Forest Products Commission
WESTERN AUSTRALIA

SUBMISSION TO

THE DRAFT FOREST MANAGEMENT PLAN 2014–2023

Contents

1. EXECUTIVE SUMMARY

The development of the Forest Management Plan 2014-2023 (FMP 2014) provides an opportunity to learn from the difficulties created in implementing the current Forest Management Plan (FMP 2004). However, as currently proposed, the Draft Forest Management Plan (DFMP) is likely to result in further contraction of the Western Australian timber industry. This will exacerbate the social and economic difficulties caused by FMP 2004.

To avert this outcome, the final settings for FMP 2014 must result in a balance between forest uses, so that there is an optimum achievement of the social and economic benefits as well as conservation outcomes. To achieve this, FMP 2014 needs to take account of the requirements for a viable timber industry.

A decline in the industry will directly affect communities like Manjimup, Greenbushes and Nannup and put them at risk of economic and social disruption. The effects of the 2004 changes are documented in the Socio-Economic Impact Assessment report. Employment in these three shires was shown to fall by 14% over the period 2001 to 2006 and the total population of Manjimup fell by nearly 10% in the ten years from 2001.

Currently the DFMP does not have a specific objective for the existing timber industry, but focuses instead on regulating a sustainable quantity of timber. Its stated goal to maintain long term industry viability is in practice determined only after meeting biodiversity conservation objectives. The outcome of this approach is a reservation system that far exceeds national standards and an absence of a strategy to provide for the viability of the existing timber industry. The jarrah forest is reserved at double the rate required to meet the JANIS[1] criteria, and the karri forest is at three times the level of reserves required. This approach is also characterised by:

- A lack of reconciliation of conservation values against a tangible goal;
- The maintenance of theoretical conservation measures, which have not been shown to have merit;
- Insufficient use of existing knowledge; and
- Limited positive action to address the threat of climate change.

The timber industry can be stabilised and potentially expanded without affecting biological conservation. This could be achieved through implementation of the proposed informal reserve changes and the further amendments to the DFMP that include:

(a) Removal of fauna habitat zones – these were introduced in 2004 and have not been shown to have any benefit;
(b) Review the areas of regrowth in reserves and remove areas that are not necessary to meet the JANIS Criteria; and
(c) Defer any additional prescriptive measures until their impact has been assessed and accepted.

For the timber industry, FMP 2014 needs to be based on a plan that is viable and sustainable for the period to 2023 and beyond. There is no doubt that the timber resource will continue to progressively change in location and character over time, and the outlook for the future industry must have a long term view.

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[1] JANIS criteria = Joint ANZECC / MCFFA National Forest Policy Statement Implementation Sub-committee which produced *Nationally Agreed Criteria for the Establishment of a comprehensive, adequate and representative reserve system for forests in Australia* (1997)

To do this requires that the final FMP is prepared in order to achieve:

- **A *quantity* of resource that maintains an economic throughput for the existing timber industries.**
  It is critical that processors can continue to have access to levels of log supply that enable them to operate efficiently.

- **A *quality* of resource that supports local value-adding opportunities.**
  Excessive reservation of high quality jarrah forest in 2004 resulted in a greater proportion of the resource being supplied from lower quality eastern jarrah forest. This can be redressed through a winding back of conservation areas that are over-represented, including the fauna habitat zones.

- **Access to the forest in a manner, and at locations, to enable practical timber production and competitively-costed delivery of logs.**
  The Western Australian timber industry operates in a global market and logs must be produced and delivered to customers at an acceptable cost. The current industry requires an immediate increase in access to resource in the south and a plan to transition to the north in future periods.

  The cost and practicality of operating in the forest must not be unintentionally increased by the introduction of untested prescriptive measures.

- **An understanding of the future timber resource and the requirements for industry adaptation.**
  An analysis of future resource characteristics is necessary to predict changes, manage future expectations and help decisions that will impact on the period of FMP 2023.

- **Investment in the use of native forest resources, particularly new engineered wood products and energy opportunities, to expand socio-economic benefits.**
  There is enormous potential for new industries based on the under-utilised portion of the wood resource. This provides opportunity for expanded socio-economic benefits in the south-west region.

Well-managed forests and industries can contribute to broader environmental outcomes such as increased carbon sequestration and the protection of the forest against the impact of climate change. **Sustainable harvesting and the removal of timber are not a threat to the biodiversity of the forest, or any of the other important values which a forest provides.**

FMP 2014 should acknowledge that sustainably managed forests can be enhanced by a timber processing sector that provides valuable socio-economic benefits to south-west communities and to Western Australia.

2. SUMMARY OF RECOMMENDATIONS

RECOMMENDATION 1:

The FMP should include an overarching objective and specific outcomes associated with the nominated purposes under Section 55 of the CALM Act, and clarity about how those values are to be balanced.

