted access to land available for timber harvesting activities.

100 The Department will work with the FPC to plan for a source location, log product and wood quality mix that seeks to support a viable forest products industry.

Key performance indicator

Key performance indicators will be used to track the implementation of the plan. One indicator has been selected related to the role of the plan in facilitating socio-economic benefits associated with the forest products industry.

Key performance indicator 21	Social and economic benefits from the timber industry.
Performance measure	1. Quantity of product by the level/extent of local value adding. 2. Investment in new processing technologies. 3. Employment and social benefits as determined by independent sociological study at plan commencement and to enable reporting at mid-term and end-of-term.

Performance target(s)	1. All high value sawlog resource processed or value added locally and an increase in low value resource taken on by local markets. 2. Increased local processing capacity. 3. Employment and social benefits maintained or increased.

Recreation and tourism

The area covered by the plan provides important opportunities to meet the growing public demand for outdoor recreation and nature-based tourism in the south-west of Western Australia. Outdoor recreation contributes to public understanding and appreciation of nature, conservation and forest management, and makes an important contribution to the social, spiritual, psychological, physical and economic wellbeing of the community. A wide variety of activities is catered for, including picnicking, bushwalking, cycling, camping, swimming, fishing and canoeing. There are also two gazetted off-road vehicle areas within pine plantations north of Perth. On occasions, areas covered by the plan are also utilised for activities such as organised car rallies and adventure racing.

The economic benefit derived from recreation and tourism activity in the south-west is derived in part from the areas covered by the plan. Recreation and tourism assets such as the Valley of the Giants and Tree Top Walk, the Bibbulmun Track and Munda Biddi Trail are recognised as world-class facilities that provide an important basis for some south-west tourism and recreation businesses. The Department's records show visitation to areas covered by the plan reached 7.1 million visits in 2012-2013, representing an increase of 2.3 million visits (48 per cent) compared to 2003-2004. Departmental records also indicate that the recreation and tourism experiences offered on land it manages earn consistently high visitor satisfaction, with an average visitor satisfaction level of 88 per cent in 2012-2013. Demand for use of land vested in the Conservation Commission in the plan area for recreation and tourism is expected to continue to grow in line with population growth in the south-west, and the need to balance the provision of enjoyable and enriching visitor experiences with conservation and other values and uses will remain an important management challenge.

Goals

The plan proposes the following activities at the whole of forest, landscape and/or local scales, for the purpose of seeking to provide opportunities for active and passive recreation and tourism that will meet public demand, so far as is practicable and sustainable, and to provide regional socio-economic benefits.

Identified values and threats

The plan seeks to protect and maintain the following values:

- the range and quality of recreation and nature-based tourism opportunities and experiences
- the associated physical and mental health benefits.

Threats to these values include**:**

- degradation of natural areas, assets and facilities that support recreation and tourism
- inadequate planning, leading to conflicts with other land uses or activities and/or recreation and tourism opportunities not matched to community demand
- poor design of assets and facilities leading to user dissatisfaction or safety risks
- inappropriate behaviour affecting the enjoyment of others, and inappropriate use of and/or wilful damage to facilities provided
- inappropriate fire regimes, including uncontrolled bushfires.

Relevant policies and guidelines of the Department

When undertaking the proposed operations (management activities) outlined below, the Department will have regard to:

Policy Statement 15: *Community Involvement*

Policy Statement 18: *Recreation, tourism and visitor services*

Policy Statement 34: *Visual Resource Management on Lands and Waters Managed by CALM*

Policy Statement 53: *Visitor Risk Management in the Department of Environment and Conservation*

Policy Statement 62: *Identification and Management of Wilderness and Surrounding Areas*

Policy Statement 68: *Management of Organised Group Activities*

DEC Parks and Visitor Services Strategy 2007 – 2011

Corporate Guideline 13: *Guidelines for the Management of Organised Group Activities*

Proponents undertaking other disturbance operations will also have regard to these documents where required by the Department.

Operations proposed to be undertaken (management activities)

101 The Department will:

- 101.1 maintain understanding of visitor and recreation demand including the knowledge, attitudes and activities of visitors in the area covered by the plan
- 101.2 continue to support and plan for recreation and tourism, and provide and maintain safe and appropriate recreation and tourism facilities and services, in locations and in a manner that seeks to meet demand and minimise conflicts with other ESFM values
- 101.3 consider possible additional areas for off-road vehicle use, in consultation with relevant stakeholders
- 101.4 provide for the expansion of camping and caravanning facilities in the area covered by the plan
- 101.5 work with relevant water agencies and utilities in planning for and managing tourism and recreation activities in water catchment areas
- 101.6 monitor and manage visitor use, including through regulating and licensing of appropriate commercial activities
- 101.7 seek to enrich visitor experiences and develop and nurture lifelong connections between the community and natural areas, by providing opportunities to learn, explore and interact with the natural and cultural environment.

Key performance indicator

Key performance indicators will be used to track the implementation of the plan. One indicator has been selected related to the management of recreation and tourism.

Key performance indicator 22	Visitation to lands covered by the plan, facilities available for recreation activities and the level of visitor satisfaction.
Performance measure	1. Number of visits to selected recreational areas. 2. Type and number of recreation and tourism facilities available in the plan area. 3. The satisfaction visitors express with their experience.
Performance target(s)	1. Level of visitation to be maintained or increased. 2. No target, trends to be reported. 3. Visitor satisfaction to meet or exceed Departmental benchmark.

Visual amenity

The natural landscapes covered by this plan are valuable for their intrinsic qualities, for the quality of life and enjoyment of people, and for the economic benefits they bring. Identifying and protecting the visual amenity of natural areas seeks to ensure that those values are maintained for the social, spiritual and economic benefit of the community. Visual landscape management seeks to ensure that all uses and activities are planned and implemented to complement, rather than detract from, the inherent visual qualities of the landscape.

Goal

The plan proposes the following activities at the landscape and local scales for the purpose of seeking to protect visual landscapes.

Identified values and threats

The plan seeks to protect and maintain the following values:

- scenic quality
- visual amenity
- sense of place.

Threats to these values include:

- poorly planned and implemented activities due to inadequate, or ineffective application of procedures
- inappropriate fire regimes, including uncontrolled bushfires.

Relevant policies and guidelines of the Department

When undertaking the proposed operations (management activities) outlined below, the Department will have regard to:

Policy Statement 19: *Fire management*

Policy Statement 34: *Visual Resource Management on Lands and Waters Managed by CALM*

Policy Statement 88: *Prescribed burning*

Code of Practice for Fire Management

Proponents undertaking other disturbance operations will also have regard to these documents where required by the Department.

Operations proposed to be undertaken (management activities)

102 The Department will make submissions in relation to development proposals that may impact on visual landscapes on land to which the plan applies that are forwarded to it for comment or advice, with a view to seeking to reduce the effect of any proposed activity on the visual quality of the landscape.

103 The Department, FPC and other proponents where required by the Department, will:

103.1 maintain and implement a visual landscape classification and management system

103.2 review where necessary and implement guidelines for the application of visual landscape management principles in land-use planning, codes of practice, operational guidelines and other relevant manuals.

104 **(Plantations):** The FPC will consider the impact of plantation operations on the visual quality of the landscape and where reasonable and practicable, will conduct those operations in a manner that seeks to reduce their impact on the visual quality of the landscape.

Access – roads and bridges

A well-designed and managed system of roads and bridges within the area covered by this plan is essential to help ensure that socio-economic benefits are able to be realised. The network provides access for neighbours and for visitors to enjoy recreational opportunities, provides easements for water, gas, electricity and communications, and connects towns and communities. It provides access for management, including access to facilitate rapid response to bushfires and other emergencies, and for haulage of logs and other forest produce. The access network is extensive, includes many culverts and bridges, and is expensive to maintain. Accordingly, maintenance needs to be prioritised so that strategic parts of the network remain functional.

Goal

The plan proposes the following activities at the whole of forest, landscape and/or local scales, for the purpose of seeking to maintain a safe and adequate access network for land to which the plan applies to enable social and economic benefits to be realised.

Identified values and threats

The plan seeks to protect and maintain the value of a safe, well planned and maintained system of strategic access roads, bridges and related infrastructure to provide for a range of management activities, including fire management and recreation use.

Threats to this value include:

- deterioration of the assets beyond the rate at which they can be maintained with existing resources
- accelerated deterioration associated with storms and inappropriate fire regimes
- increasing recreation and tourism demand.

Relevant policies and guidelines of the Department

When undertaking the proposed operations (management activities) outlined below, the Department and the FPC will have regard to Policy Statement 40: *Road management*. Proponents undertaking other disturbance operations will also have regard to this document where required by the Department.

Operations proposed to be undertaken (management activities)

105 The Department will continue to review the strategic access network in consultation with relevant stakeholders.

106 The Department will continue to seek resources to fund essential access infrastructure.

107 The Department, FPC and other proponents where required by the Department, will where reasonable and practicable, seek to retain, develop and maintain strategic access infrastructure in a manner and at locations that will service multiple needs.

108 The Department, FPC and other proponents where required by the Department, will undertake design, construction and maintenance operations for unsealed roads, and progressively rehabilitate redundant roads, in a manner that has regard to the 2009 *Unsealed Roads Manual – Guidelines to Good Practice*, issued by the Australian Roads Research Board and subsequently, have regard to relevant Departmental policy and guidelines, once finalised. The Department will consult with the FPC and other relevant agencies in preparing and revising its policy and guidelines, as appropriate.

Key performance indicator

Key performance indicators will be used to track the implementation of the plan. One indicator has been selected related to the management of strategic access.

Key performance indicator 23	Maintenance of an effective strategic road network within the area covered by the plan.
Performance measure	Access via strategic road network.
Performance target(s)	Access via strategic road network to be maintained.

Basic raw materials

Background

This section is focused on activities associated with the extraction of basic raw materials (BRM) that are not covered and approved under the Mining Act. However, activity 113, which relates to the role of the Conservation Commission and Department in commenting or advising on proposals under that Act, is included (see 'Operations proposed to be undertaken (management activities)', below).

State forest and timber reserves contain supplies of gravel, shale, clay, sand, limestone and rock that together are known as BRM. These materials are used for road making and building throughout the south-west, and those from State forest and timber reserves are provided to government agencies and local governments through leases issued under section 97 of the CALM Act. The Department uses BRM for its own purposes in recreation and management activities and facilitates its supply for timber harvesting undertaken by the FPC.

In addition to minimising the area impacted and the potential for other unintended adverse environmental impacts, the use of fewer, larger-scale BRM pits has operational advantages, particularly where mobile crushers are used. This approach has great potential to improve the recovery of BRM from any pit area, and to improve rehabilitation outcomes by having the seed-bearing topsoil returned to the site within shorter timeframes. Fewer, larger pits can be managed more intensively and possibly fenced if necessary to minimise risk of unauthorised removal and unintended infestation with *Phytophthora cinnamomi*. It is expected that users of BRM should contribute to the cost of establishing, maintaining and rehabilitating these pits.

Other statements in relation to rehabilitation requirements for BRM pits are included in the 'Developing self-sustaining ecosystems' section of the 'Ecosystem health and vitality' chapter. Some additional, complementary statements are included in this section.

Goal

The plan proposes the following activities at the whole of forest, landscape and/or local scales, for the purpose of seeking to ensure the availability of BRM, and enable regional socio-economic benefits to be realised, while managing the environmental impact of the removal of BRM.

Identified values and threats

The plan seeks to protect and maintain the value of the availability of BRM that are suitable for the intended use. Threats to this value include:

- infestation by pathogens, such as *Phytophthora* species
- ineffective utilisation of the existing resources through poor pit management.

Relevant policies and guidelines of the Department

When undertaking the proposed operations (management activities) outlined below, the Department and the FPC will have regard to:

Policy Statement 2: *Local Government Authority access to Basic Raw Materials from State forest and timber reserves*

Guidelines for the Management and Rehabilitation of Basic Raw Material Pits

Policy Statement 3: *Management of* Phytophthora *and disease caused by it*

Guidelines for Management of Phytophthora cinnamomi *and disease caused by it – Vol. 1*

Proponents undertaking other disturbance operations will also have regard to this document where required by the Department.

Operations proposed to be undertaken (management activities)

109 The Department will seek to ensure that all BRM removals from lands vested in the Conservation Commission:

109.1 comply with relevant legislation, and policies and guidelines which will be reviewed

109.2 contribute to the ongoing implementation of relevant government strategies, including the *State Gravel Supply Strategy*

109.3 where practicable, are sourced from a network of (fewer) strategic pits, which it will identify in consultation with relevant government agencies and BRM users.

110 The Conservation Commission will require that all BRM removals from land vested in the Conservation Commission are subject to the provision of certified returns to the Department for removals by the government agency or local government authority which has access to and is removing the BRM.

111 The Department, in consultation with the Conservation Commission, will develop management guidelines and processes to allow for sterilised BRM, including that from other land tenures, to be used on land to which the plan applies.

112 The Department, FPC and other proponents where required by the Department, will contribute to the maintenance of a database of areas from which BRM have been extracted, and will continue to progressively develop plans and works programs for the rehabilitation of these areas to standards agreed with the Department.

113 The Conservation Commission and Department will provide comment or advice in relation to proposals to extract BRM on land to which the plan applies that are forwarded to them, with a view to seeking:

113.1 the timely rehabilitation of all pits to acceptable standards as set by the Department, developed in consultation with relevant stakeholders

113.2 that the full cost of rehabilitation of areas from which BRM are extracted is borne by the organisation responsible for the extraction of those materials.

Leases and licences

Background

Leases and licences for access to and use of land to which the plan applies have been granted for uses such as communication towers, utilities infrastructure, grazing, extraction of BRM, water storage, and for recreation and tourism facilities, including restaurants, kiosks, caravan parks and other accommodation, plus activities such as tours and other commercial recreation activities (including organised events and commercial filming). Tourism lease and restricted 'E Class' commercial operations licence applications are assessed against criteria that include Aboriginal participation, equity and training opportunities. Noongar people have expressed a desire to develop commercial enterprises based on traditional activities, for example the production of artefacts, seed and flower collection, and bush medicines.

The Department enters into leases and licences where they meet the requirements of the CALM Act (and related regulations) and are consistent with ESFM principles. Licences have conditions attached that provide a regulatory basis for managing and monitoring permitted activities. For commercial licences, most of these conditions are set out in the Department's Commercial Operations Handbook

(Terrestrial and Marine), along with a range of other information to assist commercial operators in undertaking their activities in an ecologically sustainable manner. Extra conditions can also be attached to a licence on a case-by-case basis if considered necessary.

Goal

The plan proposes the following activities at the local scale for the purpose of seeking to manage leases and licences for appropriate facilities and uses in order to provide regional socio-economic benefits, while managing the environmental impacts associated with the leases or licences.

Identified values and threats

The plan seeks to protect, develop and maintain the following values:

- recreation and tourism opportunities and experiences
- access for other uses consistent with the legislation, including Noongar socio-economic development.

Threats to these values include lack of compliance with lease and licence conditions.

Relevant policies and guidelines of the Department

When undertaking the proposed operations (management activities) outlined below, the Department will have regard to:

Policy Statement 18: *Recreation, tourism and visitor services*

Policy Statement 53: *Visitor risk management*

Policy Statement 55: *Commercial filming on CALM managed lands and waters*

Proponents undertaking other disturbance operations will also have regard to these documents where required by the Department.

Operations proposed to be undertaken (management activities)

114 The Department will issue and administer leases and licences for facilities, activities and uses in accordance with the provisions of the CALM Act.

115 The Department will encourage the development of Noongar enterprises within the plan area.

Development of genetic resources (bioprospecting)

The development of genetic resources via bioprospecting is a small but potentially valuable industry, which could provide important yields for pharmaceutical, industrial and agricultural chemicals from native flora. The Government is also developing new bioprospecting legislation that will establish a framework to manage the intellectual property and commercial benefits that can result from bioprospecting. The Department recognises the important and valuable knowledge that Noongar people hold within the plan area. It is important that Noongar people's intellectual property rights are recognised and protected.

Goal

The plan proposes the following activity at the whole of forest scale for the purpose of seeking to promote, encourage and facilitate the controlled exploration of native flora for scientific, therapeutic and horticultural purposes, and to provide regional socio-economic benefits, while managing the environmental impacts and intellectual property issues associated with bioprospecting.

Identified values and threats

The plan seeks to protect and maintain the value of genetic resources and their potential value to people. Threats to these values include**:**

- unauthorised bioprospecting carried out beyond the legislative framework and contractual conditions
- the potential of flora remains unidentified
- the State does not receive appropriate recompense from the exploitation of the resource.

Operations proposed to be undertaken (management activities)

116 The Department will:

116.1 administer agreements with bioprospecting companies and explore and, as appropriate, enter into other agreements

116.2 contribute to the development of modern bioprospecting legislation.

9 Plan implementation and management

Background

Management systems will have an important bearing on the effectiveness of implementation of the plan's goals. The five key elements of a contemporary system for environmental management include:

- environmental policy and commitment
- planning of environmental requirements
- implementation of environmental requirements
- measurement and evaluation of environmental performance
- review and improvement of environmental outcomes.

The FPC has an environmental management system certified to AS/NZS ISO 14001, which provides a standardised, systematic management framework. It also has certification to the Australian Forestry Standard (AS4708-2007), which requires conformance not only with the management system standards, but also with recognised forestry standards at an international level under the Program for Endorsement of Forest Certification.

For the Department, there is a hierarchy of elements including this plan, that together, combine to serve the purpose and intent of a system for environmental management. The following sections provide an overview of the measures that address these elements.

Also included throughout this plan are various goals, proposed operations (management activities), and key performance indicators, including associated targets and reporting arrangements. In addition, there is a range of risk assessment, planning and approvals processes used, and operational controls that apply to environmental aspects of disturbance operations down to the local scale, that seek to protect identified values and minimise identified threats, and directly support the achievement of these goals.

Goal

An overall goal of the plan is to seek to ensure that management is undertaken in a systematic manner in accordance with the plan and is continually improved so as to achieve desired outcomes.

Environmental policy

Environmental policy is framed by legislative obligations and applicable government policies, and documented in relevant policies, guidelines, manuals, codes of practice and other documents that are subsidiary to and referred to in various sections of this plan (see Appendix 5).

Planning

The planning element of the environmental management system requires the identification of significant environmental aspects, identification of legal requirements, development of goals (sometimes referred to as objectives) and an environmental management program designed to achieve

those goals. This plan effectively meets the essential elements of planning in a system for environmental management.

Environmental aspects

This plan identifies the environmental aspects through the listing of identified values and significant threats to those values. The risks that might be posed to various environmental values by planned disturbance operations are identified and assessed during the planning processes, which applies down to the local scale. For example, the Department's planning checklists are used as part of the timber harvest planning process to identify significant values and manage risks at a site specific level.

However, there are other operations carried out by the Department and other proponents, such as infrastructure developments, which may also require similar consideration of environmental aspects. Given this, a corresponding proposed operation (management activity) has been included below (activity 117), which seeks to ensure that planning processes for all disturbance activities consider all of the matters identified in the Department's planning checklists.

Legal requirements

The environmental management system requires the identification and access to applicable legal requirements. Relevant Western Australian statutes are available to staff of the Conservation Commission, Department and the FPC through agency intranets and to the public and proponents at the State Law Publisher website (and the corresponding Commonwealth government facility provides access to relevant Commonwealth statutes). Legislative requirements are also identified in a range of subsidiary documents and planning checklists. A summary of the most relevant legislation is provided in the 'Background' chapter and Appendix 2 of this plan.

Environmental management program

An environmental management program is the key document of a system for environmental management. This plan meets this requirement as it identifies goals and performance targets, and the proposed operations (management activities) to be undertaken to achieve those goals, along with identifying responsibility for their implementation.

Implementation

Background

Implementation of a system for environmental management requires that:

- resources, roles, responsibility and authority be defined
- people undertaking tasks that could cause an environmental impact are competent on the basis of appropriate education, training or experience
- policies, goals and targets and related subsidiary documents are documented, including operational controls that are developed and implemented to meet policies, goals and targets
- a suitable recording system and control of documents be maintained to help ensure they are approved prior to use, reviewed, updated and available to those that need to use them
- emergency preparedness and response arrangements that seek to prevent or mitigate adverse environmental impacts are available and implemented
- internal and external communication is undertaken.

These are discussed in turn, next. However, resourcing is outside the scope of this plan and is managed through ongoing government budget processes.

Roles, responsibility and resources

In the mid-term audit of performance of the previous FMP, concern was expressed regarding the legislative clarity of the Department's relationship with proponents and how they operate on Department-managed land (see Conservation Commission 2008b). In the same report, the Conservation Commission also raised some issues concerning roles and responsibilities. The EPA, in its report and recommendations on the mid- and end-of-term audits of performance on the previous FMP (EPA 2010 and 2012), advised that the next FMP (this plan) should aim to clarify the statutory roles and responsibilities of the Department and the FPC. Accordingly, during the period of this plan, the interagency arrangements between the Department and the FPC are to be formalised in writing to clarify and improve the current arrangements.