RECOMMENDATION 2:

The FMP pursues, where possible, multiple use management objectives, including initiatives for the management of informal reserves.

RECOMMENDATION 3:

The proposed reserve system is assessed against the CAR criteria with a view to identifying any areas which are in excess of that required to meet these requirements.

The proposed reserve system variation to extend the Whicher National Park should only proceed if additional areas become available for timber production.

RECOMMENDATION 4:

Over-represented forest ecosystems in informal reserves and other areas of State forest currently not available for timber production, which are in excess of the requirement for the CAR system, be reviewed and where there is not a compelling reason for their retention, they be made available for timber production.

The over-represented forest ecosystems include the Karri Main Belt, Jarrah South, Jarrah Sandy and Jarrah Blackwood ecosystems.

The proposal to remove 'areas previously classified as old growth' available from the informal reserve system is supported.

RECOMMENDATION 5:

The FMP maintain the socio-economic benefits derived from the current timber sector by providing for timber yields in location, quantity and quality that will sustain their operation.

RECOMMENDATION 6:

Jarrah sawlogs sourced from southern forest areas need to be increased above FMP 2004 levels to sustain the existing industry and its associated employment.

The FMP 2004 level of jarrah sawlog supply in northern areas is sufficient to sustain existing industry and employment.

RECOMMENDATION 7:

The FMP should encourage the development of employment and regional development benefits arising from the establishment of new timber processing industries.

To provide certainty of long term access to timber resources required to achieve investment and industry development, the FMP should acknowledge the desirability of resource security, and support a review of mechanisms to enable FPC to enter into contracts for periods greater than ten years.

RECOMMENDATION 8:

The sustained yield calculations should assume:

- Full access to the available forest areas;
- Full implementation of silvicultural objectives;
- Forest thinning programs for water are modified to maintain future sawlog yield; and
- Exclusion of the recovery of trees killed through climate change and fire which can be salvaged.

RECOMMENDATION 9:

The implementation of changes to the silvicultural guidelines should not proceed until:

- There is an analysis of the benefit of the change;
- There is an analysis of the effect of the change;
- There is consultation with the Department of Water (for water production impacts), and the Forest Products Commission (FPC) (for wood production impacts); and
- Where there is not agreement from the consulted agencies, a determination is made by the Minister for the Environment in consultation with the relevant Minister.

RECOMMENDATION 10:

The program for forest thinning is supported in principle. Silvicultural prescriptions for thinning should be designed to maintain future growth of high value forest products.

Thinning regimes need to consider the management of the forest catchment as a whole, including stream zones, to provide for the best overall outcome.

To ensure the commercial viability of being able to thin forest catchments, the FMP must serve as an approval for the proposal. Catchment management plans, as outlined in the DFMP, then provide finer scale project design and integration of values acting as an approval for how the thinning is to be conducted.

RECOMMENDATION 11:

Sustainable use of timber resources should be encouraged by supporting the salvage of dead trees by:

- Excluding the salvage of dead sawlog material from sustained yield calculations;
- Providing access to informal reserves to salvage sawlogs following major disturbances;
- Providing for a system of forest access which would allow for the rapid approval of salvage harvesting of areas of forest substantially killed by fire or drought; and
- The rehabilitation of areas degraded by fire or drought being undertaken by FPC following salvage.

3. INTRODUCTION

While FPC's submission focusses on what it sees as shortcomings of the DFMP, it does recognise the following:

- Reviewing some forest management settings which were weighted in favour of nature conservation in the FMP 2004;
- Considering a range of management options to provide a balance between different objectives on issues such as firewood and fauna habitat zones;
- Addressing climate change by active management, and providing a management strategy for this risk on a small part of the forest (forest thinning); and
- Improving the management of all forest users based on risk, not just the timber industry as occurred in FMP 2004.

Overall the DFMP is a refinement of Forest Management Plan 2004-2013 (FMP 2004). It proposes to substantially maintain the weighting between land uses that were established in FMP 2004. The changes that have been introduced are in response to specific issues, and the result of an overarching review of FMP 2004's fundamental settings. There is also greater scope for the DFMP to address long-term threats and opportunities. However there is still a need that the FMP address timber industry outcomes and provide a balance between social, economic and environmental benefits.

FPC's submission to the DFMP seeks to identify likely socio-economic impacts of the DFMP :

(a) The limitations of approach adopted in preparing the DFMP
- Concerns that the lack of clear objectives has limited the accountability of the DFMP
- Achieving ecologically sustainable forest management
- Use of research findings
- Need to optimise all outcomes

(b) Re-dressing the imbalance to improve social and economic outcomes

(c) The settings required for a sustainable timber industry

(d) Addressing specific issues associated with climate change
- Thinning for water
- Timber salvage of drought and fire-killed forests

4. MAJOR THEMES

(1) Objectives and outcomes of the DFMP

The primary objective of FMP 2014 is to achieve the purposes for which the land is reserved as specified in Section 56 (1) of the *Conservation and Land Management Act*.