Competencies and training

Capacity building involves staff and contractors, as appropriate, and occurs through a combination of communications for awareness-raising, and training and development activities. The competency of people in doing their work is often assessed through the monitoring and evaluation program, which helps to identify the need for further training and improvements that may be required to the current approaches to training.

Operational controls

Implementation of the intent of this plan is supported at an operational level through detail in this plan and various subsidiary documents and processes (see Appendix 5). These include guidelines and manuals that set out requirements and document procedures and checklists. These are reviewed, revised and created as required in response to improved knowledge and changes in technology and conditions. During the term of this plan, the Department and the FPC will progress the confirmation of an agreed set of procedures, including a single index identifying which guideline or requirement is applicable to each activity or circumstance. This process will also address the issue of maintaining the currency of operational guidance documents, for the staff of both agencies.

This plan proposes a more efficient process for approval of new and revised guidance documents, consistent with existing Department processes (see the Department's Policy Statement 1: *Department of Environment and Conservation – Key documents*). For the development or revision of certain subsidiary documents, the Conservation Commission will be consulted as identified in this plan (also see Appendix 5).

Documentation and control of documents

Control of documents and records occurs according to relevant legislation (such as the *State Records Act 2000*) and through various agency administrative protocols. For example, the intranet and extranets of the Department and the FPC employ a document control system to help ensure that only current documents are available to users.

Emergency preparedness and response

Responsibilities for emergency preparedness and response are determined by legislation and described in this plan and subsidiary documents (see the 'Soil and water' chapter), and detailed in various other government documents.

Internal and external communication

There is a range of plans, methods and techniques within and between the Conservation Commission, the Department, FPC and proponents of other disturbance operations to facilitate communication regarding environmental aspects. Communication with external stakeholders is also important and is covered in the final section of this chapter.

Relevant policies and guidelines of the Department

When undertaking the proposed operations (management activities) outlined below, the Department will have regard to Management Guideline 1: *User guide for approvals matrix for operations on CALM Act reserves*.

Goal

The plan proposes the following activities at the whole of forest scale for the purpose of seeking to facilitate effective implementation of this plan.

Operations proposed to be undertaken (management activities)

117 The Department, and other proponents where required by the Department, will prepare a plan of operations, using the Department's planning checklist for disturbance activities, which is to provide sufficient information to enable the Department to evaluate the proposed operations.

118 The Department will:

- 118.1 as the regulator of timber harvesting activities on the area that is subject to this plan, prepare a regulation policy by 30 June 2014, to confirm the regulatory framework
- 118.2 in conjunction with the FPC, develop and implement formal working arrangements by 31 December 2014, consistent with the regulation policy, to among other things, define roles and responsibilities, and establish an agreed process for approving and maintaining the currency of subsidiary documents.

119 The Department, FPC and other proponents where required by the Department will, through common training and accreditation programs, where appropriate, develop the competency of staff and contractors involved in regulation, planning, supervision and implementation of disturbance operations.

120 The Department will prepare and/or revise subsidiary documents referred to by this plan having regard to the Department's Policy Statement 1: *Department of Environment and Conservation – Key documents*.

Monitoring and evaluation of performance

Performance against the plan will be assessed through monitoring, auditing, checking and identification and reporting of non-conformance. A specific form of monitoring related to increasing knowledge and adaptive management is also included in this section and supports the commitment to continuous improvement.

Monitoring

The primary purpose of this information is to assist in current and future decisions to modify management. Several agencies undertake monitoring in the plan area – for example, the Department of Water and the Water Corporation have responsibility to monitor water quality and quantity. It is

intended that reliable monitoring data and information available from other sources will continue to be used where relevant.

The Department has a number of systems available that it can use to meet the requirements for monitoring, including *FORESTCHECK,* and others that enable it to report against performance indicators. For additional information on *FORESTCHECK*, see the 'Biological diversity' chapter, and the *FORESTCHECK* information sheet series. In addition, the Department is developing guidelines to provide a framework for coordinating its broader forest monitoring activities.

Auditing

Auditing is a systematic, independent and documented process for obtaining evidence and evaluating it objectively to determine the extent of compliance and performance against organisational requirements (adapted from AS/NZS ISO 14001). It provides an objective and impartial assessment of specific areas of performance. Auditing will include a combination of internal and external audits.

Auditing of operations is undertaken at several levels, with the key ones being:

- the Department undertakes internal audits of the efficiency and effectiveness of its operational systems and compliance audits of its field performance, and undertakes audits of FPC compliance, and the performance of other external operators on land managed by the Department
- the FPC undertakes internal audits of the efficiency and effectiveness of its management systems and compliance audits of its field performance
- independent external audits are undertaken to assess the conformance of the management systems of the FPC against both the AS/NZS ISO 14001 and Australian Forestry Standard.

The priority for auditing is based on an assessment of the risk that operations may pose to the achievement of management outcomes. Audits of compliance with guidelines and codes of practice quantify results, so audit is one of the means used to check that the required standard is being achieved in the field.

The Conservation Commission may also conduct audits on particular aspects of the implementation of the plan, either itself or through parties it might engage, and will make these publicly available. In addition to these audits, formal mid- and end-of-term reviews will be undertaken by the Conservation Commission (see the section 'Review and improvement', below).

Checking

Checking occurs at a range of levels and through various processes within all agencies. Staff of the Department are involved in planning processes for a range of proposed disturbance operations, in setting conditions of approval and checking for operational compliance. FPC staff also conduct checks of activities performed by harvesting and roading contractors.

Non-conformance, corrective and preventative action

Where significant conformance issues are identified, the Department formally notifies the proponent and requests remedial action.

Knowledge and adaptive management

A commitment to increasing knowledge and undertaking adaptive management to address identified gaps or potential future gaps provides evidence of a commitment to continuous improvement.

Knowledge

Full and effective implementation of many of the proposed operations identified in this plan will be facilitated by improvement in knowledge and understanding. Knowledge can be gained from various sources such as monitoring, review and audits, the formal reviews proposed for this plan (see activity 130 below), and those conducted during the previous FMP – the findings of which have been taken into account in developing this plan.

Useful knowledge can also be obtained from 'benchmarking', which considers other systems and techniques applied elsewhere (both in other locations and in other sectors), to see what might be usefully applied in addressing local management issues.

Research is also fundamental to improving knowledge and understanding of natural systems and the response to disturbances and management intervention. The Department maintains a research function that seeks to advance the understanding and means of protection of the State's biodiversity and the sustainable utilisation of natural resources for which it is responsible. The Department's research function must accommodate the research needs of the biota throughout the whole of Western Australia, and in many areas, knowledge is less than for the area covered by this plan and the priority for conservation actions is often greater. Because of this, sufficient resources to undertake research to address all the issues that might be identified will never be available and prioritisation is necessary. The Department seeks to target scientific research to issues of high priority for biodiversity conservation. Research program priorities are periodically reviewed and published as a strategic plan outlining the key future directions and priorities. In its assessment of the Proposed FMP, the EPA (2013) stated that input from research institutions should be used to identify research priorities and collaboration opportunities on delivery of research programs, supporting the approach taken by the Department.

Adaptive management

Where knowledge is incomplete and the understanding of the impacts is uncertain, proposed operations identified in this plan are conservative, based on the precautionary approach, and may be adapted as new knowledge becomes available from various sources (see the section 'Review and improvement', below). Adaptive management will be a key component of the management system that implements this plan, recognising that there is an incomplete knowledge of ecosystems and their response to natural perturbations and the effects of management practices. The capability to undertake adaptive management depends on the accumulation of knowledge concerning management practices, their implementation and impact on the environment.

Goals

The plan proposes the following activities at the whole of forest, landscape and/or local scales, for the purpose of seeking to build knowledge, including through adaptive management, and monitor and evaluate the extent to which management of land to which the plan applies is undertaken in accordance with the plan.

Relevant policies and guidelines of the Department

When undertaking the proposed operations (management activities) outlined below, the Department will have regard to:

Policy Statement 45: *Environmental monitoring of pesticides used by CALM*

Policy Statement 63: *Information Management Policy*

Science Policy Statement 45: *Information Management Policy*

Policy Statement 78: *Science Policy*

Science Policy Guideline 1: *Science Plans*

Science Policy Guideline 2: *Implementing Research Results*

Science Policy Guideline 3: *Publications, Reports and Manuscripts*

Science Policy Guideline 4: *Databases and their Management*

Science Policy Guideline 5: *Scientific ethics and etiquette*

Science Policy Guideline 6: *Establishment and documentation of Scientific Sites*

Management Audit Branch Charter

Biodiversity Conservation Appraisal System

Proponents undertaking other disturbance operations will also have regard to these documents where required by the Department.

Operations proposed to be undertaken (management activities)

121 The Department, in consultation with the Conservation Commission, will develop by 30 June 2018, a protocol for each key performance indicator in the plan to specify how the measurement of the key performance indicator will be undertaken.

122 The Department and FPC will cooperate with the Commonwealth in the implementation of the Montreal Indicators program.

123 The Conservation Commission, Department and FPC will conduct audits in accordance with their respective annual audit program. Audit programs will be developed with consideration of the potential risk to achievement of the goals of the plan.

124 The Department will report audit results to the Conservation Commission and FPC and publish a summary of audit results.

125 The FPC will report audit results to the Department and the Conservation Commission and publish a summary of audit results.

126 The Department, and other proponents where required by the Department, will:

126.1 seek to address knowledge gaps, including through relevant 'benchmarking' activities and research programs, as appropriate

126.2 work collaboratively with other agencies and institutions on matters of mutual interest

126.3 maintain programs and activities that seek to ensure the expeditious transfer of new knowledge and understanding into improved management approaches and operational practices

126.4 conduct adaptive management projects in a manner that has regard to an adaptive management policy, to be prepared by the Department.

127 **(Plantations):** The FPC will undertake audits based on the potential risk to achievement of the goals of the plan, and which will evaluate the extent to which plantation operations are undertaken in accordance with the plan. Audits will be reported to the Department and the Conservation Commission.

Review and improvement

Background

Management reviews occur at planned intervals to help ensure the plan is achieving the desired goals. The most significant management reviews are the mid-term and end-of-term performance reviews undertaken by the Conservation Commission (Conservation Commission 2008b and 2012). The performance review includes analysing results, identifying underlying causes and developing recommendations to improve performance.

Operations and management systems are also reviewed on an informal basis in the daily course of events, informed for example, by the results of checks carried out. Formal reviews are also carried out by senior management within the Conservation Commission, Department and FPC, particularly where there is a deviation from expected standards, in which case contributing causal factors and remedial actions are identified, and procedures modified and communicated in an effort to prevent recurrence.

Goal

The plan proposes the following activities at the whole of forest scale for the purpose of seeking to ensure that reviews occur at planned intervals, to identify opportunities to improve the implementation of the proposed operations (management activities), and to assess their continuing suitability, adequacy and effectiveness.

Operations proposed to be undertaken (management activities)

128 The Conservation Commission and the Department will:

- 128.1 evaluate the results from research, monitoring, audits and adaptive management projects to determine whether the plan, or guidelines and policies referred to in the plan, should be amended
- 128.2 amend the plan if required according to the CALM Act
- 128.3 take action that is reasonable and practicable to address problems identified in management systems.

129 The Department will initiate an expert review of silvicultural practices during the second half of the term of this plan. Among other things, the review will have regard to the results from *FORESTCHECK* and other research monitoring, audits, and adaptive management projects.

130 The Conservation Commission will undertake mid-term and end-of-term performance reviews, and report by 31 December 2018 and 30 June 2022 respectively, on the extent to which management of land to which the plan applies has been undertaken in accordance with the plan, which will include consideration of the extent to which all key performance indicator targets have been achieved. The Conservation Commission will consult with appropriate and representative Noongar groups on the results of these reviews. The reports will be made publicly available on completion.

131 Where performance targets have not been achieved under activity 130, the relevant agency will investigate the cause and report, through the reports on the mid-term and end-of-term performance reviews, to the Conservation Commission, which will submit the reports to the Minister for Environment.

132 The Conservation Commission will:

132.1 evaluate the need for revision of management practices in the context of its assessment and auditing function, in consultation with the Department and where relevant, the FPC

132.2 provide its advice through the reports on the mid-term and end-of-term performance reviews to the Minister for Environment.

Stakeholder involvement

The community can contribute to the management of land vested in the Conservation Commission for environmental, economic and social outcomes. During the term of the plan, the extent of circulation of draft and/or revised Departmental policies and guidelines for comment (to selected stakeholders or to the general public through advertisement) will be determined by the Director General or in some cases by Ministerial direction, as outlined in the Department's Policy Statement 1: *Department of Environment and Conservation – Key documents*.

Volunteers are also involved in aspects of the Department's work and make an important contribution, including to various on-ground activities. The Department seeks to facilitate and encourage this and also conducts a range of community education programs and provides information on various topics relevant to management of lands and values covered by the plan.

In addition to the broader community, many of the management activities undertaken by the Department have the potential to affect values or resources that other government and non-government bodies have a legal responsibility for, or an interest in. For example, the Department of Water and the Water Corporation have legislated responsibility for water supply and water quality from catchments, and Tourism WA has a responsibility for tourism in the south-west. The Department consults with such bodies as appropriate.

Goal

The plan proposes the following activities at the whole of forest scale for the purpose of seeking to provide opportunities for the community, and relevant non-government organisations and government agencies to participate in plan implementation.

Relevant policies and guidelines of the Department

When undertaking the proposed operations (management activities) outlined below, the Department will have regard to:

Policy Statement 1: *Department of Environment and Conservation - Key documents*

Policy Statement 15: *Community Involvement*

Policy Statement 25: *Community Education and Interpretation*

Policy Statement 65: *Good neighbour policy*

DEC Volunteer Strategy 2012-2016

Proponents undertaking other disturbance operations will also have regard to these documents where required by the Department.

Operations proposed to be undertaken (management activities)

133 The Department will undertake public consultation in relation to the development and review of management policies and guidelines, having regard to Policy Statement 1: *Department of Environment and Conservation - Key documents*.

134 The Department will:

134.1 develop and implement programs that seek to provide the community with educational opportunities and information on management of land that is subject to the plan

134.2 maintain public consultation processes

134.3 provide opportunities for community participation in voluntary activities and educational and social development programs relating to management of land that is subject to the plan.

Key performance indicator

Key performance indicators will be used to track the implementation of the plan. One indicator has been selected related to the institutional framework that supports the plan.

Key performance indicator 24	Extent to which the institutional framework supports the conservation and sustainable management of forests.
Performance measure	1. The preparation and review of guidance documents referred to in the operations proposed by the plan. 2. Improved scientific understanding of ecosystem characteristics and functions. 3. Provision of information and opportunities for public involvement, education and awareness as demonstrated by: a. public attendance statistics for key education, awareness and extension programs b. number of volunteers and volunteer hours
Performance target(s)	1. Guidance documents to be prepared and/or reviewed as required during the period of the plan. 2. Scientific understanding targets: a. research projects address identified high priority knowledge gaps b. peer reviewed articles are produced by research projects c. knowlege gained is communicated to policy makers and operational managers. 3. Public attendance and volunteer contribution to be maintained.

APPENDIX 1

Reserve proposals (see page 146 for explanatory notes)

ID	FMP 2004-2013 ID	Locality name	Area (ha)[1]	Source	Proposal type	Status
1	1	Moore River	17,390	FMP 1994-2003 or earlier	Other, NP to NR	In progress
2	-	Moore River	730	Land acquisition	Other, UCL to NR	In progress
3	-	Red Gully	130	Land acquisition	Other to NR	In progress
4	-	Red Gully	2,370	Land acquisition	Other to NR	In progress
5	-	Mindarra	1,060	Land acquisition	Other to NR	In progress
6	-	Red Gully	730	Land acquisition	Other to NR	In progress
7	-	Boonanarring	1,220	Land acquisition	Other to NR	In progress
8	-	Moore River	40	Land acquisition	Other to NR	In progress
9	-	Moore River	950	Land acquisition	Other to NR	In progress
10	-	Beermullah	4	Land acquisition	Other to NR	In progress
11	-	Beermullah	10	Land acquisition	Other to NR	In progress
12	3	Boonanarring	890	FMP 1994-2003 or earlier	Other to NR	In progress
13	-	Cullalla	440	Land acquisition	Other to NR	In progress
14	8	Lake Muckenburra	70	FMP 1994-2003 or earlier	Other to NR	In progress
15	-	Wilbinga	60	FMP proposal	UCL to CP	In progress[2]
16	-	Wilbinga	1,080	FMP proposal	UCL to CP	In progress
17	4	Caraban	2,200	FMP 1994-2003 or earlier	SF to s5(1)(h)	In progress
18	5	Caraban	3,330	FMP 1994-2003 or earlier	SF to CP	In progress
19	6	Yanchep	110	FMP 1994-2003 or earlier	SF to NR	In progress
20	7	Wabling	2,440	FMP 1994-2003 or earlier	SF to NR	In progress
21	9	Julimar	28,630	FMP 1994-2003 or earlier	SF, other to CP; Interim FCA	Not started
22	10	Julimar	30	FMP 1994-2003 or earlier	s5(1)(g), other to CP	In progress
23	-	Yanchep	70	Area management plan	Other to NP	In progress
24	-	Yanchep	10	Area management plan	Misc res to NP	In progress
25	11	Ridges	2,090	FMP 1994-2003 or earlier	SF to NP	In progress
26	12	Pinjar	700	FMP 2004-2013	SF to NR	In progress
27	13	Pinjar	4,940	FMP 2004-2013	SF to s5(1)(h)	In progress
28	-	Carabooda	90	FMP proposal	UCL, other to CP	In progress[2]

APPENDIX 1 (cont.)

Reserve proposals

ID	FMP 2004-2013 ID	Locality name	Area (ha)[1]	Source	Proposal type	Status
29	-	Neerabup	7	Area management plan	Other to NP	In progress
30	-	Neerabup	20	Area management plan	Other to NP	In progress
31	-	Neerabup	20	Area management plan	Other to NP	In progress
32	-	Neerabup	40	Area management plan	Other to NP	In progress
33	-	Neerabup	490	Area management plan	Other to NP	In progress
34	15	Yongka (Melaleuca Park)	3,210	FMP 1994-2003 or earlier	SF to NR	In progress
35	16	Moondyne (Avon Valley)	5,170	FMP 1994-2003 or earlier	NR to NP	In progress
36	-	Toodyay/Moondyne (Avon Valley)	200	Land acquisition	Other to s5(1)(h)	In progress
37	17	Toodyay (Avon Valley)	3,470	FMP 1994-2003 or earlier	Misc res to NP	In progress
38	18	Toodyay (Avon Valley)	1,710	FMP 1994-2003 or earlier	Misc res to NP; Interim FCA	Not started
39	19	Morangup (Avon Valley)	940	FMP 1994-2003 or earlier	NR to NP	In progress
40	-	Clackline NR	40	Land acquisition	Other to NR	In progress
41	-	Bakers Hill	360	Land acquisition	Other to NR	In progress
42	-	Inkpen	40	Land acquisition	Other to NR	In progress
43	-	Gooseberry Hill	80	Regional management plan	Other to NP	In progress
44	-	Beelu	1,090	FMP proposal	Other, UCL to NP	In progress
45	-	Alfred Cove	4	Area management plan	Other to NR	In progress
46	-	Dundas Road	10	FMP proposal	Other to NR	In progress
47	part 27	Helena (Helena Valley)	40	RFA	SF to NP	Not progressed
48	28	Flynn (Helena Valley)	3,970	RFA	DoW freehold to NP	Not progressed
49	35	Talbot	60	RFA	Other to NR	Not progressed
50	-	Forrestdale Lake	150	Area management plan	Other to NR	In progress
51	-	Forrestdale Lake	110	Area management plan	Other to NR	In progress
52	-	Forrestdale	20	Land acquisition	Other to NR	In progress
53	37A	Illawarra (Canning)	430	FMP 2004-2013	WAPC freehold to NP	Not progressed
54	-	Dale	1,880	FMP proposal	UCL to SF	In progress
55	33	Russell	3,360	FMP 1994-2003 or earlier	SF to CP	In progress[2]

APPENDIX 1 (cont.)

Reserve proposals

ID	FMP 2004-2013 ID	Locality name	Area (ha)[1]	Source	Proposal type	Status
56	-	Leda	40	Land acquisition	Other to s5(1)(h)	In progress
57	-	Sloan's Ridge	110	FMP proposal	UCL to CP	In progress
58	41	Monadnocks	15,320	FMP 1994-2003 or earlier	s5(1)(g), SF to NP	In progress
59	43	Monadnocks	7,480	RFA	SF, DoW freehold to NP	In progress
60	44	Monadnocks	1,520	FMP 2004-2013	SF to NP	In progress
61	45	Flint	1,970	FMP 2004-2013	SF, TR to CP	In progress
62	46	Gibbs	2,270	Reinstated FMP(1994) - RFA	SF to CP	In progress
63	53A	Serpentine	30	FMP 1994-2003 or earlier	CP to NP	In progress[2]
64	-	Serpentine/Karnet	420	Land acquisition	Other to NP	In progress
65	53	Serpentine	40	FMP 1994-2003 or earlier	Other to NP	In progress[2]
66	54	Serpentine	120	RFA	Other to NP	Not progressed
67	54A	Serpentine	280	FMP 1994-2003 or earlier	NR to NP	In progress[2]
68	-	Barragup	2	Land acquisition	Other to NR	In progress
69	55	Darling Scarp	280	RFA	SF to NR	In progress
70	56	North Dandalup	40	FMP 1994-2003 or earlier	Other to NR	In progress[2]
71	50	Monadnocks	5,000	FMP 1994-2003 or earlier	SF, UCL to NP	In progress
72	51	Monadnocks	690	Reinstated FMP(1994) - RFA	SF to NP	In progress
73	48	Bannister	1,180	FMP 2004-2013	SF to CP	In progress
74	49	Gyngoorda	1,350	Reinstated FMP(1994) - RFA	SF to CP	In progress
75	47	Wearne	1,530	FMP 2004-2013	TR to CP	In progress
76	52	Wandering	4,360	FMP 1994-2003 or earlier	Other, TR to CP	In progress[2]
77	55A	Darling Scarp	160	RFA	SF to CP	In progress
78	-	McLarty	50	Land acquisition	Other to NR	In progress
79	58	Clifton south	560	FMP 1994-2003 or earlier	SF to NP	In progress
80	59	McLarty	660	FMP 1994-2003 or earlier	SF to NP	In progress
81	60	Marrarup	20	RFA	UCL to NR	In progress
82	-	Lane Poole	1,730	Area management plan	CP to NP	In progress
83	61	Lane Poole	220	FMP 1994-2003 or earlier	Misc res to s5(1)(h)	In progress[2]

APPENDIX 1 (cont.)

Reserve proposals

ID	FMP 2004-2013 ID	Locality name	Area (ha)[1]	Source	Proposal type	Status
84	-	Lane Poole	2,970	Area management plan	CP to NP	In progress
85	62	Icy Creek (Lane Poole)	180	FMP 1994-2003 or earlier	UCL to s5(1)(h)	In progress[2]
86	-	Lane Poole	1,740	Area management plan	CP to NP	In progress
87	66	Myalup	690	FMP 1994-2003 or earlier	SF to NP	In progress
88	67	Myalup	220	FMP 1994-2003 or earlier	SF to NP	In progress
89	-	Cookernup	70	Land acquisition	Other to NR	In progress
90	68	Wagerup (Yarloop)	10	FMP 1994-2003 or earlier	Other to NR	In progress
91	-	Lane Poole	2,570	Area management plan	CP to NP	In progress
92	65	George	550	FMP 1994-2003 or earlier	SF to NP	In progress
93	64	George	140	FMP 2004-2013	SF to NP	In progress
94	63	George	1,180	Reinstated FMP(1994) - RFA	SF to NP	In progress
95	73	Lane Poole	4,330	RFA	SF, UCL to CP	In progress
96	-	Byrd Swamp	40	Land acquisition	Other to NR	In progress
97	-	Clarke (Falls Brook)	40	FMP proposal	Other to NR	In progress
98	69	Clarke (Falls Brook)	410	FMP 1994-2003 or earlier	SF to NR; Interim FCA	Not started
99	70	Clarke (Falls Brook)	200	FMP 1994-2003 or earlier	SF to NR	In progress[2]
100	71	Clarke	290	Reinstated FMP(1994) - RFA	SF to NR	In progress
101	74	Lane Poole	50	FMP 2004-2013	SF to NP	In progress
102	75	Lane Poole	1,530	RFA	SF to NP	In progress
103	77	Lane Poole	38,050	FMP 1994-2003 or earlier	SF, s5(1)(g),TR, DoW freehold, other to NP	In progress
104	76	Lane Poole	1,090	FMP 2004-2013	SF to NP	In progress
105	-	Stockyard/Stene (Lane Poole)	1,990	Land acquisition	Other to NR	In progress
106	78	Lane Poole	2,430	FMP 2004-2013	SF to NP	In progress
107	79	Lane Poole	3,800	FMP 2004-2013	SF, TR to NP	In progress
108	83	Leschenault Peninsula	500	FMP 1994-2003 or earlier	Other to CP	In progress
109	88	Westralia (Wellington)	1,140	FMP 1994-2003 or earlier	SF to CP; Interim FCA	Not started
110	90	Westralia	310	FMP 2004-2013	SF to FCA	Not started

APPENDIX 1 (cont.)

Reserve proposals

ID	FMP 2004-2013 ID	Locality name	Area (ha)[1]	Source	Proposal type	Status
111	91	Batalling	400	RFA	SF to NR	In progress
112	-	Boolading	20	FMP proposal	UCL to NR	In progress[2]
113	92	The Angle	920	RFA	TR (leasehold) to NR	In progress[3]
114	110	Nth Boyanup Rd	4	FMP 1994-2003 or earlier	Other to NR	In progress
115	-	Dardanup	140	FMP proposal	SF to CP	Not started
116	107	Dardanup	120	RFA	SF to NR	In progress
117	94	Bennelaking	5,570	FMP 1994-2003 or earlier	SF, UCL, other to CP	In progress[2]
118	93	Cordering	1,110	RFA	TR (leasehold) to NR	In progress[3]
119	-	Tuart Forest	30	Draft area management plan	Other to NP	Not started
120	-	Stratham	8	Land acquisition	Other to NR	In progress
121	106	Boyanup	40	RFA	SF to NR	In progress
122	-	Vasse and Wonnerup Estuary	700	Draft area management plan	UCL, other to NR	In progress
123	111,112	Tuart Forest	100	FMP 1994-2003 or earlier	SF, UCL to NP	In progress
124	-	Tuart Forest	890	Draft area management plan	SF, UCL, other to NP	In progress
125	-	Whicher Scarp	4,020	FMP proposal	SF, TR to NP	Not started
126	122	Ryall	900	RFA	SF, TR to FCA	Not started
127	123	Ryall	280	FMP 1994-2003 or earlier	SF to CP; Interim FCA	Not started
128	124	Mullalyup	530	RFA	SF, UCL to FCA	Not started
129	125	Mullalyup	910	FMP 1994-2003 or earlier	SF to CP; Interim FCA	Not started
130	126	Harrington	690	RFA	SF to FCA	Not started
131	98	Camballan	430	FMP 1994-2003 or earlier	Leasehold to CP	In progress[3]
132	97	Camballan	6,610	Reinstated FMP(1994) - RFA	UCL, leasehold to CP	In progress[3]
133	96	Camballan	1,520	FMP 1994-2003 or earlier	UCL, other, leasehold to CP	In progress[3]
134	-	Arthur River	100	Land acquisition	Other to NR	In progress
135	132	Kulikup	150	RFA	Other to NR	In progress
136	-	Leeuwin-Naturaliste	10	Draft area management plan	Other to NP	Not started
137	114	Leeuwin-Naturaliste	10	FMP 1994-2003 or earlier	UCL to NP	In progress

APPENDIX 1 (cont.)

Reserve proposals

ID	FMP 2004-2013 ID	Locality name	Area (ha)[1]	Source	Proposal type	Status
138	115	Leeuwin-Naturaliste	7	RFA	Other to NP	In progress
139	-	Leeuwin-Naturaliste	5	Draft area management plan	UCL to NP	Not started
140	part 116	Yelverton (Yelverton) (R 47672)	50	RFA	Other to NP	Not started
141	-	Yelverton NP	20	Draft area management plan	Other to NP	Not started
142	-	Yelverton	40	Draft area management plan	Other to NP	In progress
143	117	Yelverton	440	RFA	TR to FCA	Not started
144	118	Whicher	310	RFA	SF to FCA	Not started
145	127	Mullalyup	1,260	FMP 1994-2003 or earlier	SF, CALM Executive Body freehold to CP; Interim FCA	Not started
146	130	Golden Valley	60	FMP 1994-2003 or earlier	CALM Executive Body freehold to FCA	Not started
147	129	Greenbushes	330	RFA	SF to FCA	Not started
148	part 128	Greenbushes	20	FMP 1994-2003 or earlier	CALM Executive Body freehold to NR	In progress
149	-	Leeuwin-Naturaliste	20	Draft area management plan	Other to NP	Not started
150	-	Leeuwin-Naturaliste	270	Draft area management plan	UCL to NP	Not started
151	143	St John Brook	3,560	Reinstated FMP(1994) - RFA	SF, other to CP	In progress
152	142	Jarrahwood	160	RFA	Other to CP	In progress
153	141	Ellis Creek	140	FMP 1994-2003 or earlier	SF to CP; Interim FCA	Not started
154	138	Greenbushes	530	FMP 1994-2003 or earlier	SF to NR; Interim FCA	Not started
155	137	Hester west	1,040	FMP 1994-2003 or earlier	SF, TR to CP; Interim FCA	Not started
156	135	Hester south	1,460	RFA	SF, other to FCA	Not started
157	-	Leeuwin-Naturaliste	9	Draft area management plan	Other to NP	Not started
158	-	Leeuwin-Naturaliste	20	Draft area management plan	UCL, other to NP	Not started
159	-	Bramley	10	Draft area management plan	TR to NP	Not started
160	part 147	Bramley (R 47956)	30	RFA	Other to NP	Not started
161	148	Bramley	260	RFA	TR to FCA	Not started
162	part 147	Bramley (R 47956)	10	RFA	Other to NP	Not started

APPENDIX 1 (cont.)

Reserve proposals

ID	FMP 2004-2013 ID	Locality name	Area (ha)[1]	Source	Proposal type	Status
163	-	Bramley	5	Draft area management plan	Other to NP	Not started
164	part 147	Bramley (R 47956)	3	RFA	Other to NP	Not started
165	146	Mowen	1000	Reinstated FMP(1994) - RFA	SF to NR	In progress
166	156B	Butler	1,260	FMP 2004-2013	SF to FCA (Ministerial condition)	Not started
167	140	Dalgarup	940	FMP 1994-2003 or earlier	SF to NR; Interim FCA	Not started
168	139	Nelson	620	RFA	SF to FCA	Not started
169	-	Dalgarup	200	Land acquisition	Other to NP	In progress
170	167	Glenlynn	1,400	RFA	SF, TR, other to FCA	Not started
171	part 190	Kingston (Greater Kingston)	10	FMP 2004-2013	SF to NP	Not started
172	168	Wournbelup/Chowerup	2,180	RFA	UCL, other to NR	In progress
173	169	Wournbelup	600	FMP 1994-2003 or earlier	UCL to SF	In progress
174	170	Chowerup	710	FMP 1994-2003 or earlier	UCL, other to SF	In progress
175	-	Leeuwin-Naturaliste	8	Draft area management plan	Other to NP	Not started
176	-	Leeuwin-Naturaliste	20	Draft area management plan	Other to NP	Not started
177	150	Witchcliffe	1,070	FMP 1994-2003 or earlier	UCL, other to SF	In progress
178	150A	Witchcliffe	490	FMP 2004-2013	UCL to NP	In progress
179	-	Forest Grove	30	Draft area management plan	UCL, other to NP	Not started
180	-	Forest Grove	130	Draft area management plan	Other to NP	Not started
181	-	Blackwood River	200	Land acquisition	Other to NP	In progress
182	166	Beaton	440	FMP 1994-2003 or earlier	TR to CP; Interim FCA	Not started
183	151	Leeuwin-Naturaliste	310	FMP 1994-2003 or earlier	Other to NP	In progress
184	-	Leeuwin-Naturaliste	490	Draft area management plan	UCL to NP	Not started
185	-	Leeuwin-Naturaliste	70	Draft area management plan	Other to NP	Not started
186	-	Scott River	7	Draft area management plan	Other to NP	Not started
187	-	Beerup	150	Land acquisition	Other to NR	In progress
188	161	Hilliger	9,110	RFA	SF, UCL, other to FCA	Not started
189	-	Easter	60	FMP proposal	SF to FCA	Not started

APPENDIX 1 (cont.)

Reserve proposals

ID	FMP 2004-2013 ID	Locality name	Area (ha)[1]	Source	Proposal type	Status
190	176	One Tree Bridge	680	FMP 1994-2003 or earlier	SF, s5(1)(g), CALM Executive Body freehold, UCL, other to CP; Interim FCA	Not started
191	177	Lewin	50	FMP 1994-2003 or earlier	UCL, other to SF	In progress
192	178	Solai	160	FMP 1994-2003 or earlier	TR, UCL, other to SF	In progress
193	179	King Jarrah	190	FMP 1994-2003 or earlier	Misc res to SF	In progress
194	180	Dingup	230	FMP 1994-2003 or earlier	SF to CP; Interim FCA	Not started
195	194	Weinup	80	RFA	Other to NR	Not progressed
196	200	Bolbelup	1,530	RFA	TR, UCL to FCA	Not started
197	201	Bolbelup	40	FMP 1994-2003 or earlier	Other to SF	In progress
198	-	Leeuwin-Naturaliste	40	Draft area management plan	Other to NP	Not started
199	-	Leeuwin-Naturaliste	230	Land acquisition	Other to NP	In progress
200	-	Leeuwin-Naturaliste	40	Draft area management plan	Other to NP	Not started
201	-	Hardey Inlet	140	Draft area management plan	NP to NR	Not started
202	-	Hardey Inlet	8	Draft area management plan	Other to NR	Not started
203	-	Hardey Inlet	3	Draft area management plan	UCL to NR	Not started
204	-	Augusta	80	Draft area management plan	UCL, other to CP	Not started
205	-	Hardey Inlet	200	Draft area management plan	UCL, other to NR	Not started
206	-	Hardey Inlet	110	Draft area management plan	Other to NR	Not started
207	-	Scott River	110	Draft area management plan	UCL, other to NP	Not started
208	-	Gingilup Swamps	100	Draft area management plan	UCL to NR	Not started
209	-	Gingilup Swamps	440	Draft area management plan	UCL to NR	Not started
210	-	Gingilup Swamps	10	Draft area management plan	Other to NR	Not started
211	-	Gingilup Swamps	120	Draft area management plan	Other to NR	Not started
212	203A	Central (D'Entrecasteaux)	600	FMP 2004-2013	SF to NP	In progress
213	-	D'Entrecasteaux	1,100	Area management plan	CALM Executive Body freehold to NP	In progress
214	-	Strickland (Beedelup)	180	FMP proposal	SF, Other, UCL to NP	Not started

APPENDIX 1 (cont.)

Reserve proposals

ID	FMP 2004-2013 ID	Locality name	Area (ha)[1]	Source	Proposal type	Status
215	184	Sir James Mitchell NP	190	FMP 1994-2003 or earlier	NP to SF	In progress
216	196	Talling (Tone-Perup)	30	FMP 1994-2003 or earlier	Other to NR	Not progressed
217	-	Perup	4,040	Area management plan	Other to Conservation reserve[4]	Not started
218	202	Bokarup	480	FMP 1994-2003 or earlier	Other, UCL to NR	In progress
219	203	Quannup (D'Entrecasteaux)	4,500	FMP 1994-2003 or earlier	Leasehold to NP	In progress[3]
220	186	Nairn	60	FMP 1994-2003 or earlier	UCL to SF	In progress
221	-	Quindinup (Bolbelup)	110	Land acquisition	Other to NR	In progress
222	-	Talling (Lake Muir)	620	FMP proposal	UCL to NR	Not started
223	235	Chitelup (Lake Muir)	310	FMP 2004-2013	SF to NR	In progress
224	265A	Perillup	130	RFA	NR to FCA	Not started
225	271	Kwornicup Lake	10	FMP 1994-2003 or earlier	Other to NR	In progress
226	226	Northcliffe	20	FMP 1994-2003 or earlier	UCL to SF	In progress
227	270	Pardelup	3,720	RFA	SF, TR, other to FCA	Not started
228	272	Denbarker	260	RFA	Other, leasehold (Aboriginal) to FCA	Not started
229	part 273	Mt Barker	60	RFA	UCL, other to FCA	Not started
230	227	Northcliffe	50	FMP 1994-2003 or earlier	UCL to SF	In progress
231	228	Northcliffe	60	FMP 1994-2003 or earlier	UCL to SF	In progress
232	224	Gardner	560	FMP 1994-2003 or earlier	UCL to SF	In progress
233	239A	Wye-Deep	3,020	FMP 2004-2013	SF to FCA	Not started
234	274A	Denbarker	230	FMP 2004-2013	UCL, other to FCA	Not started
235	225	D'Entrecasteaux	1,000	FMP 1994-2003 or earlier	SF to NP	In progress
236	239B	Dawson	410	FMP 2004-2013	SF to FCA	Not started
237	239C	Dawson	70	FMP 2004-2013	SF, other to FCA	Not started
238	239D	Dawson	540	FMP 2004-2013	SF to FCA	Not started
239	245	Crown res 14325 (Walpole-Nornalup)	80	FMP 2004-2013	Other to NP	In progress
240	-	Walpole-Nornalup	40	Land acquisition	Other to NP	In progress

APPENDIX 1 (cont.)

Reserve proposals

ID	FMP 2004-2013 ID	Locality name	Area (ha)[1]	Source	Proposal type	Status
241	239E	Keystone-Swarbrick	950	FMP 2004-2013	SF, other to FCA	Not started
242	247A	Swarbrick	260	FMP 2004-2013	SF to FCA	Not started
243	246	Walpole Townsite (Walpole-Nornalup)	60	FMP 2004-2013	UCL to NP	In progress
244	247	Swarbrick (Walpole-Nornalup)	200	RFA	SF to NP	In progress
245	241A	Collis	320	FMP 2004-2013	SF, s5(1)(g), UCL to FCA	Not started
246	241B	Collis	170	FMP 2004-2013	SF to FCA	Not started
247	242A	Collis	1,110	FMP 2004-2013	SF, s5(1)(g) to FCA	Not started
248	-	Walpole-Nornalup	10	Land acquisition	Other to NP	In progress
249	243A	Trent	100	FMP 2004-2013	TR to FCA	Not started
250	244	Bow River	270	FMP 2004-2013	SF to FCA	Not started
251	256	Bow River	360	FMP 2004-2013	SF, UCL, other to FCA	Not started
252	-	Kent River	100	Area management plan	UCL to NR	In progress
253	260	Thames	320	FMP 2004-2013	TR to FCA	Not started
254	262	Styx	20	FMP 1994-2003 or earlier	Other to SF	In progress
255	261	Styx	4,430	FMP 2004-2013	SF, other to FCA	Not started
256	263	Thames	60	FMP 2004-2013	Other to FCA	Not started
257	275A	Harewood	3,200	FMP 2004-2013	SF, TR, other to FCA	Not started
258	276A	Denmark River	50	FMP 2004-2013	SF to FCA	Not started
259	277	Harewood	110	FMP 2004-2013	SF to FCA	Not started
260	279	Harewood south east	110	FMP 2004-2013	SF to FCA	Not started
261	278	Crown res 15623	60	FMP 2004-2013	s5(1)(g) to FCA	Not started
262	284A	Hay	690	FMP 2004-2013	SF, UCL to FCA	Not started
263	286	Hay	910	FMP 2004-2013	TR to FCA	Not started
264	-	Redmond	70	FMP proposal	UCL to SF	Not started
265	-	Redmond	1,210	RFA	TR to NR	Not started

Note the proposed reserves cover a range of tenures from freehold to vacant Crown land. Where possible, the Department will manage the areas vested in the Conservation Commission consistent with their intended future purpose and relevant Department policies, until they have been formally reclassified as proposed by this plan. Activity in other tenures not vested in the Conservation Commission is not necessarily affected by the proposals, until they take effect.

CP:	Conservation park	**Other:**	Crown reserve or freehold land not vested in the Conservation Commission
DoW:	Department of Water	**s5(1)(g):**	CALM Act Section 5(1)(g) – land vested under the *Land Act 1933*
FCA:	Forest conservation area. An FCA is SF classified as such through Section 62(1) of the CALM Act	**s5(1)(h):**	CALM Act Section 5(1)(h) – land vested under the *Land Administration Act 1997*
FCA interim:	A transitory classification as FCA prior to proceeding to a formal reserve category	**SF:**	State forest
Misc res:	Land vested in Conservation and Land Management Executive Body or former National Parks and Nature Conservation Authority	**TR:**	Timber reserve
NP:	National park	**UCL:**	Unallocated Crown land
NR:	Nature reserve	**WAPC:**	Western Australian Planning Commission
		WRC:	Water and Rivers Commission

[1] areas greater than 10 hectares have been rounded to the nearest 10 hectares

[2] provided for in *Reserves (National Parks, Conservation Parks, Nature Reserves and Other Reserves) Act 2004*, but depends on delisting of registered national estate areas

[3] progress depends on surrender of pastoral lease

[4] as proposed in the *Perup management plan 2012*. While the Department prefers these parcels of land to become conservation reserve, the specific proposed tenure and class will be subject to government consideration and determination.

APPENDIX 2

Other relevant legislation

The *Bush Fires Act 1954* provides regulation of the control of bushfire and the use of prescribed fire, however, it is not aimed at biodiversity conservation. The *Emergency Management Act 2005* sets out the emergency management arrangements for the State and requires that a number of emergency response plans be maintained. The response plan for bushfire is Westplan Bushfire, which sets out the Department's role in bushfire suppression operations as a 'Controlling Agency'.