> *"A controlling body shall, in the preparation of proposed management plans for any land, have the objective of achieving or promoting the purpose for which the land is vested in it, or for which the care, control and management of the land are placed with it ..."*

For State Forest the purposes identified under CALM Act Section 55 (1a) are:

(a) conservation;

(b) recreation;

(c) timber production on a sustained yield basis;

(d) water catchment protection; or

(e) other purpose being a purpose prescribed by the regulations.

In the DFMP only two of the four purposes (conservation and water) have a defined overarching objective, i.e. that biodiversity is preserved, and water resources are to be protected (p. 16). Neither recreation nor timber production have overarching objectives in the DFMP. It is therefore difficult to understand how the DFMP arrived at the balance of values across the forest and whether it meets its intended objectives. Its structure presents many of its core decisions as a *fait accompli* without explanation.

These objectives appear to have become confused in the DFMP by the fact that 'goals' of the DFMP appear to be attainment of the Montreal Criteria. Criteria and indicators such as those developed under the Montreal Process are designed for use as monitoring tools; they are not intended to be the primary drivers of land management decisions. A consequence of using the Montreal Criteria as goals is to put biodiversity conservation in precedence over other values. This is apparent in:

- The lack of a specific goal to guide the allocation into various land uses;
- The acceptance of a level of reservation that is far in excess of that required to achieve the National benchmarks;
- The inclusion of extensive areas of regrowth in the reserve system;
- The inclusion of further restrictions to timber harvesting based on ecological principles which have yet to be tested or measured as being beneficial;
- The lack of a strategy to address the impact of climate change on biodiversity values; and
- The limited use of research results which have demonstrated that the jarrah forest biodiversity rapidly recovers following harvesting.

This approach results in the DFMP's timber industry outcomes becoming a consequence of decisions for biodiversity conservation. In the current approach the DFMP provides for a high level of reservation for conservation for which no justification or substantiation is provided. At the same time the plan is likely to deliver a contraction in the timber industry because its fundamental requirements are not being considered. This mirrors the consequences of FMP 2004 when the timber industry impact of a 'conservation first' approach was not taken into account.

There is no doubt that recognition of these additional objectives would result in a different outcome. **Sustainable harvesting and the removal of timber are not a threat to the biodiversity of the forest, or any of the other important values which a forest provides**. This is supported by the results of research (FORESTCHECK) that have shown that the effect of harvesting on biodiversity to be temporary. Biodiverse forest ecosystems have been found within 15 years of disturbance, and after 40 years they were indistinguishable from undisturbed forest. (Abbott 2011)[2].

By setting an objective to sustain the existing social and economic benefits realised through the timber industry, the FMP could achieve a rebalance between conservation and timber production outcomes that is required.

A consequence of not having an objective for the timber industry within the DFMP is that there is not a basis for either assessing how well the plan satisfies the objectives, or how to reconcile between the competing and complementary purposes for the forest. In FPC's view the primary objectives should reflect the need for:

- a reserve system which meets the CAR reserve requirements;
- complementary management of other areas to supplement nature conservation values;
- sustained levels of public water supply;
- the existing timber industry to support local communities
- additional local timber processing to enhance the socio-economic benefits; and
- a range of recreation opportunities that maintain a satisfying nature-based experience.

RECOMMENDATION 1:

The FMP should include an overarching objective and specific outcomes associated with the nominated purposes under Section 55 of the CALM Act, and clarity about how those values are to be balanced.

(2) Integration of objectives

The principles of ecologically sustainable forest management (ESFM) are intended to guide the decisions of the DFMP. The first principle is that the decision-making process should effectively integrate both long-term and short-term economic, environmental, social and equitable considerations. It is disappointing that the DFMP largely accepts the land allocations provided under FMP 2004 and does not examine whether FMP 2004 achieved the integration of these long-term and short-term considerations.

FMP 2004 compromised economic objectives by a policy of exclusion rather than integration. The approach of exclusive use continues in the DFMP through initiatives such as: the proposed Whicher Range National Park, reservation along the Bibbulmum track, and proposals for the Munda Biddi track. The justification is usually to 'protect' values from disturbance. This policy of exclusion is unnecessary if a forest is well managed. It is only when the FMP becomes a competition for access to land that conflict and lack of integration occurs. For example, there may be less land available for timber production, but the timber industry still requires a minimum volume to remain viable.

[2] Abbott I. and Williams M.R. (2011) *Silvicultural impacts in jarrah forest of Western Australia: synthesis, evaluation, and policy implications of the FORESTCHECK monitoring project of 2001 – 2006* in Aust. For. V74 No.4

Timber production then becomes more intensive (shorter rotations, heavier thinning) and less compatible with other uses.