The *Soil and Land Conservation Act 1945* provides mechanisms for the conservation of soil and land resources principally through mitigation of the effects of erosion, salinity and flooding.

Activities of the Department and other agencies are planned and conducted to afford protection to particular sites and values as required by the *Aboriginal Heritage Act 1972* and the *Heritage of Western Australia Act 1990*.

Water allocation plans prepared by the Department of Water, and source protection plans prepared by the Department of Water in liaison with the Water Corporation, include objectives and policies that the Department takes into account when planning at strategic and operational levels. The use of water in the plan area is covered under the *Rights in Water and Irrigation Act 1914*. Permits (related to the disturbance of beds and banks) and licences (for the taking and use of water) are required within proclaimed areas. The protection of water resources in the plan area (such as surface water catchments) is covered under the *Country Areas Water Supply Act 1947* and the *Metropolitan Water Supply Sewerage and Drainage Act 1909*.

The Acts identified above are the major ones relevant to water resource management, but additional measures are possible through the *Water Agencies (Powers) Act 1984*, which enables the responsible Minister to make regulations and by-laws in relation to water resources protection and water quality, among other matters. Also, under the *Waterways Conservation Act 1976*, which focuses principally on estuarine waterways, the ability to construct infrastructure such as jetties and the like can be controlled by the issue of permits. Under this Act, the responsible Minister can also control the disposal of material into waterways via a licensing system.

The Department of State Development (DSD) administers State Agreement Acts and associated projects. State Agreements are in force for major mining projects operating on lands covered by this plan (mostly State forest), including the bauxite/alumina operations of Alcoa and Worsley, and the coal mining operations of Griffin and Premier Coal, affecting smaller areas near Collie.

The CALM Act does not generally preclude land vested in the Conservation Commission from mining or development projects. Section 4(1) of the CALM Act provides that, with some exceptions, nothing in the CALM Act will derogate from the operation of any other Act relating to minerals or petroleum or any State Agreement for a development project. However, concurrence or consent of the Minister for Environment is required for most lands managed by the Department within the plan area (see below). In addition, mining and industrial development projects will likely be required to undergo environmental, heritage and 'future act' assessments (under the Commonwealth *Native Title Act 1994*). Those projects should also address State initiatives such as this plan. State Agreement project companies are typically required to provide written reports annually and triennially on their environmental management programs, which are provided to relevant government agencies for review and comment. Government agencies provide advice to the companies on issues that may arise. Mining activities within the Alcoa and Worsley leases are administered by DSD under Ministerial conditions through respective liaison groups and via the relevant departmental-company working arrangements.

The State also supplies pine log timber under other State Agreements. These will largely determine the level of production from pine plantations during the period of the plan.

The Mining Act controls mineral exploration activities (including fossicking and prospecting) and mining operations other than those within State Agreement areas. Petroleum (which includes oil, gas and geothermal energy) exploration and production within State land and onshore waters are authorised under the *Petroleum and Geothermal Energy Resources Act 2006*. This Act may soon be amended to also cover the geological storage of greenhouse gases. Also of relevance is the *Petroleum Pipelines Act 1969* and associated infrastructure such as the Albany Natural Gas Pipeline. The Department of Mines and Petroleum (DMP) is the State's lead agency for related assessment and approvals under both Acts and is a decision-making authority for non-State Agreement Act projects.

Sections 24, 24A and 25 of the Mining Act define the type of consultation the Minister for Mines undertakes with the Minister for Environment, who is advised by the Conservation Commission (which in turn is assisted by the Department, as the land manager). This varies according to activity and reserve tenure, as follows:

- national parks and 'class A' nature reserves – the Minister for Mines shall first consult and obtain the concurrence of the Minister for Environment, and for Mining Leases and General Purpose Leases, must be approved by both Houses of Parliament
- other land reserved under Part 4 of the *Land Administration Act 1997*, including conservation parks and nature reserves that are not 'class A' – the Minister for Mines shall first consult and obtain the recommendations of the Minister for Environment
- State forests and timber reserves within the South West Mineral Field – the Minister for Mines shall first consult with and obtain the concurrence of the Minister for Environment
- State forests and timber reserves *outside* the South West Mineral Field – the Minister for Mines shall first consult and obtain the recommendations of the Minister for Environment.

Under the Petroleum and Geothermal Energy Resources Act, the Minister for Mines shall consult with and obtain the recommendations of the Minister for Environment on the conditions for entry into reserved land (section 15A).

In addition, under a memorandum of understanding between DMP and the EPA, 'significant' mineral and petroleum proposals can be referred to the EPA for its assessment under Part IV of the EP Act. Under section 38 of the EP Act, all projects can be referred to the EPA for assessment by a proponent, the decision-making authority (for example, DMP), the Department, the Conservation Commission, or a member of the public. Triggers for significance are usually based on EPA guidance material and the *Environmental Impact Assessment Administrative Procedures*.

The Aboriginal Heritage Act and the Heritage of Western Australia Act are also relevant. Under section 24 of the Mining Act, the Minister for Mines may consent to mining, including exploration activities, subject to conditions that may be intended to protect environmental and cultural heritage. Extraction operations are allowed only after approval is granted for each specific proposal submitted to DMP, which consults with the Department and other relevant agencies.

It is important to note that in those instances where consultation with the Minister for Environment is not required under the Mining Act, the Conservation Commission may still have an essential advisory role as part of its functions under section 19 of the CALM Act, where proposals potentially impact lands vested in it.

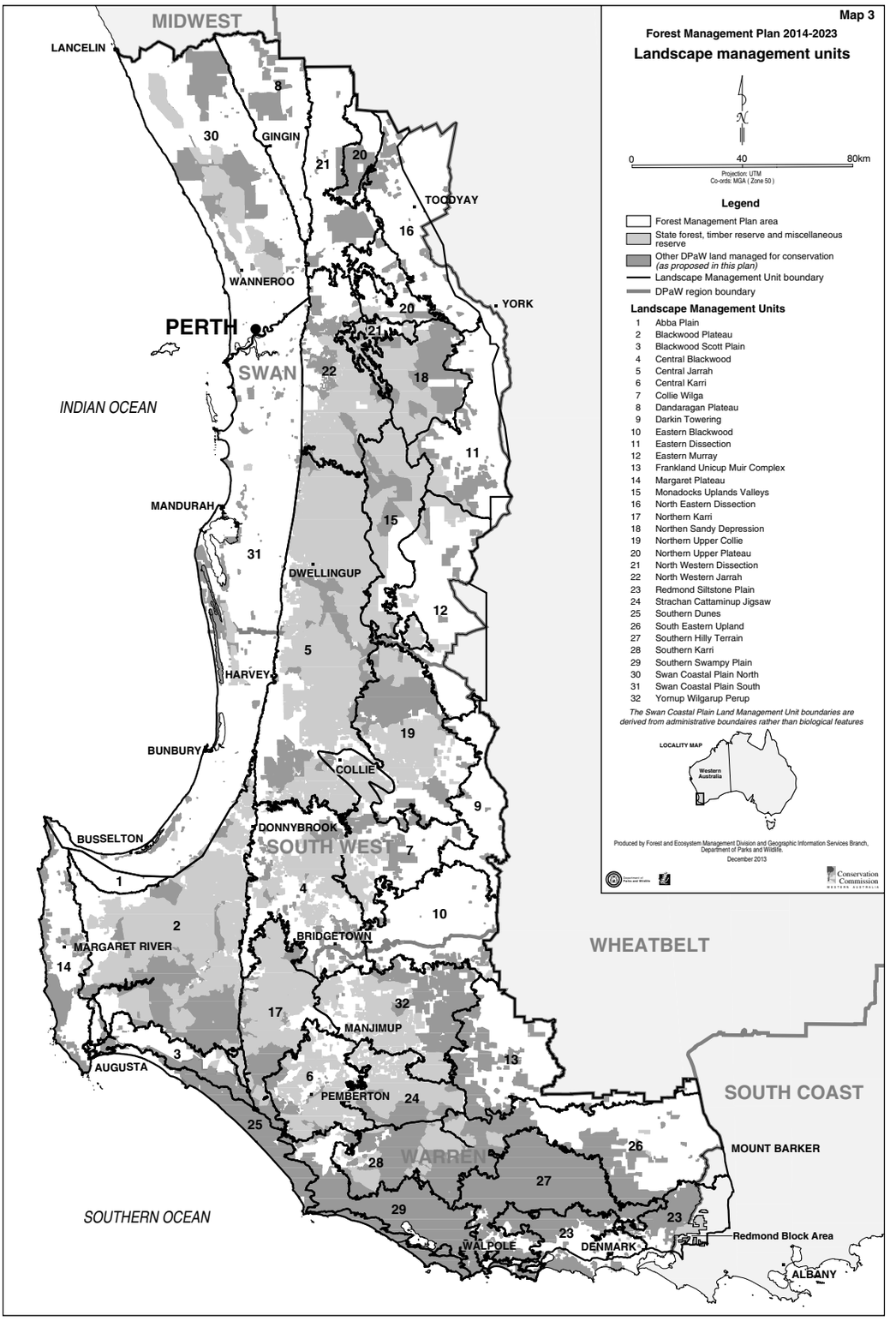
The Department has certain statutory obligations under the *Biosecurity and Agriculture Management Act 2007* (BAM Act) concerning biosecurity matters generally, and particularly with respect to the management of pathogens that cause forest diseases, through the CALM Act. The management and control of weeds in Western Australia is guided by the BAM Act and the *Agriculture and Related*

Resources Protection Act 1976, which is administered by the Department of Agriculture and Food WA (and note it is intended that the BAM Act will replace the Agriculture and Related Resources Protection Act and some other Acts in the near future, which may bring some changes to management requirements).

The *Agricultural and Veterinary Chemicals (Western Australia) Act 1995* covers the use and control of pesticides, including the requirement to use pesticides in accordance with label requirements or approved 'off label' permits. The *Health Act 1911* is applicable to pesticides used by the Crown within a public drinking water source area. The conditions for pesticide use in these areas are specified in the Department of Health *Public Service Circular 88 Use of herbicides in catchment areas*, and also relevant to this is the Department of Water *Statewide Policy 2 Pesticide Use in public drinking water source areas*. The *Contaminated Sites Act 2003* provides for the identification, recording, management and remediation of contaminated sites. Sites contaminated with hydrocarbons, fertilisers or pesticides will fall within this Act. However, contaminated sites do not include areas where fertiliser or pesticide is applied correctly.

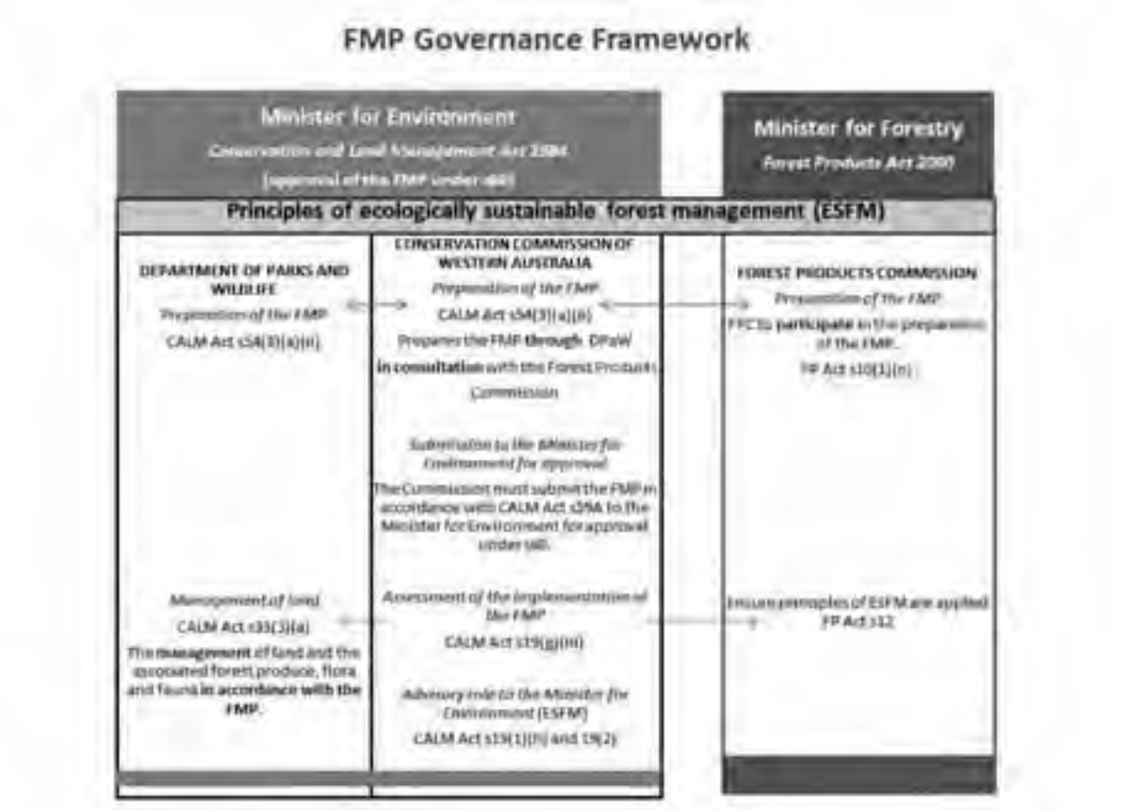
Appendix 3: Landscape Management Units (LMUs)

Note further refinement of the boundaries of those LMUs beyond the RFA area will occur during the period of the plan.



Appendix 4

The plan governance framework



APPENDIX 5

Policies and key documents

There is a hierarchy of statutes and documents that guide management.

Controlling document	Content	Custodian
Acts of Parliament	Bill that has been enacted by Parliament and which contains a sequence of provisions containing statements and rules designed to give effect to a particular national or State responsibility.	Parliament
Government policy, strategy and agreement	Policy on specific issues relevant to forest management that has a statutory or whole-of-government backing. Developed to clarify uncertainty or fill gaps in legislation or to guide decisions where there are choices, especially in regard to contentious issues.	State Government, Australian Government
Management plan	Strategies for management utilising CALM Act requirements and relevant policies.	Conservation Commission
Corporate policy	Corporate level statement of principles and rules to guide decisions and actions in the conduct of the Department's business.	Conservation Commission and the Department
Corporate guideline	Corporate level set of procedures that will guide and direct actions by departmental staff to achieve consistency and required standards. Guidelines contain sufficient detail to help ensure that processes are streamlined to a set routine.	Department Director
Code of practice	Details of the principles about tasks that are required and how tasks are to be performed to meet management requirements.	Department, FPC and other industry bodies depending on the activity
Operational policy	Divisional level statement of operational policy to guide decisions and actions by departmental staff.	Department Director
Divisional guidelines and procedures Alternative names: Standard operating procedures, protocols.	Divisional, Branch, Section, Unit or Regional level set of guidelines to guide and direct actions by departmental staff.	Department Director, Branch, Section, Unit or Regional Manager
Manual Alternative name: User guide	Branch, Region or functional level compendium of documents, mostly technical in nature, to assist people to locate and use a particular system or process.	Department Director, Branch, Section, Unit or Regional Manager
Prescription	Branch, Region or District level documents that direct people how to undertake a particular task.	Department District/ Region/ Branch Manager

The following lists policies of the Department relevant to the plan.

Department of Parks and Wildlife policies	
No.	**Title**
1	DEC Key Documents
2	Local Government Authority access to basic raw materials from State forest and timber reserves
3	Management of *Phytophthora* and disease caused by it
9	Conservation of threatened flora in the wild
10	Rehabilitation of disturbed land
13	Commercial flora harvesting
14	Weeds on CALM lands
15	Community involvement
18	Recreation, tourism and visitor services
19	Fire management
25	Community education and interpretation
29	Translocation of threatened flora and fauna
31	Management of reserves for the conservation of nature
33	Conservation of endangered and specially protected fauna in the wild
34	Visual resource management of lands and waters managed by CALM
40	Road management (this policy is under review and some content is no longer current)
41	Beekeeping on public land
44	Wildlife management programs
45	Environmental monitoring of pesticides used by CALM
47	Control of *Sirex* woodwasp in pine plantations
50	Setting priorities for the conservation of Western Australia's threatened flora and fauna
53	Visitor risk management in the Department of Environment and Conservation
55	Commercial filming on CALM managed lands and waters
57	DEC Enforcement and prosecutions policy
62	Identification and management of wilderness and surrounding areas
63	Information management policy
65	Good neighbour policy
68	Management of Organised Group Activities
69	Acknowledgment of Aboriginal traditional custodians
78	Science Policy
86	Aboriginal customary activities
88	Prescribed burning
	Science Policy Guideline No. 1 – Science plans
	Science Policy Guideline No. 2 – Implementing research results
	Science Policy Guideline No. 3 – Publications, reports and manuscripts
	Science Policy Guideline No.4 – Databases and their management
	Science Policy Guideline No. 5 – Scientific ethics and etiquette

The following lists the key documents of the Department and other documents relevant to the plan.

Key Department of Parks and Wildlife documents (cont.)
Biodiversity Conservation Appraisal System
Code of Practice for Fire Management
Code of Practice for Timber Harvesting in Western Australia
DEC Volunteer Strategy 2012 – 2016
DEC Parks and Visitor Services Strategy 2007 – 2011
Guidelines for conservation management plans relating to mineral exploration on lands managed by DEC
Guidelines for the management and rehabilitation of basic raw material pits
Management Audit Branch Charter
Management Guideline No. 1 – User Guide for approvals matrix for operations on CALM Act reserves
Management of Commercial Harvesting of Protected Flora in Western Australia 2008 – 2013
Manual of management guidelines for timber harvesting in Western Australia
Phytophthora cinnamomi and disease caused by it – Volume I. Management Guidelines
Silviculture Guideline No. 1 – Silvicultural Practice in the Jarrah Forest
Silviculture Guideline No. 2 – Silvicultural Practice in Wandoo Forest and Woodland
SFM Interim Guideline No. 2 – Interim guideline for the first thinning of bauxite rehabilitation areas established after 1988 with native species in the Wungong Catchment
Silviculture Guideline No. 3 – Silvicultural Practice in the Karri Forest
SFM Interim Guideline No. 3 – Interim Guideline for the first thinning of bauxite rehabilitation areas established before 1988 with exotic species in the Wungong Catchment
SFM Guideline No. 4 – Guidelines for the Protection of the Values of Informal Reserves and Fauna Habitat Zones
SFM Guideline No. 5 – Soil and Water Conservation Guideline
SFM Guideline No. 6 – Guidelines for the Selection of Fauna Habitat Zones
SFM Manual No. 1 – Manual of Procedures for the Management of Soils Associated with Timber Harvesting in Native Forests
SFM Manual No. 3 – Manual for the Management of Surface Water
Other relevant documents
Unsealed Roads Manual – Guidelines to Good Practice (Australian Roads Research Board 2009)
Code of Practice for Timber Plantations in WA (FIFWA, AFG and FPC 2006)
WA Environmental Offsets Policy (Government of WA 2011)

The following lists policies and position statements of the Conservation Commission relevant to the plan.

Conservation Commission of Western Australia documents
Policy statement 3 (2008) – Basic Raw Materials Government and local government access to conservation estate
Policy statement 4 - (2006) – Minor Changes to Conservation Estate
Audit Policy (2008) for the performance assessment of conservation reserve and forest management plans and biodiversity management in Western Australia
Position Statement 1 (2011) – Fire Management
Position Statement 2 (2011) – Implementation of Conservation Reserve Proposals
Position Statement 3 (2011) – Mining in Terrestrial Conservation Reserves
Position Statement 4 (2011) – Mosquito Management
Position Statement 5 (2011) – Drainage
Position Statement 6 (2012) – Management Plans for lands vested in the Conservation Commission under the *Conservation and Land Management Act 1984*

The following documents identified in this plan are to be developed or reviewed by the Department (unless noted otherwise in italics).