An alternative approach could be promoted by the DFMP. At present it proposes a number of measures to reduce the impact of harvesting on conservation in the multiple use forest, but it should balance this by promoting a wider application of the multiple use strategy, producing all values from the forest at an appropriate scale. An approach to FMP 2014 where multiple use is promoted will allow for a less intensive approach to be taken with timber harvesting.

A broader multiple use approach should include a review of the extent and purpose of some informal reserves. This has occurred in the case of the travel routes in the southern forest and this initiative is supported. However FPC considers that access to level one travel routes for timber production should occur where there has been degradation of the over storey which affects its visual quality.

In the case of stream and river zones there needs to be a review of the ongoing management requirements. These zones were designed to protect water quality from disturbances upslope, and to maintain the biodiversity values of the riparian vegetation. However with climate change it appears likely that these zones may be some of the first to be affected. There have been very significant declines in the ground water levels as a result of declining rainfall and changing forest water demand. Maintaining a sustainable vegetation cover and improved stream flow will require increases in the water table. This might be achieved by management of the upslope forest to reduce its water use and by some level of thinning within the current reserves.

Further, there seems little to be gained from not allowing the salvage of dead trees from informal reserves. Providing for low levels of timber production where it is complementary to the values being managed is one example of how multiple use management could operate at different intensities across the forest. The adoption of a 'limited disturbance' approach to the management of informal reserves could serve to counterbalance additional management limitations proposed in the multiple use forest.

RECOMMENDATION 2:

The FMP pursues, where possible, multiple use management objectives, including initiatives for the management of informal reserves.

(3) Levels of reservation

The Nationally Agreed Criteria for the Establishment of a Comprehensive, Adequate and Representative Reserve System (CAR) for Forests in Australia (JANIS 1997) are the recognised standard for forest reservation accepted by the Australian and New Zealand Environment and Conservation Council (ANZECC) and the Ministerial Council on Forestry, Fisheries and Aquaculture.

Figures 1 and 2 illustrate the extent of the land use allocations proposed under the DFMP, in relation to the nationally agreed objectives for a CAR reserve system. Table 1 is a desk-top evaluation of the forest ecosystems against the CAR criteria. It is apparent from this data that most forest ecosystems have been reserved to a level that satisfies or is in excess of CAR requirements. Jarrah forest is reserved at twice the rate required to meet the CAR target, and the karri forest is reserved at three times the rate.

Figure 1: Jarrah Land Use Allocation

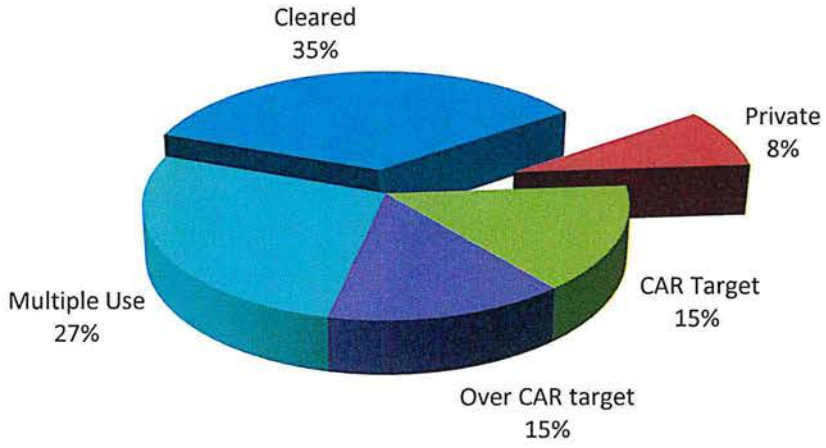
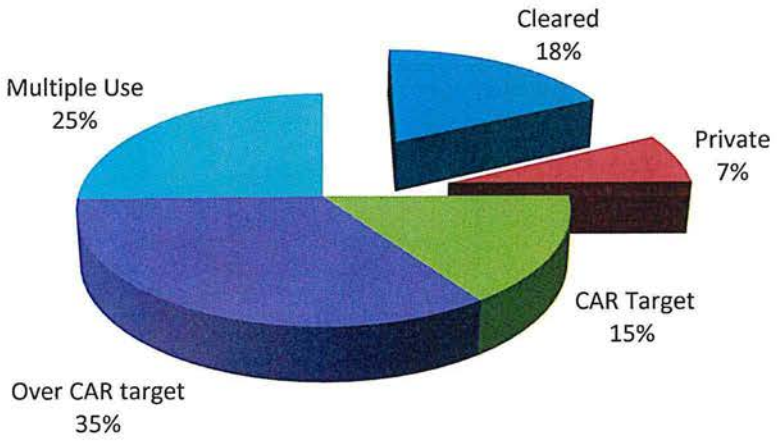


Figure 2: Karri Land Use Allocation



The question of reserve adequacy was found by JANIS (1997) to be a question of *what is the level of reservation that will ensure viability and integrity of populations, species and communities.* It proposed that the following factors are supportive of achieving this outcome:

- the level of reservation;
- compatibility of adjacent land management; and
- reserve replication to capture variations and to manage risk.