Management activity reference	**Subject matter**
6.2	Review planning processes for all disturbance activities for a uniform approach for assessment of old-growth forest status
6.3	Develop a procedure to identify and demarcate old-growth forest*
10	Develop recovery plans for selected threatened species and ecological communities
15.1	Include reference to requirements for protection of key habitat for listed threatened species in relevant codes of practice and other guidelines *[and FPC and other proponents, where possible]*
16	Revise fire management documents for management of legacy habitat elements
17.1	Revise the *Guidelines for selection of fauna habitat zones*, to be consistent with the settings included in this plan*
40.1	Develop guidelines for the ongoing management of minesite rehabilitation
42	Revise documents for rehabilitation requirements for extraction tracks, landings, roads and tracks no longer required
43	Revise fire management documents for management of erosion risks
44	Revise relevant documents to address containment of spills *[FPC also]*
49	*Conservation Commission to* develop a position statement on proposals to take water from land to which the plan applies (in consultation with the Department)
52	Revise planning processes for timber harvesting in partially cleared catchments with respect to potential salinity impacts
55.8	Review documents for silviculture and fire management with a view to incorporating techniques that recognise the contribution of areas covered by the plan to global carbon cycles
73.3	Develop guidance for timely planning and approval of salvage harvest operations associated with unplanned disturbance events
78	*FPC to* amend plantation silviculture guidelines (in consultation with the Department)

81.2	Develop guidelines for the rehabilitation of clearfelled plantation areas that are not to remain as plantation (in consultation with the FPC)
86.2	Prepare guidelines for the management of other forest produce (where appropriate)
94	Develop and/or revise guidelines on joint management, customary activities and Noongar heritage
97.1	Develop and/or revise guidelines for management of other Australian heritage
103.2	Review documents where necessary for the application of visual resource management principles
108	Develop road design, construction and maintenance guidelines
109.1	Review documents relating to management of BRM
111	Develop guidelines for use of sterilised BRM*
118.1	Prepare a regulatory policy for timber harvesting
118.2	Develop formal inter-agency working arrangements (in conjunction with the FPC)
121	Develop protocols for each key performance indicator*

* signifies to be developed or reviewed by the Department in consultation with the Conservation Commission

APPENDIX 6

Area reservation levels of forest ecosystems

	Total pre-1750 extent (ha)	Present extent within the plan area (ha)	Present extent on all lands vested in the Conservation Commission (ha)	CAR target (ha)	Formal reserves Area of ecosystem representation (hectares) Existing gazetted as at 30.06.2013 (Additions proposed) N.P. (ha)	N.R. (ha)	C.P. (ha)	5(1) (g),(h) (ha)	FCA (ha)	All formal reserves and FCA (ha)	Informal reserves (ha)	Other (fauna habitat zones) (ha)	Formal reserves, FCA, informal reserves, and other protected areas (ha)
Jarrah dominant													
Jarrah Blackwood	343,500	278,800	267,260	51,530	72,200	1,230	2,800	30		91,940	21,510	6,460	119,910
					(2,580)	(1,100)	(3,750)	-	(8,250)				
Jarrah Leeuwin	56,400	19,550	9,540	8,460	7,660	70	-	-		8,460	330	-	8,790
					(180)	(-)	(-)	(-)	(540)				
Jarrah Mt Lindesay	126,600	42,970	26,680	18,990	17,590	650	-	40		23,210	540	-	23,750
					(-)	(710)	(-)	-	(4,210)				
Jarrah North East	717,100	350,240	260,790	107,570	18,210	7,990	7,920	-		112,230	13,340	9,050	134,620
					(44,560)	(4,780)	(28,550)	(-)	(220)				
Jarrah North West	670,600	499,600	448,720	100,590	38,240	1,640	2,990	13,240		94,960	34,850	22,140	151,950
					(29,130)	(1,390)	(5,060)	(250)	(3,020)				
Jarrah Rate's Tingle	1,500	1,250	1,160	1,250	1,160	-	-	-		1,160	-	-	1,160
					(-)	(-)	(-)	(-)	(-)				
Jarrah Red Tingle	350	270	220	270	220	-	-	-		220	-	-	220
					(-)	(-)	(-)	(-)	(-)				
Jarrah Sandy	107,900	71,090	64,130	16,190	10,410	230	2,100	-		24,520	3,380	1,910	29,810
					(5,390)	(-)	(6,150)	(-)	(230)				
Jarrah South	557,300	438,920	420,150	83,600	191,750	31,490	20	410		234,430	32,590	5,820	272,840
					(220)	(880)	(1,060)	(-)	(8,600)				

APPENDIX 6 (cont.)

Area reservation levels of forest ecosystems

	Total pre-1750 extent (ha)	Present extent within the plan area (ha)	Present extent on all lands vested in the Conservation Commission (ha)	CAR target (ha)	Formal reserves Area of ecosystem representation (hectares) Existing gazetted as at 30.06.2013 (Additions proposed) N.P. (ha)	N.R. (ha)	C.P. (ha)	5(1) (g),(h) (ha)	FCA (ha)	All formal reserves and FCA (ha)	Informal reserves (ha)	Other (fauna habitat zones) (ha)	Formal reserves, FCA, informal reserves, and other protected areas (ha)
Jarrah Unicup	81,000	29,460	16,960	12,150	240	15,100	-	-		16,870	40	-	16,910
					(-)	(360)	(-)	(-)	(1,170)				
Jarrah Woodland	106,400	67,220	50,360	15,960	15,600	4,800	310	170		29,070	21,150	20	50,250
					(4,020)	(610)	(2,530)	(-)	(1,040)				
Jarrah Yellow Tingle	11,600	9,670	8,260	1,740	7,550	-	-	-		8,260	-	-	8,260
					(20)	(-)	(-)	(-)	(690)				
Sub total	**2,780,250**	**1,809,040**	**1,574,230**		**380,830**	**63,200**	**16,140**	**13,890**	**-**	**645,320**	**127,730**	**45,400**	**818,450**
					(86,100)	**(9,830)**	**(47,100)**	**(250)**	**(27,970)**				
Karri dominant													
Karri Main Belt	193,000	163,910	151,440	28,950	68,580	220	10	40		70,930	20,760	1,010	92,700
					(430)	(100)	(400)	(-)	(1,140)				
Karri Rate's Tingle	1,100	860	790	860	790	-	-	-		790	-	-	790
					(-)	(-)	(-)	(-)	(-)				
Karri Red Tingle	7,200	5,860	5,220	1,080	5,140	-	-	-		5,220	-	-	5,220
					(80)	(-)	(-)	(-)	(-)				
Karri West Coast	14,500	6,270	4,750	2,180	4,200	50	-	-		4,690	10	-	4,700
					(410)	(-)	(10)	(-)	(20)				

APPENDIX 6 (cont.)

Area reservation levels of forest ecosystems

	Total pre-1750 extent (ha)	Present extent within the plan area (ha)	Present extent on all lands vested in the Conservation Commission (ha)	CAR target (ha)	Formal reserves Area of ecosystem representation (hectares) Existing gazetted as at 30.06.2013 (Additions proposed) N.P. (ha)	N.R. (ha)	C.P. (ha)	5(1) (g),(h) (ha)	FCA (ha)	All formal reserves and FCA (ha)	Informal reserves (ha)	Other (fauna habitat zones) (ha)	Formal reserves, FCA, informal reserves, and other protected areas (ha)
Karri Yellow Tingle	15,800	13,260	11,770	2,370	11,220	-	-	-		11,770	-	-	11,770
					(20)	(-)	(-)	(-)	(530)				
Sub total	**231,600**	**190,160**	**173,960**	**34,740**	**89,930**	**270**	**10**	**40**		**93,400**	**20,770**	**1,010**	**115,180**
					(940)	**(100)**	**(410)**	**(-)**	**(1,690)**				
Wandoo dominant													
Western Wandoo Forest	363,200	146,600	99,510	54,480	22,640	10,440	7,340	20		64,890	6,630	1,600	73,120
					(8,290)	(900)	(15,220)	(0)	(50)				
Western Wandoo Woodland	163,000	72,080	44,740	24,450	14,980	2,250	670	-		33,490	2,930	390	36,810
					(6,340)	(230)	(9,030)	(-)	(-)				
Sub total	**526,200**	**218,680**	**144,250**	**78,930**	**37,620**	**12,690**	**8,010**	**20**	**-**	**98,380**	**9,560**	**1,990**	**109,930**
					(14,230)	**(1,130)**	**(24,250)**	**(0)**	**(50)**				
Other													
Bullich and Yate	2,800	2,440	2,190	2,440	1,470	40	-	-		2,160	30	-	2,190
					(650)	(-)	(-)	(-)	(-)				
Darling Scarp	36,300	14,250	3,980	5,450	2,450	320	70	-		3,590	390	-	3,980
					(210)	(350)	(130)	(-)	(70)				

APPENDIX 6 (cont.)

Area reservation levels of forest ecosystems

	Total pre-1750 extent	Present extent within the plan area	Present extent on all lands vested in the Conservation Commission	CAR target	Formal reserves Area of ecosystem representation (hectares)				FCA	All formal reserves and FCA	Informal reserves	Other (fauna habitat zones)	Formal reserves, FCA, informal reserves, and other protected areas
					Existing gazetted as at 30.06.2013 (Additions proposed)								
					N.P.	N.R.	C.P.	5(1) (g),(h)					
	(ha)	(ha)	(ha)	(ha)	(ha)	(ha)	(ha)	(ha)	(ha)	(ha)	(ha)	(ha)	(ha)
Peppermint & Coastal Heath	80,100	70,830	62,380	12,020	55,910	1,420	-	10		62,180	150	-	62,330
					(4,540)	(300)	(-)	(-)	(-)				
Rocky Outcrops	26,400	12,440	12,980	3,960	6,370	20	50	70		8,740	4,240	-	12,980
					(1,790)	(-)	(390)	(-)	(50)				
Sand Dunes	11,300	11,300	11,310	1,700	11,070	-	-	-		11,310	-	-	11,310
					(250)	(-)	(-)	(-)	(-)				
Shrub, Herb, & Sedgelands	429,900	296,300	256,170	64,490	193,880	11,810	280	890		226,060	30,110	-	256,170
					(6,640)	(1,580)	(730)	(-)	(10,250)				
Swamps	15,300	8,070	6,650	2,300	3,270	2,630	120	20		6,270	380	-	6,650
					(10)	(180)	(-)	(-)	(20)				
Whicher Scarp	23,700	9,960	5,250	3,560	320	20	90	-		3,260	610	30	3,900
					(2,410)	(-)	(60)	(-)	(360)				
Sub total	**625,800**	**425,590**	**360,910**		**274,740**	**16,260**	**610**	**990**		**323,570**	**35,910**	**30**	**359,510**
					(16,500)	**(2,410)**	**(1,310)**	**(-)**	**(10,750)**				

APPENDIX 6 (cont.)

Area reservation levels of forest ecosystems

	Total pre-1750 extent (ha)	Present extent within the plan area (ha)	Present extent on all lands vested in the Conservation Commission (ha)	CAR target (ha)	Formal reserves Area of ecosystem representation (hectares) Existing gazetted as at 30.06.2013 (Additions proposed) N.P. (ha)	N.R. (ha)	C.P. (ha)	5(1) (g),(h) (ha)	FCA (ha)	All formal reserves and FCA (ha)	Informal reserves (ha)	Other (fauna habitat zones) (ha)	Formal reserves, FCA, informal reserves, and other protected areas (ha)
Total	**4,163,850**	**2,643,470**	**2,253,350**		**783,120**	**92,420**	**24,770**	**14,930**		**1,160,670**	**193,970**	**48,430**	**1,402,070**
					(118,170)	**(13,470)**	**(73,070)**	**(260)**	**(40,460)**				

Notes:

1. Ecosystem and tenure datasets have been updated since the RFA and previous FMP.
2. The RFA boundary has been extended to include the full extent of both the Darling Scarp and Whicher Scarp ecosystems.
3. Identification of the Whicher Scarp ecosystem has reduced the extent of the Jarrah Blackwood ecosystem.
4. Forest ecosystem data are incomplete on lands that are not currently vested in the Conservation Commission.
5. The appendix shows the extent of mapped ecosystems. It does not show the total of each tenure category which may also include reservoirs, exotic species, and cleared land.
6. The distribution of the total area of fauna habitat zones between the forest ecosystems may differ slightly due to the finalisation of zones under the FMP (2004-2013). The total area of fauna habitat zones under this plan will be about 48,430 ha.
7. Totals of rows and columns within the table may not be consistent due to rounding.

APPENDIX 7

Percentage reservation levels of forest ecosystems

	Total pre-1750 extent (ha)	Present extent within the plan area (% pre-1750)	Present extent on all lands vested in the Conservation Commission (% pre-1750)	CAR target (% pre-1750)	Formal reserves Ecosystem representation as a percentage of pre-1750 extent				FCA (% pre-1750)	All formal reserves and FCA (% pre-1750)	Informal reserves (% pre-1750)	Other (fauna habitat zones) (% pre-1750)	Formal reserves, FCA, informal reserves, and other protected areas (% pre-1750)
					Existing gazetted as at 30.06.2013 (Additions proposed)								
					N.P. (% pre-1750)	N.R. (% pre-1750)	C.P. (% pre-1750)	5(1) (g),(h) (% pre-1750)					
Jarrah dominant													
Jarrah Blackwood	343,500	81	78	15	21.0	0.4	0.8	-		26.8	6.2	1.9	34.9
					(0.8)	(0.3)	(1.1)	(-)	(2.4)				
Jarrah Leeuwin	56,400	35	17	15	13.6	0.1	-	-		15.0	0.6	-	15.6
					(0.3)	(-)	(-)	(-)	(1.0)				
Jarrah Mt Lindesay	126,600	34	21	15	13.9	0.5	-	-		18.3	0.4	-	18.8
					(-)	(0.6)	(-)	(-)	(3.3)				
Jarrah North East	717,100	49	36	15	2.5	1.1	1.1	-		15.7	1.9	1.3	18.8
					(6.2)	(0.7)	(4.0)	(-)	(-)				
Jarrah North West	670,600	75	67	15	5.7	0.2	0.4	2.0		14.2	5.2	3.3	22.7
					(4.3)	(0.2)	(0.8)	(-)	(0.5)				
Jarrah Rate's Tingle	1,500	83	77	100 extant	77.3	-	-	-		77.3	-	-	77.3
					(-)	(-)	(-)	(-)	(-)				
Jarrah Red Tingle	350	77	63	100 extant	62.9	-	-	-		62.9	-	-	62.9
					(-)	(-)	(-)	(-)	(-)				
Jarrah Sandy	107,900	66	59	15	9.6	0.2	1.9	-		22.7	3.1	1.8	27.6
					(5.0)	(-)	(5.7)	(-)	(0.2)				
Jarrah South	557,300	79	75	15	34.4	5.7	-	0.1		42.1	5.8	1.0	48.9
					(-)	(0.2)	(0.2)	(-)	(1.5)				

APPENDIX 7 (cont.)

Percentage reservation levels of forest ecosystems

	Total pre-1750 extent (ha)	Present extent within the plan area (% pre-1750)	Present extent on all lands vested in the Conservation Commission (% pre-1750)	CAR target (% pre-1750)	Formal reserves Ecosystem representation as a percentage of pre-1750 extent				FCA (% pre-1750)	All formal reserves and FCA (% pre-1750)	Informal reserves (% pre-1750)	Other (fauna habitat zones) (% pre-1750)	Formal reserves, FCA, informal reserves, and other protected areas (% pre-1750)
					Existing gazetted as at 30.06.2013 (Additions proposed)								
					N.P. (% pre-1750)	N.R. (% pre-1750)	C.P. (% pre-1750)	5(1) (g),(h) (% pre-1750)					
Jarrah Unicup	81,000	36	21	15	0.3	18.6	-	-		20.8	-	-	20.9
					(-)	(0.4)	(-)	(-)	(1.4)				
Jarrah Woodland	106,400	63	47	15	14.7	4.5	0.3	0.2		27.3	19.9	-	47.2
					(3.8)	(0.6)	(2.4)	(-)	(1.0)				
Jarrah Yellow Tingle	11,600	83	71	15	65.1	-	-	-		71.2	-	-	71.2
					(0.2)	(-)	(-)	(-)	(5.9)				
Sub total	**2,780,250**	**65**	**57**										
Karri dominant													
Karri Main Belt	193,000	85	78	15	35.5	0.1	-	-		36.8	10.8	0.5	48.0
					(0.2)	(0.1)	(0.2)	(-)	(0.6)				
Karri Rate's Tingle	1,100	78	72	100 extant	71.8	-	-	-		71.8	-	-	71.8
					(-)	(-)	(-)	(-)	(-)				
Karri Red Tingle	7,200	81	73	15	71.4	-	-	-		72.5	-	-	72.5
					(1.1)	(-)	(-)	(-)	(-)				
Karri West Coast	14,500	43	33	15	29.0	0.3	-	-		32.3	0.1	-	32.4
					(2.8)	(-)	(0.1)	(-)	(0.1)				
Karri Yellow Tingle	15,800	84	74	15	71.0	-	-	-		74.5	-	-	74.5
					(0.1)	(-)	(-)	(-)	(3.4)				
Sub total	**231,600**	**82**	**75**										

APPENDIX 7 (cont.)

Percentage reservation levels of forest ecosystems

	Total pre-1750 extent (ha)	Present extent within the plan area (% pre-1750)	Present extent on all lands vested in the Conservation Commission (% pre-1750)	CAR target (% pre-1750)	Formal reserves Ecosystem representation as a percentage of pre-1750 extent Existing gazetted as at 30.06.2013 (Additions proposed) N.P. (% pre-1750)	N.R. (% pre-1750)	C.P. (% pre-1750)	5(1) (g),(h) (% pre-1750)	FCA (% pre-1750)	All formal reserves and FCA (% pre-1750)	Informal reserves (% pre-1750)	Other (fauna habitat zones) (% pre-1750)	Formal reserves, FCA, informal reserves, and other protected areas (% pre-1750)
Wandoo dominant													
Western Wandoo Forest	363,200	40	27	15	6.2	2.9	2.0	-		17.9	1.8	0.4	20.1
					(2.3)	(0.2)	(4.2)	(-)	(-)				
Western Wandoo Woodland	163,000	44	27	15	9.2	1.4	0.4	-		20.5	1.8	0.4	20.1
					(3.9)	(0.1)	(5.5)	(-)	(-)				
Sub total	**526,200**	**42**	**27**										
Other													
Bullich and Yate	2,800	87	78	100 extant	52.5	1.4	-	-		77.1	1.1	-	78.2
					(23.2)	(-)	(-)	(-)	-				
Darling Scarp	36,300	39	11	15	6.7	0.9	0.2	-		9.9	1.1	-	11.0
					(0.6)	(1.0)	(0.4)	(-)	(0.2)				
Peppermint & Coastal Heath	80,100	88	78	15	69.8	1.8	-	-		77.6	0.2	-	77.8
					(5.7)	(0.4)	(-)	(-)	(-)				
Rocky Outcrops	26,400	47	49	15	24.1	0.1	0.2	0.3		33.1	16.1	-	49.2
					(6.8)	(-)	(1.5)	(-)	(0.2)				
Sand Dunes	11,300	100	100	15	97.8	-	-	-		100.0	-	-	100.0
					(2.2)	(-)	(-)	(-)	(-)				

APPENDIX 7 (cont.)

Percentage reservation levels of forest ecosystems

	Total pre-1750 extent (ha)	Present extent within the plan area (% pre-1750)	Present extent on all lands vested in the Conservation Commission (% pre-1750)	CAR target (% pre-1750)	Formal reserves Ecosystem representation as a percentage of pre-1750 extent				FCA (% pre-1750)	All formal reserves and FCA (% pre-1750)	Informal reserves (% pre-1750)	Other (fauna habitat zones) (% pre-1750)	Formal reserves, FCA, informal reserves, and other protected areas (% pre-1750)
					Existing gazetted as at 30.06.2013 (Additions proposed)								
					N.P. (% pre-1750)	N.R. (% pre-1750)	C.P. (% pre-1750)	5(1) (g),(h) (% pre-1750)					
Shrub, Herb, & Sedgelands	429,900	69	60	15	45.1	2.7	0.1	0.2		52.6	7.0	-	59.6
					(1.5)	(0.4)	(0.2)	(-)	(2.4)				
Swamps	15,300	53	43	15	21.4	17.2	0.8	0.1		41.0	2.5	-	43.5
					(0.1)	(1.2)	(-)	(-)	(0.1)				
Whicher Scarp	23,700	42	22	15	1.4	0.1	0.4	-		13.8	2.6	0.1	16.5
					(10.2)	(-)	(0.3)	(-)	(1.5)				
Sub total	**625,800**	**68**	**58**										
Total	**4,163,850**	**63**	**54**										

Notes:

1. Ecosystem and tenure datasets have been updated since the RFA and previous FMP.
2. The RFA boundary has been extended to include the full extent of both the Darling Scarp and Whicher Scarp ecosystems.
3. Identification of the Whicher Scarp ecosystem has reduced the extent of the Jarrah Blackwood ecosystem.
4. Forest ecosystem data are incomplete on lands that are not currently vested in the Conservation Commission.
5. The appendix shows the extent of mapped ecosystems. It does not show the total of each tenure category which may also include reservoirs, exotic species, and cleared land.
6. Totals of rows and columns within the table may not be consistent due to rounding.

APPENDIX 8

Reservation of old-growth forest

Forest ecosystem	Area of old-growth forest on public land	CAR Target		Areas of old-growth forest in formal reserves and Forest Conservation Areas				Areas of old-growth forest in informal reserves and other protected areas		Total area protected (confined to land vested in the Conservation Commission)	
				Existing reserves at 30.06.13		Additional proposed reserves at 31.06.13					
	(ha)	(ha)	(%)	(ha)	(%)	(ha)	(%)	(ha)	(%)	(ha)	(%)
Jarrah dominant											
Jarrah Blackwood	45,693	27,416	60	39,132	85.6	4,189	9.2	2,358	5.2	45,608	100.0
Jarrah Leeuwin	486	486	100	479	98.6	7	1.4	-	-	486	100.0
Jarrah Mt Lindesay	11,964	7,178	60	10,930	91.4	676	5.6	358	3.0	11,963	100.0
Jarrah North East	13,025	13,025	100	1,430	11.0	10,153	78.0	1,441	11.0	13,025	100.0
Jarrah North West	7,954	7,954	100	2,247	28.2	5,160	64.9	534	6.7	7,940	99.8
Jarrah Rate's Tingle	1,091	1,091	100	1,091	100.0	-	-	-	-	1,091	100.0
Jarrah Red Tingle	214	214	100	211	98.4	3	1.6	-	-	214	100.0
Jarrah Sandy	2,223	2,223	100	14	0.6	2,194	98.7	15	0.7	2,223	100.0
Jarrah South	152,544	91,526	60	137,495	90.1	5,204	3.4	9,613	6.3	152,311	99.8
Jarrah Unicup	4,257	2,554	60	3,980	93.5	255	6.0	23	0.5	4,257	100.0
Jarrah Woodland	12,059	7,235	60	9,945	82.5	1,375	11.4	728	6.0	12,048	99.9
Jarrah Yellow Tingle	7,074	4,244	60	6,594	93.2	479	6.8	-	-	7,073	100.0
Sub total	**258,584**			**213,546**		**29,696**		**15,070**		**258,312**	
Karri dominant											
Karri Main Belt	52,178	31,307	60	45,332	86.9	511	1.0	6,198	11.9	52,041	99.7
Karri Rate's Tingle	731	731	100	731	100.0	-	-	-	-	731	100.0
Karri Red Tingle	3,288	1,973	60	3,214	97.8	74	2.2	-	-	3,288	100.0

APPENDIX 8 (cont.)

Reservation of old-growth forest

Forest ecosystem	Area of old-growth forest on public land	CAR Target		Areas of old-growth forest in formal reserves and Forest Conservation Areas				Areas of old-growth forest in informal reserves and other protected areas		Total area protected (confined to land vested in the Conservation Commission)	
				Existing reserves at 30.06.13		Additional proposed reserves at 30.06.13					
	(ha)	(ha)	(%)	(ha)	(%)	(ha)	(%)	(ha)	(%)	(ha)	(%)
Karri dominant											
Karri West Coast	522	522	100	472	90.4	50	9.6	-	-	522	100.0
Karri Yellow Tingle	6,955	4,173	60	6,760	97.2	196	2.8	-	-	6,956	100.0
Sub total	**63,674**			**56,507**		**831**		**6,198**		**63,538**	
Wandoo dominant											
Western Wandoo Forest	8,846	8,846	100	4,442	50.2	3,168	35.9	1,234	13.9	8,845	100.0
Western Wandoo Woodland	3,254	3,254	100	1,751	53.8	1,107	34.0	395	12.2	3,254	100.0
Sub total	**12,099**			**6,193**		**4,276**		**1,629**		**12,098**	
Other											
Darling Scarp	283	283	100	166	58.8	110	38.8	7	2.4	283	100.0
Whicher Scarp	-	-		-		-		-		-	
Sub total	**283**			**166**		**110**		**7**		**283**	
Total	**334,640**			**276,414**		**34,912**		**22,904**		**334,231**	

Notes:

1. Data presented are for old-growth forest within the RFA area.
2. Datasets contributing to the generation of old-growth forest have been updated since the RFA and previous FMP.
3. Old-growth forest on land vested in the Conservation Commission is current at 30.06.13 and on other public land at 31.12.01.
4. Darling Scarp includes Jarrah and Wandoo Forest and Woodland.

APPENDIX 9

Beard-Hopkins vegetation associations within the plan area

* Vegetation associations that occur within the plan area and have greater than 75 per cent of their occurrence in the plan area outside the RFA area		**Pre-1750 extent of vegetation associations**						
Beard-Hopkins code	**Description of vegetation association**	**Total within plan area**	**All land**				**Public land**	
			Within RFA		**Outside RFA**		**Outside RFA**	
		(ha)	**(ha)**	**% of Total**	**(ha)**	**% of Total**	**(ha)**	**% of Total**
*a23,32m,3Sc/a26m	Mosaic: Shrublands; *Acacia lasiocarpa* & *Melaleuca acerosa* heath / Shrublands; *Acacia rostellifera* & *Acacia cyclops* thicket	28,490	-	-	28,490	100	8,390	29
a31Sc	Shrublands; *Acacia decipiens*	8,790	8,790	100	-	-	-	-
agLc	Low forest: peppermint (*Agonis flexuosa*)	17,300	15,190	88	2,110	12	480	3
agLi	Low woodland; *Agonis flexuosa*	2,710	2,620	97	90	3	10	-
agSi	Shrublands; peppermint scrub, *Agonis flexuosa*	34,050	33,860	99	190	1	150	-
*aSZc	Shrublands; Acacia scrub-heath unknown spp	4,560	-	-	4,560	100	3,000	66
*b1,2Li	Low woodland; *Banksia attenuata* & *B. menziesii*	1,590	140	9	1,440	91	680	43
*bLi	Low woodland; Banksia	199,880	7,100	4	192,780	96	108,050	54
*bLi/dZc	Mosaic: Low woodland; Banksia / Shrublands; Dryandra heath	1,530	-	-	1,530	100	-	-
*bLi/mSc	Mosaic: Low woodland; Banksia / Shrublands; teatree thicket	41,050	-	-	41,050	100	14,630	36
c5e6Li	Low woodland; *Allocasuarina huegeliana* & York gum	6,720	3,380	50	3,350	50	-	-
c5Li	Low woodland; *Allocasuarina huegeliana*	70	70	100	-	-	-	-
chSc	Shrublands; *Calothamnus quadrifidis* & *Hakea trifircata* (Cape Naturaliste)	2,730	2,310	85	420	15	370	14
ds	Bare areas; drift sand	14,250	12,130	85	2,120	15	1,210	8
e1,3Tc	Tall forest; karri & marri (*Corymbus calophylla*)	160,230	160,230	100	-	-	-	-

APPENDIX 9 (cont.)

Beard-Hopkins vegetation associations within the plan area

* Vegetation associations that occur within the plan area and have greater than 75 per cent of their occurrence in the plan area outside the RFA area		**Pre-1750 extent of vegetation associations**						
Beard-Hopkins code	**Description of vegetation association**	**Total within plan area**	**All land**				**Public land**	
			Within RFA		**Outside RFA**		**Outside RFA**	
		(ha)	**(ha)**	**% of Total**	**(ha)**	**% of Total**	**(ha)**	**% of Total**
e1,68,74Tc	Tall forest; karri, red tingle & yellow tingle	5,390	5,390	100	-	-	-	-
e1,68Tc	Tall forest; karri & red tingle (*E. jacksonii*)	1,100	1,100	100	-	-	-	-
e1,74Tc	Tall forest; karri & yellow tingle (*E. guilfoyleii*)	15,220	15,220	100	-	-	-	-
e1,75Tc	Tall forest; karri & Rate's tingle (*E. brevostylis*)	780	780	100	-	-	-	-
e18,72Mi	Medium woodland; *Eucalyptus rudis* & blackbutt with some bullich, jarrah & marri (fringing Blackwood River)	9,040	9,040	100	-	-	-	-
e18mMi	Medium woodland; *Eucalyptus rudis* & *Melaleuca rhaphiophylla*	23,400	15,150	65	8,250	35	400	2
e1Tc	Tall forest; karri (*Eucalyptus diversicolor*)	68,590	66,730	97	1,860	3	820	1
e1Tc/e2,3Tc	Mosaic: Tall forest; karri / Tall forest; jarrah & marri	11,160	11,160	100	-	-	-	-
e2,18Mi	Medium woodland; jarrah & river gum	60	60	100	-	-	-	-
e2,3,18,agMi	Medium woodland-fringing; jarrah, marri, *Eucalyptus rudis* & *Agonis flexuosa*	63,560	63,560	100	-	-	-	-
e2,3,5,7Mi	Medium woodland; jarrah, marri, wandoo & yate	13,650	13,650	100	-	-	-	-
e2,3,5Mc	Medium forest; jarrah, marri & wandoo	6,780	6,780	100	-	-	-	-
e2,3,5Mi	Medium woodland; jarrah, marri & wandoo	206,520	79,240	38	127,280	62	5,000	2
e2,3,72Mi	Medium woodland; jarrah, marri & blackbutt	15,150	15,150	100	-	-	-	-
e2,3,Tc	Tall forest; jarrah & marri	1,250	1,250	100	-	-	-	-

APPENDIX 9 (cont.)

Beard-Hopkins vegetation associations within the plan area

* Vegetation associations that occur within the plan area and have greater than 75 per cent of their occurrence in the plan area outside the RFA area		**Pre-1750 extent of vegetation associations**						
Beard-Hopkins code	**Description of vegetation association**	**Total within plan area**	**All land**				**Public land**	
			Within RFA		**Outside RFA**		**Outside RFA**	
		(ha)	**(ha)**	**% of Total**	**(ha)**	**% of Total**	**(ha)**	**% of Total**
e2,3Lc	Low forest; jarrah & marri	650	650	100	-	-	-	-
e2,3Mc	Medium forest; jarrah-marri	2,433,470	2,417,720	99	15,750	1	2,200	-
e2,3Mc (e5)	Medium forest; jarrah & marri on laterite with wandoo in valleys, sandy swamps with teatree and banksia	66,390	66,390	100	-	-	-	-
e2,3Mc/e2Lc	Mosaic: Medium forest; jarrah-marri / Low forest; jarrah	17,870	17,310	97	560	3	80	-
e2,3Mc/e3,5Mi	Mosaic: Medium forest; jarrah-marri / Medium woodland; marri-wandoo	5,610	5,230	93	380	7	-	-
e2,3Mi	Medium woodland; jarrah & marri	2,550	730	29	1,820	71	1,480	58
*e2,3Mi/bLi/mLc	Mosaic: Medium forest; jarrah-marri / Low woodland; banksia / Low forest; teatree (*Melaleuca* spp.)	99,420	4,330	4	95,080	96	10,120	10
*e2,3Mi/bLi/mLc/c6Li	Mosaic: Medium forest; jarrah-marri / Low woodland; banksia / Low forest; teatree / Low woodland; *Casuarina obesa*	14,050	-	-	14,050	100	1,600	11
e2,3Mp	Medium sparse woodland; jarrah & marri	810	790	98	20	2	-	-
e2,3Mr bLi	Medium open woodland; jarrah & marri, with low woodland; banksia	17,450	16,720	96	730	4	-	-
*e2,3Mr bLi/e2,3,Mp	Mosaic: Medium open woodland; jarrah & marri, with low woodland; banksia / Medium sparse woodland; jarrah & marri	39,790	7,110	18	32,680	82	8,330	21
*e2,4Mi	Medium woodland; tuart & jarrah	56,040	-	-	56,040	100	17,900	32

APPENDIX 9 (cont.)

Beard-Hopkins vegetation associations within the plan area

* Vegetation associations that occur within the plan area and have greater than 75 per cent of their occurrence in the plan area outside the RFA area		**Pre-1750 extent of vegetation associations**						
Beard-Hopkins code	**Description of vegetation association**	**Total within plan area**	**All land**				**Public land**	
			Within RFA		**Outside RFA**		**Outside RFA**	
		(ha)	**(ha)**	**% of Total**	**(ha)**	**% of Total**	**(ha)**	**% of Total**
e2,5,45Mi	Medium woodland; jarrah, wandoo & powderbark	35,900	35,750	100	150	-	130	-
e2,5Mc	Medium forest; jarrah & wandoo (*E. wandoo*)	86,500	86,500	100	-	-	-	-
e2,5Mi	Medium woodland; jarrah & wandoo	150	150	100	-	-	-	-
e2,63Mi	Medium woodland, jarrah & *Eucalyptus haematoxylon* (Whicher Ra.)	19,210	19,150	100	60	-	10	-
e2,68Mc	Medium forest; jarrah & red tingle	2,170	2,170	100	-	-	-	-
e2,74Mc	Medium forest; jarrah & yellow tingle	7,390	7,390	100	-	-	-	-
e2,74Mc/e2,75Mc	Mosaic: Medium forest; jarrah & yellow tingle / Medium forest; jarrah & Rate's tingle	100	100	100	-	-	-	-
e2,75Mc	Medium forest; jarrah & Rate's tingle	1,180	1,180	100	-	-	-	-
e2bLi	Low woodland; jarrah-banksia	40,760	40,500	99	260	1	80	-
e2Lc	Low forest; jarrah	68,670	66,250	96	2,430	4	440	1
e2Li	Low woodland; jarrah	4,200	4,200	100	-	-	-	-
*e2Mb cbLi	Medium very sparse woodland; jarrah, with low woodland; banksia & casuarina	57,350	290	1	57,060	99	10,490	18
e2Mi	Medium woodland; jarrah (south coast)	37,440	37,440	100	-	-	-	-
e2Mr	Medium open woodland; jarrah	15,950	15,950	100	-	-	-	-
e2Tc	Tall forest; jarrah (*E. marginata*)	4,630	4,630	100	-	-	-	-

APPENDIX 9 (cont.)

Beard-Hopkins vegetation associations within the plan area

* Vegetation associations that occur within the plan area and have greater than 75 per cent of their occurrence in the plan area outside the RFA area		**Pre-1750 extent of vegetation associations**							
Beard-Hopkins code	**Description of vegetation association**	**Total within plan area**	**All land**				**Public land**	
			Within RFA		**Outside RFA**		**Outside RFA**	
		(ha)	**(ha)**	**% of Total**	**(ha)**	**% of Total**	**(ha)**	**% of Total**
*e3,18Mr	Medium woodland; marri & river gum	16,940	3,700	22	13,240	78	1,090	6
e3,37Mi	Medium woodland; marri & yate	1,270	1,270	100	-	-	-	-
*e3,4Mr	Medium open woodland; marri & tuart	1,210	-	-	1,210	100	-	-
e3,5,45Mi	Medium woodland; marri, wandoo & powderbark	60	60	100	-	-	-	-
e3,5Mi	Medium woodland; marri & wandoo	481,170	464,680	97	16,490	3	1,320	-
e37Mc	Medium forest; bushy yate (*E. cornuta*)	280	280	100	-	-	-	-
e37Mi	Medium woodland; yate (*E. occidentalis*)	800	800	100	-	-	-	-
e3Mc	Medium forest; marri	310	310	100	-	-	-	-
e3Mi	Medium woodland; marri	23,870	11,660	49	12,210	51	70	-
e3Mi (e2,5,18,c)	Medium woodland; marri with some jarrah, wandoo, river gum and casuarina	48,120	21,220	44	26,900	56	450	1
*e3Mr	Medium open woodland; marri	4,570	50	1	4,530	99	150	3
*e3Mr/mSc	Mosaic: Medium open woodland; marri / Shrublands; teatree thicket	450	-	-	450	100	-	-
*e4Mi	Medium woodland; tuart	50,370	-	-	50,370	100	15,620	31
*e4Mr	Medium open woodland; tuart	1,270	-	-	1,270	100	450	35
*e4Mr/bLi	Mosaic: Medium open woodland; tuart / Low woodland; banksia	510	-	-	510	100	-	-
*e4Ti	Tall woodland; tuart (*E. gomphocephala*)	3,140	10	-	3,140	100	2,320	74

APPENDIX 9 (cont.)

Beard-Hopkins vegetation associations within the plan area

* Vegetation associations that occur within the plan area and have greater than 75 per cent of their occurrence in the plan area outside the RFA area		**Pre-1750 extent of vegetation associations**						
Beard-Hopkins code	**Description of vegetation association**	**Total within plan area**	**All land**				**Public land**	
			Within RFA		**Outside RFA**		**Outside RFA**	
		(ha)	**(ha)**	**% of Total**	**(ha)**	**% of Total**	**(ha)**	**% of Total**
e5,45Mi	Medium woodland; wandoo & powderbark (*E. accedens*)	5,930	5,930	100	-	-	-	-
*e5,6,8Mi	Medium woodland; York gum, wandoo & salmon gum (*E. salmonophloia*)	210	-	-	210	100	-	-
e5,7Mi	Medium woodland; wandoo & yate	900	900	100	-	-	-	-
e5Mi	Medium woodland; wandoo	7,150	4,040	57	3,110	43	340	5
e5Mr	Medium open woodland; wandoo	400	400	100	-	-	-	-
e5Mr/xZc	Mosaic: Medium open woodland; wandoo / Shrublands; mixed heath	1,650	1,650	100	-	-	-	-
e67Si	Shrublands; mallee scrub, *E. decipiens*	70	70	100	-	-	-	-
e6Mi	Medium woodland; York gum	92,740	41,570	45	51,170	55	280	-
e7mMi	Medium woodland; yate & paperbark (*Melaleuca* spp.)	1,290	1,290	100	-	-	-	-
fl	Bare areas; freshwater lakes	12,980	9,280	71	3,700	29	2,630	20
jZc	Shrublands; *Jacksonia horrida* heath	7,160	7,160	100	-	-	-	-
*k3Ci	Succulent steppe; samphire	1,120	-	-	1,120	100	170	15
*m4Zc	Shrublands; melaleuca heath	3,410	-	-	3,410	100	1,940	57
*mangrove	Low forest; mangroves or thicket; mangroves	50	-	-	50	100	30	60
mcLc	Low forest; teatree & casuarina	20	10	50	10	50	10	50
mLc	Low forest; paperbark (*Melaleuca rhaphiophylla*)	3,500	1,030	29	2,470	71	320	9

APPENDIX 9 (cont.)

Beard-Hopkins vegetation associations within the plan area

* Vegetation associations that occur within the plan area and have greater than 75 per cent of their occurrence in the plan area outside the RFA area		**Pre-1750 extent of vegetation associations**						
Beard-Hopkins code	**Description of vegetation association**	**Total within plan area**	**All land**				**Public land**	
			Within RFA		**Outside RFA**		**Outside RFA**	
		(ha)	**(ha)**	**% of Total**	**(ha)**	**% of Total**	**(ha)**	**% of Total**
mLc xGc	Sedgeland; sedges with low tree savanna woodland; paperbarks over & various sedges	6,170	6,170	100	-	-	-	-
mLi	Low woodland; paperbark (*Melaleuca* spp.)	122,720	117,600	96	5,120	4	1,350	1
mLSi	Shrublands tree-heath; paperbark over teatree thickets	19,810	19,810	100	-	-	-	-
*mSc	Shrublands; teatree thicket	18,790	4,260	23	14,530	77	3,350	18
*pLc	Low forest; cypress pine	1,980	-	-	1,980	100	1,960	99
r	Bare areas; rock outcrops	6,810	6,610	97	200	3	50	1
*sl	Bare areas; salt lakes	7,340	170	2	7,170	98	6,400	87
*x14SZc	Shrublands; scrub-heath on the Swan Coastal Plain	10,310	-	-	10,310	100	3,190	31
*x14SZc/dZc	Mosaic: Shrublands; scrub-heath on the Swan Coastal Plain / Shrublands; dryandra heath	15,410	-	-	15,410	100	3,530	23
*x8SZc	Shrublands; scrub-heath on yellow sand plain banksia-xylomelum alliance in the Geraldton Sandplain & Avon-Wheatbelt regions	5,970	-	-	5,970	100	60	1
*x9SZc	Shrublands; scrub-heath Dryandra-Calothamnus assoc. with *B. prionotes* on limestone in the northern Swan Region	9,000	-	-	9,000	100	1,700	19
xGc	Sedgeland; reed swamps, occasionally with heath	40,390	35,540	88	4,850	12	1,890	5
xSc	Shrublands; thicket, mixed	30	30	100	-	-	-	-

APPENDIX 9 (cont.)

Beard-Hopkins vegetation associations within the plan area

* Vegetation associations that occur within the plan area and have greater than 75 per cent of their occurrence in the plan area outside the RFA area		**Pre-1750 extent of vegetation associations**						
Beard-Hopkins code	**Description of vegetation association**	**Total within plan area**	**All land**				**Public land**	
			Within RFA		**Outside RFA**		**Outside RFA**	
		(ha)	**(ha)**	**% of Total**	**(ha)**	**% of Total**	**(ha)**	**% of Total**
xSi	Shrublands; *Melaleuca incana*, *Hakea tuberculata*, *Viminaria juncea* scrub on ironstone, south coast	1,080	1,080	100	-	-	-	-
*xSZc	Shrublands; scrub-heath	3,280	-	-	3,280	100	1,320	40
xZc	Shrublands; mixed heath	4,470	1,670	37	2,790	63	2,790	63

Notes:
1. Vegetation association and tenure datasets have been updated since the previous FMP.
2. The RFA boundary has been extended to include the full extent of both the Darling Scarp and Whicher Scarp ecosystems.