It is clear from Table 1 that reserve adequacy is well addressed in terms of adequacy and replication to cover the risk factors. FPC contends that the adjacent multiple use forest is highly compatible with the reserves. In particular the results of FORESTCHECK demonstrate that the management of the jarrah forest for timber production is able to achieve significant biodiversity conservation outcomes.

TABLE 1: Assessment of DFMP Reserve system against the CAR Criteria (a) Jarrah forest ecosystems

Forest Ecosystem	Criteria 1	Criteria 2	Criteria 3	Criteria 4	Criteria 5	Criteria 6	Criteria 7	Criteria 8	Old Growth
TARGET	15% of area of original distribution	60% of remaining area	100% of remaining area	Geographic spread	Habitat Quality	Reserve size	Range - geographic and successional	Fragmented landscape criteria	60% or 100%
Jarrah Blackwood	35%	not applicable	not applicable					not applicable	100%
Jarrah Leeuwin	16%	not applicable	not applicable						100%
Jarrah Mt Lindesay	19%	not applicable	not applicable					not applicable	100%
Jarrah North East	18%	not applicable	not applicable					not applicable	100%
Jarrah North West	23%	not applicable	not applicable					not applicable	99.6%
Jarrah Rates Tingle	not applicable	not applicable	77%					not applicable	100%
Jarrah Red Tingle	not applicable	not applicable	63%					not applicable	100%
Jarrah Sandy	29%	not applicable	not applicable					not applicable	100%
Jarrah South	49%	not applicable	not applicable					not applicable	100%
Jarrah Unicup	21%	not applicable	not applicable					not applicable	100%
Jarrah Woodland	47%	not applicable	not applicable	Not known	Not known	Not known	Not known	Not known	99.5%
Jarrah Yellow Tingle	not applicable	71%	not applicable					not applicable	100%

	Exceeds criterion		Meets criterion		Marginal or does not meet criterion

TABLE 1: Assessment of DFMP Reserve system against the CAR Criteria (b) Karri forest ecosystems

Forest Ecosystem	Criteria 1	Criteria 2	Criteria 3	Criteria 4	Criteria 5	Criteria 6	Criteria 7	Criteria 8	Old Growth
TARGET	15% of area of original distribution	60% of remaining area	100% of remaining area	Geographic spread	Habitat Quality	Reserve size	Range - geographic and successional	Fragmented landscape criteria	60% or 100%
Karri main Belt	48%	Not applicable	Not applicable					Not applicable	99.7%
Karri Rates Tingle	Not applicable	Not applicable	92%					Not applicable	100%
Karri Red Tingle	Not applicable	89%	Not applicable					Not applicable	100%
Karri West Coast	Not applicable	75%	Not applicable					Not applicable	100%
Karri Yellow Tingle	Not applicable	89%	Not applicable					Not applicable	100%

	Exceeds criterion		Meets criterion		Marginal or does not meet criterion

Given this high level of achievement, what justification can there be for the reservation of ecosystems well beyond the CAR requirements? The reality is that many were not established by reference to the National Forest Policy or in fact any scientific assessment of their merits. There were very significant extensions to the reserve system in FMP2004 which were based on policy rather than science. These inclusions included a number of regrowth forests.

In 2004 the impacts of the current land use allocations on the timber industry were very significant. (Section (4)). There is now an opportunity to adjust the level of reservation to one which still meets the objective criteria, but also improves the socio-economic outcomes.

The following forest ecosystems ("Over-reserved ecosystem") are well in excess of the national standard and should be the focus of any review:

Forest Ecosystem	Area in excess of CAR target
Jarrah Blackwood	69,690 ha
Jarrah South	191,480 ha
Jarrah Sandy	20,500 ha
Karri Main Belt	63,920 ha

The over-reserved ecosystems are made up of a combination of formal reserves and forest conservation areas (FCAs), informal reserves and fauna habitat zones (FHZs). Any proposal to change their status will need to be addressed through the FMP process, and those which have been dedicated through parliamentary processes – would also need to be changed through the same process.

FPC suggests that the parts of the CAR system which could be changed through the FMP process are most significant in the above forest ecosystems. These are (excluding any portion which is old growth):

- Informal reserves
- fauna habitat zones (20,390 hectares)
- forest conservation areas (18,200 hectares)
- Areas of State forest that are outstanding recommendations from FMP 2004 which have not been rededicated (22,110 hectares)

If the portion of these areas (regrowth portions) which are not required to meet conservation requirements were to become available for timber production, the difficulties of maintaining current demand levels would be eased. (See section 4(4)).