APPENDIX 10

Representation on public land of Beard-Hopkins vegetation associations that occur predominantly outside the RFA area

Beard-Hopkins code	Description of vegetation association	Pre-1750 extent (ha)	Present extent (ha)	Existing and proposed conservation reserves			Other land vested in the Conservation Commission (ha)	Other public land (ha)
				Area (ha)	% of pre-1750 extent	% of present extent		
a23,32m,3Sc/a26m	Mosaic: Shrublands; *Acacia lasiocarpa & Melaleuca acerosa* heath / Shrublands; *Acacia rostellifera & Acacia cyclops* thicket	8,390	7,500	3,320	40	44	-	4,180
aSZc	Shrublands; Acacia scrub-heath unknown spp.	3,000	2,990	2,220	74	74	-	770
b1,2Li	Low woodland; *Banksia attenuata & B. menziesii*	680	570	-	-	-	-	570
bLi	Low woodland; banksia	108,050	84,230	50,500	47	60	16,510	17,220
bLi/mSc	Mosaic: Low woodland; banksia / Shrublands; teatree thicket	14,630	14,260	10,220	70	72	2,290	1,750
e2,3Mi/bLi/mLc	Mosaic: Medium forest; jarrah-marri / Low woodland; banksia / Low forest; teatree *(Melaleuca* spp.)	10,120	6,960	2,770	27	40	1,040	3,150
e2,3Mi/bLi/mLc/c6Li	Mosaic: Medium forest; jarrah-marri / Low woodland; banksia / Low forest; teatree / Low woodland; *Casuarina obesa*	1,600	540	190	12	35	-	350
e2,3Mr bLi/e2,3,Mp	Mosaic: Medium open woodland; jarrah & marri, with low woodland; banksia / Medium sparse woodland; jarrah & marri	8,330	8,300	7,810	94	94	-	490
e2,4Mi	Medium woodland; tuart & jarrah	17,900	7,200	3,440	19	48	1,150	2,610
e2Mb cbLi	Medium very sparse woodland; jarrah, with low woodland; banksia & casuarina	10,490	4,160	810	8	19	220	3,130
e3,18Mr	Medium woodland; marri & river gum	1,090	320	-	-	-	60	260
e3Mr	Medium open woodland; marri	150	110	-	-	-	-	110
e4Mi	Medium woodland; tuart	15,620	11,940	8,220	53	69	90	3,630
e4Mr	Medium open woodland; tuart	450	420	390	87	93	20	10

APPENDIX 10 (cont.)

Representation on public land of Beard-Hopkins vegetation associations that occur predominantly outside the RFA area

Beard-Hopkins code	Description of vegetation association	Pre-1750 extent (ha)	Present extent (ha)	Existing and proposed conservation reserves			Other land vested in the Conservation Commission (ha)	Other public land (ha)
				Area (ha)	% of pre-1750 extent	% of present extent		
e4Ti	Tall woodland; tuart (*E. gomphocephala*)	2,320	1,830	1,820	78	99	-	10
k3Ci	Succulent steppe; samphire	170	110	70	41	64	-	40
m4Zc	Shrublands; melaleuca heath	1,940	1,820	1,540	79	85	-	280
mangrove	Low forest; mangroves or thicket; mangroves	30	5	-	-	-	-	5
mSc	Shrublands; teatree thicket	3,350	2,880	2,480	74	86	20	380
pLc	Low forest; cypress pine	1,960	1,550	-	-	-	-	1,550
sl	Bare areas; salt lakes	6,400	5,790	5,200	81	90	-	590
x14SZc	Shrublands; scrub-heath on the Swan Coastal Plain	3,190	1,760	780	24	44	-	980
x14SZc/dZc	Mosaic: Shrublands; scrub-heath on the Swan Coastal Plain / Shrublands; dryandra heath	3,530	3,230	2,730	77	85	-	500
x8SZc	Shrublands; scrub-heath on yellow sand plain banksia-xylomelum alliance in the Geraldton Sandplain & Avon-Wheatbelt regions	60	50	50	83	100	-	-
x9SZc	Shrublands; scrub-heath Dryandra-Calothamnus assoc. with *B. prionotes* on limestone in the northern Swan Region	1,700	1,660	-	-	-	1,520	140
xSZc	Shrublands; scrub-heath	1,320	1,310	1,270	96	97	10	30

Notes:

1. Vegetation associations and tenure datasets have been updated since the previous FMP.
2. The RFA boundary has been extended to include the full extent of both the Darling Scarp and Whicher Scarp ecosystems.

APPENDIX 11

Informal reserves

The types and purpose of informal reserves are described below, along with the criteria for their inclusion in the Department's corporate database. Informal reserves are managed in accordance with the Department's *Guidelines for Protection of the Values of Informal Reserves and Fauna Habitat Zones* (DEC 2009a).

a) Informal reserve types in State forest and timber reserves

Informal reserves are those areas identified in the Department's corporate database as informal reserves, of the kind set out in the following table:

Informal reserve type	Purpose	Criteria for inclusion in Department's corporate database
Old-growth forest	Protect areas of old-growth forest outside the formal reserve system.	Areas of ecologically mature jarrah forest larger than two hectares that have not been infested with *Phytophthora* dieback, where the effects of anthropogenic disturbance (e.g. timber production, mining, grazing) are either absent or now negligible. Areas of karri forest larger than two hectares where the effects of anthropogenic disturbance (e.g. timber production, mining, grazing) are absent and which are dominated by trees in the late mature to senescent growth stage. Areas of ecologically mature wandoo forest or woodland larger than two hectares where the effects of anthropogenic disturbance (e.g. mining, timber production) are absent.
River and stream zones	Provide forest undisturbed by timber harvesting. Protect water quality. Protect aesthetic and social values. Protect productive capacity, soil values and carbon pools.	A 60-metre wide corridor in the area of first, second and third order[15] streams, with all boundaries being at least 20 metres from the bank of the stream. A 150-metre wide corridor in the area of fourth order streams, with all boundaries being at least 50 metres from the bank of the stream. A 400-metre wide corridor in the area of fifth order streams, and streams of any higher category, with all boundaries being at least 100 metres from the bank of the stream.
Diverse ecotype zones	Protect sensitive ecosystems.	Rock outcrops, greater than 0.2 hectares, swamps and wetlands, heath, sedge, herb and low-density woodland communities. Ecological characteristics will be used to determine the boundary of these zones, which are defined in the Department's corporate database by vegetation codes.

[15] Classification system for width and importance of streams, varying from one for minor streams, to seven for major streams or rivers).

Informal reserve type	Purpose	Criteria for inclusion in Department's corporate database
Travel route zones	Protect aesthetic and social values.	A corridor that extends at least 200 metres from each side of Level 1 travel routes in the Warren Region[16]. A corridor that extends at least 100 metres from each side of Level 2 travel routes in the Warren Region. A corridor that extends at least 200 metres from each side of the Bibbulmun Track.
Less well reserved vegetation complexes	Provide additional protection for the less well reserved vegetation complexes that occur on State forest and timber reserves.	Vegetation complexes that have either: (i) less than five per cent of their pre-European area in existing or proposed formal and informal reserves; or (ii) between five and 10 per cent of their pre-European area in existing or proposed formal and informal reserves and less than 15 per cent of their pre-European area remaining. The less well reserved vegetation complexes currently on the Department's corporate database are identified in this appendix.
Poorly reserved forest ecosystem	Provide additional protection for a poorly reserved forest ecosystem that occurs on State forest and timber reserves.	Darling Scarp forest ecosystem that has less than 15 per cent of pre-European area in existing or proposed formal plus CAR informal reserves.
RFA accredited linkage zones	Provide low disturbance linkage zones.	The areas identified in the Department's corporate database that provide a link between the proposed Milyeannup National Park and an adjacent stream zone, and a corridor between the Helena and Flynn parts of the proposed Helena Valley National Park.

Note that FHZs are not informal reserves (see the 'Biological diversity' chapter).

As explained in the 'Biological diversity' chapter, some small areas were designated as 'Areas previously classified as old-growth forest', as a type of informal reserve in the previous FMP. These are areas in the corporate database classified as old-growth forest on the commencement of the previous FMP, which were subsequently determined not to be old-growth forest or any other type of informal reserve. This category is a legacy, 'default' category that does not provide protection to areas with any special conservation values that warrant protection as an informal reserve and accordingly, it will not be retained in this plan.

[16] Classification system for viewer sensitivity levels. Level one includes highways and other main roads with high (e.g. greater than 75 vehicles per day) levels of usage (sealed or unsealed). Level two includes main roads with moderate levels of usage (sealed or unsealed).
Note: except for the Bibbulmun Track, and as proposed in this plan for parts of the Munda Biddi Trail, travel route zones apply only in the Warren Region.

b) Specific informal reserves

i) Travel routes in this plan

Level 1 travel routes (all or part of the following roads)

Bibbulmun Track
Boat Landing Road
Cascades Track
Channybearup Road
Coronation Road
Deeside Coast Road
Diamond Tree Road
Donnelly Mill Road
Eastbourne Road
Glauders Road
Graphite Road
Middlesex Road
Mockerdillup Road
Moons Crossing Road
Mordalup Road
Muir Highway
Pemberton North Road
Pemberton-Northcliffe Road
Pemberton-Northcliffe Tramway
Percival Road
Perup Road
Rainbow Trail
Rainbow Trail/Tramway Trail Link
Range Road
River Road (south of Warren River)
Sears Road
Seven Day Road
Smiths Road (includes access road to 100 year forest)
South West Highway
Spring Gully Road
Stirling Road
Tramway Trail
Vasse Highway
Wheatley Coast Road
Windy Harbour Road

Note: the entire Karri Forest Explorer Drive is covered by all, or part, of a number of roads listed above.

Level 2 travel routes (all or part of the following roads)

Andrew Road
Balbarrup Road
Black Point Road
Boorara Road
Corballup Road
Cutting Road
Donnelly Drive
Gardner River Road
Gordon Road
Grays Road
Jangardup Road
Kurandra Road
Loverock Road
Mobil Road
Morgan Road
Orchid Road
Panda Road
Peppermint Grove Road
Pneumonia Road
River Road (north of Warren River)
Rowes Road
Seaton Ross Road
Springdale Road
Tom Road
Waistcoat Road

As outlined in the 'Biological diversity' chapter, this plan also provides for travel routes for part of the Munda Biddi Trail.

ii) Less well reserved vegetation complexes

Vegetation complexes with less than five per cent of pre-European area in existing and proposed formal plus informal reserves and that occur on State forest. The data regarding the reservation levels of these complexes are reviewed from time to time. The previous FMP listed the following complexes:

> *BLf (Balingup valley floors); BT (Bridgetown); Fo (Forrestfield); ML (Mumballup); NWg1 (Newgalup); SC (Sidcup); Wi (Williams*); *Yd (Yelverton sandy deposits); Yw (Yelverton valleys and depressions); TP (Toponup)*

Vegetation complexes with between five per cent and 10 per cent of pre-European area in existing and proposed formal plus informal reserves, and less than 15 per cent of pre-European area remaining and that occur on State forest. The data regarding the reservation levels of these complexes are reviewed from time to time. The previous FMP listed the following complex:

> *NWf2 (Newgalup*)

APPENDIX 12

Threatened species and ecological communities recovery plans relevant to the area covered by the plan

IUCN threat categories

Methods used to decide priorities for conservation action for threatened species are described in the Department's Policy No. 50: *Setting priorities for the conservation of Western Australia's threatened flora and fauna*. The IUCN has revised its categories of threat and criteria for the year 2000 Red List. All threat categories remain the same, however the lower risk category 'conservation dependent' has disappeared. The Department currently retains this category within the 'Priority' species listing. The threat categories are:

- *Critically Endangered* – A taxon is critically endangered when it is facing extremely high risk of extinction in the wild in the immediate future.
- *Endangered* – A taxon is endangered when it is not critically endangered but is facing a very high risk of extinction in the near future.
- *Vulnerable* – A taxon is vulnerable when not critically endangered or endangered but is facing a high risk of extinction in the wild in the medium term future.

Recovery plans

All taxa that are identified as critically endangered are conserved through the preparation and implementation of recovery plans or interim recovery plans. Taxa that are identified as endangered and vulnerable have recovery plans prepared, and are allocated research and management resources, in priority order. Recovery plans and interim recovery plans are prepared for a defined time period, but remain in operation until replaced, or the taxon is no longer listed as threatened.

Full recovery plans

Carnaby's Black-Cockatoo (*Calyptorhynchus latirostris*) Recovery Plan 2002-2012

Chuditch Recovery Plan 2012

Dunsborough Burrowing Crayfish (*Engaewa reducta*), Margaret River Burrowing Crayfish (*Engaewa pseudoreducta*) and Walpole Burrowing Crayfish (*Engaewa walpolea*) Recovery Plan 2007-2016

Forest Black Cockatoo (Baudin's Cockatoo *Calyptorhynchus baudinii* and Forest Red-tailed Black Cockatoo *Calyptorhynchus banskii naso*) Recovery Plan 2007-2016

Gilbert's Potoroo (*Potorous gilbertii*) Recovery Plan 2004

Muir's Corella (*Cacatua pastinator pastinator*) Recovery Plan

Orange-bellied and White-bellied Frogs Recovery Plan 1995 (2nd Edition) (1992-2001)

South Coast Threatened Birds Recovery Plan 2009-2018 (Noisy Scrub-bird, Western Ground Parrot, Western Whipbird)

Sunset Frog Recovery Plan 2002 (2001-2006)

Western Swamp Tortoise (*Pseudemydura umbrina*) Recovery Plan 2010 (4th edition)

Western Trout Minnow (*Galaxias truttaceus hesperius*) Recovery Plan 2008

Woylie (*Bettongia penicillata ogilbyi*) Recovery Plan 2012

Interim recovery plans

Andersonia annelsii	
Andersonia gracilis	
Banksia nivea subsp. *uliginosa*	Honeypot dryandra
Banksia squarrosa subsp. *argillacea*	Pingle
Boronia exilis	Scott River boronia
Brachyscias verecundus	
Caladenia bryceana subsp. *bryceana*	Dwarf spider orchid
Caladenia busselliana	
Caladenia caesarea subsp. *maritima*	
Caladenia huegelii	Grand spider orchid
Caladenia procera	
Caladenia viridescens	
Caladenia winfieldii	Majestic spider orchid
Calytrix breviseta subsp. *breviseta*	Swamp starflower
Chamelaucium sp. Gingin (N.G. Marchant 6)	Gingin wax
Conospermum undulatum	
Conostylis misera	Grass conostylus
Cryptandra congesta	
Darwinia apiculata	Scarp darwinia
Darwinia ferricola	
Darwinia whicherensis	
Drakaea confluens	
Drakaea elastica	Glossy-leaved hammer orchid
Eucalyptus balanites	Cadda Road mallee
Eucalyptus phylacis	
Gastrolobium papilio	
Grevillea acropogon	
Grevillea althoferorum subsp. *fragilis*	Split-leaved grevillea
Grevillea brachystylis subsp. *grandis*	Short-styled grevillea
Grevillea curviloba subsp. *curviloba*	Curved-leaf grevillea
Grevillea curviloba subsp. *incurva*	Narrow curve-leaf grevillea
Grevillea elongata	Ironstone grevillea
Grevillea fuscolutea	
Grevillea maccutcheonii	McCutcheon's grevillea
Grevillea rara	
Lambertia echinata subsp. *occidentalis*	Western prickly honeysuckle
Lambertia orbifolia subsp. Scott River Plains (L.W.Sage 684)	
Lasiopetalum pterocarpum	Wing-fruited lasiopetalum
Macarthuria keigheryi	
Marianthus paralius	
Petrophile latericola	
Pseudocheirus occidentalis	Western ringtail possum
Rhacocarpus rehmannianus subsp. *webbianus*	Webb's moss

Rulingia sp.Trigwell Bridge (R.Smith s.n. 20.6.89)	Trigwell's rulingia
Sphenotoma drummondii	Mountain paper-heath
Stylidium semaphorum	
Synaphea sp. Fairbridge Farm (D. Papenfus 696)	
Synaphea sp. Pinjarra (R. Davis 6578)	
Synaphea stenoloba	Dwellingup synaphea
Thelymitra dedmaniarum	Cinnamon sun orchid
Verticordia apecta	Hay River featherflower
Verticordia fimbrilepis subsp. *fimbrilepis*	
Verticordia plumosa var. *ananeotes*	
Verticordia plumosa var. *pleiobotrya*	
Wurmbea calcicola	

Recovery plans for threatened ecological communities

Aquatic Root Mat Community Number 1 of Caves of the Leeuwin Naturaliste Ridge
Aquatic Root Mat Community Number 2 of Caves of the Leeuwin Naturaliste Ridge
Aquatic Root Mat Community Number 3 of Caves of the Leeuwin Naturaliste Ridge
Aquatic Root Mat Community Number 4 of Caves of the Leeuwin Naturaliste Ridge
Aquatic Root Mat Community Number 1 of Caves of the Swan Coastal Plain
Stromatolite like freshwater microbialite community of coastal brackish lakes
Communities of Tumulus Springs (Organic Mound Springs, Swan Coastal Plain)
Perth to Gingin Ironstone Association
Stromatolite like microbialite community of coastal freshwater lakes
Shrublands on southern Swan Coastal Plain Ironstones (Busselton area)
Sedgelands in Holocene dune swales of the southern Swan Coastal Plain
Shrublands and woodlands of the eastern side of the Swan Coastal Plain
Eucalyptus calophylla - Kingia australis woodlands on heavy soils, Swan Coastal Plain
Eucalyptus calophylla - Xanthorrhoea preissii woodlands and shrublands, Swan Coastal Plain
Melaleuca huegelii - Melaleuca acerosa (currently M. systena) shrublands on limestone ridges
Shrublands and woodlands on Muchea Limestone
Scott River Ironstone Association

Threatened flora management programs

An important strategy the Department is using to assist the listing, prioritisation and conservation management of vascular flora is the preparation of regional and district threatened flora management programs. These review the status of declared threatened flora and of priority taxa in a departmental region or district and determine local priorities and outline management needs.

Programs approved

Declared rare flora and other plants in need of special protection in the Northern Forest Region (now part of Swan Region).

Declared rare flora and other plants in need of special protection in the Metropolitan Area (now part of Swan Region).

Declared rare and poorly known flora in the Central Forest Region (now South West Region).

Declared rare and poorly known flora in the Warren Region.

Priority flora and fauna

Because of the State's large and diverse biota, there are many species that are known from only a few collections, or a few sites, but which have not been adequately surveyed. Such species may be rare or threatened, but cannot be considered for declaration as threatened flora or fauna until such survey has been undertaken. These species are included on supplementary conservation lists called the Priority Flora List and Priority Fauna List.

There are three categories of priority species covering these poorly known species. The categories are arranged to give an indication of the priority for undertaking further surveys based on the number of known sites, and the degree of threat to those populations. A fourth category of priority species is included for those species that have been adequately surveyed and are considered to be rare but not currently threatened. A fifth category of priority fauna are those listed as conservation dependent, being species which have been removed from the threatened fauna list but are still dependent on conservation programs for their ongoing survival. Special consideration is given to the management of priority species. Commercial harvesting of priority flora on Crown land is not permitted under Commercial Purposes Licence conditions.

Acronyms

AS/NZS ISO 14001	Standards Australia, 2004. AS/NZS ISO 14001:2004. *Environmental Management Systems - Requirements with Guidance for Use*
BAM Act	*Biosecurity and Agriculture Management Act 2007*
BRM	Basic raw materials
CALM	Former Department of Conservation and Land Management
CALM Act	*Conservation and Land Management Act 1984*
CAR	Comprehensive, adequate and representative – as applied to the conservation reserve system
CSIRO	Commonwealth Scientific and Industrial Research Organisation
DEC	Former Department of Environment and Conservation
DMP	Department of Mines and Petroleum
EPA	Environmental Protection Authority
EP Act	*Environmental Protection Act 1986*
EPBC Act	(Commonwealth) *Environment Protection and Biodiversity Conservation Act 1999*
ESFM	Ecologically sustainable forest management
FCA	Forest conservation area
FHZ	Fauna habitat zone
FMP	Forest Management Plan
FPC	Forest Products Commission
GHG	Greenhouse gas
ICOMOS	The International Council on Monuments and Sites
IOCI	Indian Ocean Climate Initiative
KPI	Key performance indicator
LMU	Landscape management unit (see Appendix 3)
RFA	Regional Forest Agreement
TEC	Threatened ecological community
UNFCCC	United Nations Framework Convention for Climate Change
WA	Western Australia
WC Act	*Wildlife Conservation Act 1950*

Glossary

Adaptive management	A process of responding positively to change. The term adaptive management is used to describe an approach to managing complex natural systems that builds on common sense and learning from experience, experimenting, monitoring, and adjusting practices based on what was learned.
Allowable cut	The maximum quantity of a particular native forest log type that can be harvested during the period of the plan.
Basic raw materials	Materials such as gravel, shale, clay, sand, limestone and rock used principally for road construction and building purposes.
Biological diversity (Biodiversity) (described in CALM Act)	The variability among living biological entities and the ecosystems and ecological complexes of which those entities are a part and includes: (a) diversity within native species and between native species; (b) diversity of ecosystems; and (c) diversity of other biodiversity components.
Biological diversity component (described in CALM Act)	Includes habitats, ecological communities, genes and ecological processes.
Bioprospecting	The removal or use of biological and genetic resources of any organism or other organic substance for scientific research or commercial development.
Bole	The tree trunk from the ground to the crown break. The bole does not include the major branches supporting the crown.
Burra charter	The Australia ICOMOS charter for the conservation of places of cultural significance.
Catchment	The land area drained by a single stream, river, or drainage network.
Clean on Entry	A requirement at a defined, signposted point nominated in a Hygiene Management Plan for entering machinery and vehicles (typically) to be free of soil, plant and other material, to minimise the risk of spreading weeds, pests and diseases.

Clearfell	A silvicultural method in which all, or nearly all, trees in a defined area are removed at one time to allow regeneration to establish and develop (note legacy elements are marked for retention, and some non-commercial trees may still remain on site).
Coarse woody debris	Dead woody material such as boles and branches on the ground or in streams.
Contract of Sale	A contract between the FPC and a buyer for the sale of forest products in accordance with the Forest Products Act, Forest Management Regulations 1993 and relevant policies and guidelines.
Coupe	An area of forest that is planned for timber harvesting as a single unit. It may contain more than one silvicultural objective, such as a number of discrete gaps and areas of thinning.
Criterion	A category, condition or processes by which sustainable forest management may be assessed.
Culling	The reduction in the density of unwanted vegetation, usually to reduce competition to retained crop trees or for establishing or releasing regeneration.
Cutover area	For the purposes of this plan, the cutover area is the total forest area harvested each year to provide the allowable cut. This total comprises the sum of all the silvicultural treatments (e.g. thinning, shelterwood, etc) and clearing for mining, and can fluctuate across years due to the mix of forest structure, regeneration and dieback status of areas on harvest plans.
Critically endangered	A taxon is critically endangered when it is facing an extremely high risk of extinction in the wild in the immediate future.
Department, or the Department	The Western Australian Department of Parks and Wildlife (formerly part of the Department of Environment and Conservation).
Dieback (*Phytophthora* dieback)	In the south-west of Western Australia, a disease of plants caused by infection by the soil-borne organisms of the genus *Phytophthora*, of which *P. cinnamomi* is the most widespread.
Disturbance	Any relatively discrete event in time that disrupts ecosystems, communities, or population structure and changes resource availability or the physical environment.

	Disturbance may be natural (e.g. lightning caused fire) or human induced (e.g. timber harvesting).
Draft FMP, or Draft plan	The *Draft Forest Management Plan 2014-2023* as released by the Conservation Commission on 15 August 2012 for public consultation.
Ecological community	An integrated assemblage of species that inhabit a particular area.
Ecologically sustainable forest management	Forest management and use consistent with the principles described in section 19(2) of the CALM Act.
Ecosystem	A community or an assemblage of communities of organisms, interacting with one another and the environment in which they live.
Ecotone	An ecological transition zone, often characterised by a shift to a different plant community(s).
Endangered	A taxon is endangered when it is not critically endangered but is facing a very high risk of extinction in the near future.
Endemic	Flora or fauna that is confined in its natural occurrence to a particular region.
Environmental Management System (EMS)	A framework for the systematic management of an organisation's environmental obligations and objectives. Many organisations are certified as having an EMS that conforms to the AS/NZS ISO 14001 standard.
Evapotranspiration	Loss of water from an area of land through the transpiration of plants and evaporation from the soil.
Exotic species	Any species growing or living outside its natural range of occurrence. Normally this refers to species purposely or accidentally introduced into countries or regions where they do not historically occur.
Fauna	The animals inhabiting an area; including mammals, birds, reptiles, amphibians and invertebrates. Usually restricted to animals occurring naturally and excluding feral or introduced animals. With respect to the WC Act (Section 6), fauna is: (a) any animal indigenous to any State or Territory of the Commonwealth or the territorial waters of the Commonwealth; (b) any animal that periodically migrates to and lives in any State or Territory of the Commonwealth or the territorial waters of the Commonwealth; and

	(c) any animal declared as fauna pursuant to subsection (2), and includes in relation to any such animal – (d) any class or individual member thereof; (e) the eggs, larvae or semen; (f) the carcass, skin, plumage or fur thereof, but does not include any prescribed animal or prescribed class of animal.
Fauna habitat zone	Patches of forest systematically distributed across the landscape which are temporarily excluded from timber harvesting.
Fauna Distribution Information System	Departmental database of taxonomy, conservation status of fauna species and advice on management practices.
Feral animal	An introduced or domestic animal now living in the wild.
First and second grade sawlog jarrah	A log cut from the bole of a jarrah tree that is a minimum of 2.1 metres in length, has a minimum under bark diameter of 200 millimetres and has a minimum of 30 per cent millable timber on the worst end face.
First and second grade sawlog karri	A log cut from the bole of a karri tree that is a minimum of 2.4 metres in length, has a minimum under bark diameter of 200 millimetres and has a minimum of 30 per cent millable timber on the worst end face.
Fire regime	The history of fire use in a particular vegetation type or area including frequency, intensity, season and scale of burning over time. It may also refer to proposals for use of fire.
Flora	The plants growing in an area; including flowering and non-flowering plants, ferns, mosses, lichens, algae and fungi. Usually restricted to species occurring naturally and excluding weeds. With respect to the WC Act (Section 6), flora is any plant (including any wildflower, palm, shrub, tree, fern, creeper or vine) which is: (a) native to the State or (b) declared to be flora pursuant to subsection (4), and includes any part of flora and all seeds and spores thereof.
Floristic	Of or relating to flowers, a flora, or the biogeographical study of plants.
Forest	An area, incorporating all living and non-living components, that is dominated by trees having usually a single stem and a mature or potentially mature stand height exceeding two metres and with existing or potential crown cover of overstorey strata about equal to or greater than 20 per cent.

Forest block	A named administrative subdivision of the forest, varying in size from about 3,000 to 8,000 hectares.
FORESTCHECK	An integrated monitoring project, designed to provide information about changes and trends in biodiversity.
Forest ecosystem	An indigenous ecosystem with an overstorey of trees of more than 20 per cent crown cover. These ecosystems should normally be discriminated at a resolution requiring a map-standard scale of 1:100,000. Preferably these units should be defined in terms of floristic composition in combination with substrate and position within the landscape.
Forest produce	For the purposes of the CALM Act, 'forest produce' includes trees, parts of trees, timber, sawdust, chips, firewood, charcoal, gum, kino, resin, sap, honey, seed, bees-wax, rocks, stone and soil but, subject to the foregoing, does not in Division 1 of Part VIII include minerals within the meaning of the Mining Act.
Forest products	As for the purposes of both the CALM Act and the Forest Products Act: trees or parts of trees; timber, sawdust or chips; charcoal, gum, resin, kino or sap; and firewood, located on public land or sharefarmed land.
Forest products industry	For the purposes of this plan, the wood products industry and upstream in-forest operations, including timber harvesting and log haulage.
Forest regeneration	The renewal of a forest arising from planting or from seed or the young plants on a site. The process by which a forest is renewed.
Formal reserve	See 'Reserve – Formal'.
Gap	A discrete opening in the overstorey canopy that reduces competition and allows seedlings to become established and/or develop.
Global carbon cycles	The carbon cycle is the biogeochemical cycle by which carbon is exchanged among the biosphere, pedosphere, geosphere, hydrosphere, and atmosphere of the Earth.
Guideline	A document type that guides and directs actions for achieving consistency and required standards. Guidelines permit some flexibility in their application.

Habitat	A component of an ecosystem providing food and shelter to a particular organism.
Heritage	Something inherited from past generations that is valued.
High salt risk	Refers to certain river systems within the historic intermediate rainfall zone (based on data up to 1978) that are least disturbed and as such, presumed to have the most intact aquatic ecosystems and consequently are the most environmentally sensitive to rises in saline groundwater.
Hygiene (in relation to dieback)	Actions that decrease the risk of the pathogen being introduced, spread or its impact intensified.
Hygiene management plan	The document including action(s) and map(s) that describes and controls how approved human access to uninfested protectable areas is to be managed, so that the role of human activity as a vector for establishing new centres of infestation is minimised.
Informal reserve	See 'Reserve – Informal'.
Indicator	A measure (measurement) of an aspect of a criterion. A quantitative or qualitative variable that can be measured or described and that, when observed periodically, may demonstrate trends.
Land category	Section 5 of the CALM Act specifies the categories of land to which the Act applies and section 6 defines those land categories. For the purposes of the plan the land categories are: State forest, timber reserves, national parks, conservation parks, nature reserves, any other land reserved under the Land Act and vested by order under that Act in the Conservation Commission and any other land other than excluded waters, reserved under Part 4 of the Land Administration Act, the care control and management of which are placed by order under that Part with the Conservation Commission.
Landform	All the physical, recognisable, naturally formed features of land having a characteristic shape. Includes major forms such as a plain, mountain or plateau, and minor forms such as a hill, valley or alluvial fan.
Landscape management unit	An agglomeration of vegetation complexes and ecological vegetation systems, as defined and mapped by Mattiske and Havel (2002), to form more compact management units that recognise the underlying ecological characteristics. See Appendix 3.

Landscape scale	A mosaic where the mix of local ecosystems and landforms is repeated in a similar form over a kilometres-wide area. Several attributes including geology, soil types, vegetation types, local flora and fauna, climate and natural disturbance regimes tend to be similar and repeated across the whole area. It could be a (sub) catchment or, for convenience, an administrative management unit such as a forest block or an aggregation of forest blocks. Landscape scale is usually tens of thousands to a few thousand hectares.
Legacy habitat elements	Refers to existing key habitat features, such as hollow-bearing trees and logs, which may take many decades to replace and which are retained after harvesting or remain after natural disturbance, which provide refugia and enrich the structural complexity of the new stand.
Local scale	A discrete area of land to which one or more operations have been or are planned to be applied.
Monitoring	A process of repeated measurement or observation, for specified purposes of one or more elements, usually according to prearranged schedules in space and time, using comparable data collection methods. Often used to assess a management program, condition of the environment and/or resources being managed, to help determine if desired activities, processes, outputs and outcomes are being achieved.
Montreal Process	An agreed framework of criteria and indicators that provide member countries with a common definition of what characterises sustainable management of temperate and boreal forests.
Non-bole log	Wood from the branches of a tree above the crown break. The non-bole material in mature trees is not included in inventory and is additional to the sustained yield.
Old-growth forest	Ecologically mature forest where the effects of unnatural disturbance are now negligible. The definition focuses on forest in which the upper stratum or overstorey is in a late mature to senescent growth stage.
Other bole volume	Bole log products not meeting first or second grade sawlog standards.
'Other exotics'	Areas of exotic species including mine site rehabilitation, (about 3,200 hectares) and certain arboreta and trial plots (about 390 hectares). See 'Plantations' and Map 4.

Patch	A group of trees resulting from a natural regeneration event or a past forest management activity such as gap creation and regeneration. May also refer to a particular, relatively small area of forest and/or other vegetation type(s).
Performance measure	Qualitative or quantitative measures developed to assess progress toward attainment of an objective.
Pest	Troublesome or destructive animals including insects, either introduced or native.
Pesticides	Includes herbicides, insecticides, fungicides and related products registered for use in pest control.
Phytophthora cinnamomi*, or *P. cinnamomi	Water mould. The pathogen that causes most *Phytophthora* dieback disease.
Plantation	State forest and timber reserve planted with exotic species being predominantly pine and not including areas of 'Other exotics'. See 'Other exotics' and Map 4.
Policy	A document containing principles and rules that outline an organisation's position and which guides decisions and actions taken in the conduct of its activities.
Prescribed burning	The controlled application of fire under specified environmental conditions to a predetermined area and at the time, intensity and rate of spread required to attain planned resource management objectives.
Previous FMP	The *Forest Management Plan 2004-2013*.
Protectable area	Defines areas of land managed by the Department over which hygiene management rules for the plant pathogen *Phytophthora*, including clean on entry, will apply. These areas are generally free of disease.
Rare species	Taxa which are uncommon, not widely distributed, or occurring sparsely across their range.
Recovery plan	A plan that describes the actions required to achieve the recovery of threatened species or ecological community from the current threat of extinction or destruction. May be an Interim Recovery Plan when insufficient information is available to prepare a full recovery plan.

Regrowth forest	Native forest which is dominated by similar aged stems that have not reached the mature growth stage, originating from previous harvest events, such as gap creation, or other disturbances, such as bushfire.
Rehabilitation	The process necessary to return disturbed land to a predetermined surface, vegetational cover, land-use or productivity.
Reserve – conservation	An area set aside primarily for the conservation of natural ecosystems but which may allow a level of recreation consistent with the proper maintenance and restoration of the natural environment.
Reserve – formal	One of the land category categories of national park, nature reserve, conservation park, or CALM Act sections 5(1)(g) or 5(1)(h) reserves for the purpose of conservation.
Reserve – informal	An area within State forest or timber reserve set aside for conservation under an approved management plan; has had opportunity for the public to comment on changes to reserve boundaries; able to be accurately defined on a map; and is of an area and design sufficient to sustain the values it seeks to protect. See Appendix 11.
Reservoir Protection Zones	Areas around reservoirs and bores that act to control land or water based activities to protect water quality, as established by the Department of Water.
Resilience	The capacity of an ecosystem to withstand external pressures and, over time, return to its prior condition, including its ability to maintain its essential characteristics such as taxonomic composition, structural forms, ecosystem functions and processes (adapted from Thompson *et al*, 2009, who cite Holling 1973).
Riparian	Pertaining to the banks of streams, rivers or lakes.
Rotation	The period between regeneration establishment and the final harvest.
Salt sensitivity zone	The Swan and South West regions and parts of the Warren Region are classified as low salt sensitivity and other parts of the Warren Region are classified as moderate salt sensitivity (see Map 7).
Salvage harvest	The removal of forest produce and/or forest products following an unplanned disturbance event to recover economic value that would otherwise be lost. Salvage

	operations require approval by the Department. By their nature, salvage harvest areas may not appear on the three or one year harvest plan(s) that pre-date the operation.
Seed tree	1. A tree left standing for the purpose of providing seed for regeneration. 2. A silvicultural method in which trees are retained to provide seed for natural regeneration.
Senescent stand	The development stage that follows the mature stand and precedes natural death, usually involving a decreased ability to repair damage and degradation. Characterised by a dominance of dead branches in the tree crown, together with the formation of new branches from dormant buds.
Shelterwood	A jarrah silvicultural treatment that involves a partial reduction in the density of overstorey trees and action to establish regeneration under the remaining mature trees.
Silviculture	The theory and practice (silvicultural practices) of managing the establishment, composition, health, quality and growth of forests and woodlands to achieve specified management objectives.
Silviculture for ecosystem health	The development and application of silvicultural practices to provide for ecosystem health.
Silviculture for water production	The development and application of silvicultural practices to provide for water production.
Single tree selection	A silvicultural method where trees from a range of size classes are removed throughout the stand to promote growth of remaining trees.
Specially protected	Those species declared under the WC Act to be specially protected because they are deemed by the Minister to be likely to become extinct or are rare or otherwise in need of special protection.
Stand	A group of trees or patch of forest that can be distinguished from other groups on the basis of size, age, species composition, structural condition or other attribute.
Structure	When applied to a forest, is the horizontal and vertical distribution of the live and dead vegetation.
Subsequent FMP	The forest management plan for the period 2024 to 2033.

Sustained yield, or Sustained timber yield	For the purpose of this plan, the first and second grade sawlog yield that the forest can produce for an extended period (to at least the year 2070) at a given intensity of management.
Taxa (taxon)	A defined unit (for example, species or genus) in the classification of plants and animals.
Thinning	A felling made to reduce the density of trees within a stand. Usually undertaken to improve the growth of trees that remain by reducing competition, without either permanently breaking the canopy or encouraging regeneration. May also be undertaken to enhance forest health, water production or achieve another objective.
Threatened and priority ecological community	Threatened species and communities are those under risk of extinction. Priority species and communities are those that may be threatened but for which there are insufficient survey data, and those that are rare but not threatened. Some of these and/or others may also be listed under the EPBC Act. Also see Appendix 12.
Threatened taxa	Taxa that are endorsed by the Minister as being specially protected under the WC Act because they are likely to become extinct or are rare, and are ranked as either vulnerable, endangered, critically endangered or presumed extinct. Threatened taxa may be at risk due to being naturally rare or geographically restricted, or have become so as a result of human activities, and are in danger of declining further, or becoming extinct, unless adverse factors acting on them can be identified and ameliorated.
Threatening process	Those processes which may result in the long-term reduction of biodiversity. Examples include predation and habitat change by introduced animals; competition and displacement by introduced plants and destruction and modification of habitat.
Timber	Sawn or other products derived from first and second grade jarrah and karri sawlogs.
Timber harvesting	The cutting, felling, and gathering of forest products undertaken as part of a planned sequence of silvicultural activities including the regeneration of the forest.
Treemarking	The procedure in which trees are marked for retention (or removal) prior to timber harvesting or other operations in a forest.

Turbidity	Discolouration of water due to suspended solids, chemicals or organic matter.
Two-tiered forest	Native forest stands of mixed age and structure, comprising mature trees intermixed with younger regrowth trees arising from regeneration following the death or removal of mature trees by previous harvests or other disturbances. Also referred to as 'mixed age forest' or 'uneven-aged forest'.
Uneven-aged stand	A stand of trees composed of three or more age classes, either intimately mixed or in small groups.
Vegetation complex	A combination of distinct site vegetation types, usually associated with a particular geomorphic, climatic, floristic and vegetation structural association.
Weed	A plant, often a self-sown exotic, growing where it is not wanted.
Weed – environmental	A naturalised non-indigenous plant species outside the agricultural context that adversely affects the health, survival or regeneration of indigenous species in natural vegetation communities.
Whole of forest scale	All land categories that are subject to the plan.
Wood	The material produced in the stems and branches of trees and other woody plants.
Woodflows	Projected supply of wood products arising from scheduling the area of forest available and the sequence of harvesting operations over an extended period of time.
Wood products	All timber and other wood products, inclusive of sawlogs, firewood, chiplogs and other log products supplied to the wood products industry.
Wood products industry	All sectors of the wood products industry, including sawmilling, poles and bridge timbers, engineered wood products, furniture, joinery, flooring and residue industries.
Woodstock™	Proprietary forest management planning software.
Yield	The amount of wood products produced from the forest by a particular management strategy.

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Hon Albert Jacob MLA
Minister for Environment; Heritage

Statement No: 952

STATEMENT THAT A PROPOSAL MAY BE IMPLEMENTED
(PURSUANT TO THE PROVISIONS OF THE
ENVIRONMENTAL PROTECTION ACT 1986)

Forest Management Plan 2014-2023

Proposal: Forest Management Plan 2014-2023 (as described in Table 1 of this Statement)

Proponent: Conservation Commission of Western Australia

Proponent Address: 17 Dick Perry Avenue,
Kensington, WA 6151

Assessment Number: 1921

Report of the Environmental Protection Authority Number: 1483

This Statement authorises the implementation of the Proposal described and documented in Table 1 of Schedule 1. The implementation of the Proposal is subject to the following implementation conditions.

1 Amendments to the Proposed Forest Management Plan 2014-2023

1-1 The proponent shall amend the Proposal in accordance with conditions 1-1 (1) to (3) prior to it being transmitted to the Minister for Environment under the *Conservation and Land Management Act 1984* in line with the following:

(1) Amend management activity 121 to include a target completion date within the first half of the implementation of the Forest Management Plan for the development of a protocol for each key performance indicator to specify how the measurement of each key performance indicator will be undertaken;

(2) Amend management activity 130 to include target completion dates for the mid-term and end-of-term performance reviews, and to require that the reviews are made publicly available on completion;

(3) Amend management activity 14.2 to include a target completion date within the first quarter of the implementation of the Forest Management Plan for the preparation of *Goals for Understorey Structural Diversity*;

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(4) Amend management activity 17.1 to include a target completion date within the first quarter of the implementation of the Forest Management Plan for the revision of *Guidelines for Selection of Fauna Habitat Zones*;

(5) Amend management activity 118.1 to include a target completion date within the first quarter of the implementation of the Forest Management Plan for the preparation of a regulation policy to confirm the regulatory framework around timber harvesting;

(6) Amend management activity 6.3 to include a target completion date within the first quarter of the implementation of the Forest Management Plan for the preparation of a procedure to identify and demarcate old-growth forest;

(7) Amend management activity 118.2 to include the target completion date of 31 December 2014 for the development and implementation of formal working arrangements between the Department of Parks and Wildlife and the Forest Products Commission;

(8) Amend management activity 61 so that any proposal to increase the average annual yield of logs above the quantities stipulated in Tables 4 and 5 and up to the upper limits stipulated in Table 6 is to be approved by the Minister for Environment; and

(9) Amend management activity 4 to reference the correct Appendix.

Albert Jacob MLA
MINISTER FOR ENVIRONMENT; HERITAGE

21 NOV 2013

Schedule 1

Table 1: Summary of the Proposal

Proposal Title	Forest Management Plan 2014-2023
Short Description	Proposed Forest Management Plan 2014 – 2023 dated April 2013 which applies to land vested in the Conservation Commission within the Swan, South West and Warren regions of the Department of Environment and Conservation, and the lands collectively referred to as 'Redmond' forest block within the South Coast Region (refer to Figure 1). Implemented in accordance with conditions of this statement.

Figure 1: Area covered by the Proposed Forest Management Plan 2014-2023