RECOMMENDATION 3:

The proposed reserve system is assessed against the CAR criteria with a view to identifying any areas which are in excess of that required to meet these requirements.

The proposed reserve system variation to extend the Whicher National Park should only proceed if additional areas become available for timber production.

RECOMMENDATION 4:

Over-represented forest ecosystems in informal reserves and other areas of State forest currently not available for timber production, which are in excess of the requirement for the CAR system, be reviewed and where there is not a compelling reason for their retention, they be made available for timber production.

The over-represented forest ecosystems include the Karri Main Belt, Jarrah South, Jarrah Sandy and Jarrah Blackwood ecosystems.

The proposal to remove 'areas previously classified as old growth' available from the informal reserve system is supported.

(4) Sustaining a viable timber industry

(a) The Sawmill Sector

FMP 2004 introduced changes to access to the forest which had major adverse impacts on the local timber industry. The effect of these changes on the industry and communities is documented in the Socio-Economic Impact Assessment undertaken by URS.

While the effect of the reduction in timber quantities was well understood, the changes in log size and quality were not. Reduced size of logs (both in diameter and length), reduced forest yields and increased regulatory requirements have each had a negative effect on the viability of the timber supply chain.

The rapid decline in log size and quality significantly affected the ability of sawmills to recover high grades of timber. Most sawmills were established to process large mature trees with few defects. Previously the proportion of smaller regrowth logs had been planned to progressively increase over several decades; allowing a steady investment in re-tooling the industry. The rate of change in 2004 immediately implemented the transition to regrowth logs. This transition occurred earlier than previously anticipated, hence the regrowth is smaller than if it had been grown for a further 20–40 years.

The 2004 changes also placed a greater reliance on the sawlogs from the eastern forests. These logs generally contain more defects, in particular gum rings. These defects lower the recovery of the high value portion of the timber. Previously this resource had been blended in at a lower rate; however the reduced access to timber resulted in a greater reliance on this resource under the FMP 2004.

The combined impact of these changes resulted in the proportion of prime grade sawn timber being reduced, adversely affecting the financial viability of the sawmill sector. To address these changes, industry made adjustments to log production, processing and the target markets. There has also been a high level of acceptance by sawmillers of bole sawlogs which contain a higher proportion of non-sawlog material.

In addition to the resource impacts there were very significant impacts on the supply chain. Analysis was undertaken (URS 2008)[3] and significant increases in cost were evident. FMP 2004 saw harvest costs increased by about 15% and haulage costs by 20%. These could be traced back to changes in conditions of access and the location of resource in relation to sawmillers.

Despite their actions the sawn timber sector has seen a loss of processors resulting from these changes. Mills at Collie, Yarloop, Palgarup and Deanmill have closed, and one at Oldbury has significantly reduced its intake of logs. More recently Deanmill re-opened under a different owner. With mill capacity declining by 50% during the term of the FMP it is clear that it has been a highly unsettled period, and **the objective of FMP 2014 must be to provide a greater level of stability to the industry**.

[3] URS Forestry (2008) *F I N A L R E P O R T: Native Hardwood Supply Chain Study* Commercial-in-confidence Report to FPC and FIFWA

The socio-economic performance of the south-west timber shires surveyed (URS 2012) has been poorer than others. There is an aggregate decline in employment of 14% in these shires numbers between 2001 and 2006. The Shire of Manjimup has been the most heavily affected experiencing a fall in both employment and population over this period. It is apparent from the URS study that the proposed eco-tourism boom that was intended to replace the timber industry has not eventuated, and in fact tourism has also declined.

FMP2014 should give priority to providing a stable platform for the existing industry.

RECOMMENDATION 5:

The FMP maintain the socio-economic benefits derived from the current timber sector by providing for timber yields in location, quantity and quality that will sustain their operation.

To ensure the sustainability of the existing industry there needs to be a continuity of supply of higher quality sawlogs within an economic haulage distance of the existing timber processing infrastructure. This industry is predominantly in the southern areas (table 2).

Table 2: Existing Sawmilling Capacity/Demand in the Southern Areas (cubic metres)

	Jarrah Sawlog	Karri Sawlogs
Southern Sawmill Capacity	125,500+	55,200+
FMP 2004 first and second grade supply	57,000	54,000
FMP 2004 low grade sawlog supply	15,000	4,000

+ INDICATIONS OF ADDITIONAL CAPACITY IF RESOURCE WERE AVAILABLE

The three karri processors are well placed with resource balancing the capacity. An opportunity to increase the resource may occur in the future when increased quantities of regrowth forest reach maturity. The major issue facing karri sawmillers will be the increased proportion of younger regrowth sawlogs. These logs do not provide the quality of structural timbers that can be cut from currently large mature logs.

The southern jarrah sawmillers are confronted with the options of escalating log costs as a result of the larger portion of the available resource being to the north, or maintaining a viable operation with a blend of lower grade logs.

The actual availability of sawlogs from southern areas has been lower than previously planned, with the Greenbushes area contributing very little during FMP 2004. While the sustained yield calculations provides an indication of the quantities that can be made available with an area, the number of constraints and conflicting objectives can make these quantities difficult to access.

Greater volumes must now be delivered to southern mills from the north. This approach is not sustainable as haulage distances in excess of 200 kilometres are required to meet supply requirements, resulting in the average haulage distance for some mills exceeding 100 kilometres.

To sustain the existing jarrah sawmill industry, employment and communities in the south, increased access to forest resources at reduced production cost will be required. This can be achieved by an increase in access to sawlog resources from the southern areas. The additional jarrah sawlog quantity required could be of the order of 20,000–30,000 cubic metres per annum above the quantities predicted in 2004. The balance of supply could potentially be made up from lower grades (bole and third grade sawlogs) and sawlogs transported from northern areas. Further modelling is required to confirm these estimates.

The balance between demand/processing capacity and the sustainable supply of resource for the northern areas (Mornington and Swan Cells) is shown in the Table 3 below.

TABLE 3: Existing Sawmilling Capacity/Demand in the Northern Areas (cubic metres)

	Jarrah Sawlog
Northern Sawmill Capacity	29,000
FMP 2004 first and second grade supply	74,000
FMP 2004 low grade supply	30,000

In the north the FMP 2004 supply is greater than quantities that can be processed by local sawmills. It has, however, proven difficult to access all the northern resource due to it being dominated by smaller regrowth sawlogs, and the retention of greater numbers of logs to meet silvicultural objectives than was predicted by DEC. While there is an ongoing potential for a sawmill industry, there may also be an opportunity to develop alternative processes which can better use the smaller regrowth resource.

Marri sawlogs have proven to be highly sought after for supply into the furniture industry. For this market demand outstrips the capacity to supply.

RECOMMENDATION 6:

Jarrah sawlogs sourced from southern forest areas need to be increased above FMP2004 levels to sustain the existing industry and its associated employment.

The FMP 2004 level of jarrah sawlog supply in northern areas is sufficient to sustain existing industry and employment.

(b) Other industry sectors

Other industries using non-sawlog grades are equally important in supporting the timber industry, employment and dependent communities. The supply of chip logs, firewood and charcoal logs make up the bulk of the lower grade log supplies. In the karri forest almost all the available resources are used, whereas in the jarrah forest only about 43 per cent of the available wood resource has established markets. This presents significant opportunity for new industry and employment (See section 3.2). It also addresses the concern that past practice has not provided for the future growth of higher value timber products. (Section (4)(d)).

Under FMP 2004 sustaining supply to these industries is not a major issue as there remains large quantities of unused other bole material, particularly in the jarrah forest. Changes to the retention requirements for ground (habitat) logs and dead standing trees may have an influence on resources for dry firewood and dry charcoal logs within economic distance from those markets. These proposed changes to operational specifications may lead to unforeseen consequences and should be thoroughly examined before a decision to make these changes. (See section (4)(e)).

(c) Building new opportunities

The availability of significant quantities of unused wood resource provides a very significant opportunity for expanding the industries that can process smaller regrowth logs and lower grade timbers.

A call for Expressions of Interest conducted by FPC has identified opportunities for new industries to become established based on forest resources. In moving from a proposal to an investment takes a number of steps and at this point in time it is difficult to progress due to the uncertainty associated with the availability of resource. At this point there is no guarantee of any resource beyond 31 December 2013. For a significant investment to occur it would be expected that there would be a level of resource security of about 20 years.

The benefits of attracting new investment are the social and economic outcomes from new industries, as well as improving the overall viability of the existing industry. These come from being able to effectively thin and regenerate the forest, and having greater harvesting efficiency.

The limitations of the CALM Act and the Forest Products Act restrict FPC's capacity to make commitments beyond ten years. As the yields are calculated on a sustainable basis (i.e. they will be available for 50+ years), the sustainability of the resource does not appear to be a limiting factor beyond ten years.

RECOMMENDATION 7:

The FMP should encourage the development of employment and regional development benefits arising from the establishment of new timber processing industries.

To provide certainty of long term access to timber resources required to achieve investment and industry development, the FMP should acknowledge the desirability of resource security, and support a review of mechanisms to enable FPC to enter into contracts for periods greater than 10 years.

(d) Calculating the sustained yield

In undertaking the sustained yield calculation it is necessary to make certain assumptions about access to land, about timber products and how the harvest will be managed. The issues associated with access to land are addressed in section 2.

The basis of sustained yield calculation is the level of sawlog harvest. At present this is most logical as it is the product which both derives the greatest social and economic value, as well as being derived from the mature forest.

The management assumptions that underpin the sustained yield are equally critical. FPC understands key management variables are:

- the level of utilisation;
- the implementation of silvicultural practice; and
- the implementation of the catchment thinning program (see section S).

A higher yield is realised under optimum management where forests are regenerated and thinned in a timely manner, and all resource is recovered. A lower yield is realised when management cannot achieve these outcomes.

FPC is of the view that sustained yield should be based on best practice silvicultural management of the forest. This provides the opportunity to provide for optimum social and economic outcomes. If at the end of ten year best practice does not occur, then there is an adjustment taking into account actual management outcomes.

The assumption that the management of the forest will not be optimum does not provide an opportunity for the potential yield to be realised and becomes a self-fulfilling prophecy. By assuming the 'low-yield regime', a higher yield cannot be implemented as FPC is restricted in the quantity of timber that can be taken.

It is important to also consider how drought and fire-killed trees should be considered in calculating the sustained yield. Outside nominal allowances for losses it is suggested that salvage should be outside the sustained yield calculation.

RECOMMENDATION 8:
The sustained yield calculations should assume:

- **Full access to the available forest areas**
- **Full implementation of silvicultural objectives**
- **Forest thinning programs for water are modified to maintain future sawlog yield**
- **Exclusion of the recovery of trees killed through climate change and fire which can be salvaged**

(e) Managing the harvest

The practicality and viability of timber harvesting has become increasing difficult as access to the forest has become more restricted and subject to additional conditions. In 2004 the reservation of large areas of some of the most productive forest has required that timber harvesting operate in lower yielding areas. Due to the limited range of current markets for timber products it has proven more difficult to maintain viable harvesting costs, resulting in increases in the cost and by-passing some unviable areas.

A significant additional cause of increased cost has been the requirement to implement a number of measures introduced in FMP 2004. In particular the measures related to the prevention of soil damage. These measures were untested and did not have a clear objective other than to reduce forest access at times when it was possible that soil may be damaged. There was no assessment of the practicality of the proposals, and a flawed system was forced on the industry, resulting in major disruptions and cost.

This measure effectively resulted in a three month period when timber harvesting is very uncertain and, if it occurs, at much reduced productivity. This resulted in the harvesting contractors bearing their capital costs but being only able to use their staff, machines and equipment over nine months. As a result of these and other changes, harvesting costs increased by 15% in 2004 (URS 2008).

A number of new measures are proposed in the DFMP and subsidiary documents, in particular the jarrah silvicultural guideline. These present the same concerns as the changes in FMP 2004. They are untested as to whether there is any benefit for biodiversity objectives or their timber production impact.

RECOMMENDATION 9:

The implementation of changes to the silvicultural guidelines should not proceed until:

- **There is an analysis of the benefit of the change**
- **There is an analysis of the effect of the change**
- **There is consultation with the Department of Water (for water production impacts), and the Forest Products Commission (for wood production impacts)**
- **Where there is not agreement from the consulted agencies, a determination is made by the Minister for the Environment in consultation with the relevant Minister**

The soil management system of the current FMP needs review. While its functioning has improved since 2004, it still heavily restricts industry and it is unclear whether it is achieving a meaningful outcome. The key elements to address in managing soil outcomes are as follows:

- Greater flexibility in use of the index (TIsdi) as an indicator of soil condition.
- Simplify the wet soil approvals process and allow it to be managed at a local level between FPC and DEC regional staff.
- Reduce the burden of monitoring and increase the focus on surveillance rather than completion of detailed transect surveys.
- Remove the age limitations on thinning of young karri regrowth. This will become increasingly important as operations move into increasing areas of second thinning.

5. Addressing the climate change threat

It is recognised that climate change is a major threat facing the forest and all the values that it produces.

The predicted decline in rainfall and consequential impact on ground water will affect ecosystem productivity.

The existing modelling for ground water levels in the northern forest catchments is startling.

The modelling has identified the interaction between the condition of the forest (stocking, density, age of trees) and the ground water levels. Dense unthinned regrowth will use significantly more water than mature forest, or thinned regrowth. Much of the forest is in a condition in which it can be thinned to provide significant improvement in ground water levels.

The implications of not acting are significant. There is ample evidence of the decline in stream flow provided by the water authorities. There is also growing evidence of the impact on biodiversity. Aquatic plots remeasured after 25 years (Davis and Storey 2012)[4] have indicated a transition in stream condition towards drier and fewer permanent streams.

Vegetation plots established to classify the jarrah forest into ecotypes in 1975 (Havel 1975)[5] are in the process of being reassessed. Mattiske Consulting[6] has re-assessed 480 of these plots in the 31 Mile Brook, near Gleneagle, and is reporting on 37 years of change under drying climatic conditions. In their initial report they make two important observations in relation to vegetation changes:

- "Extensive tree deaths and poor tree condition in both areas surrounding granite outcrops and areas of secondary laterisation; and
- Noticeable shifts in the extent of streamzone and swamp communities when compared to the original mapping of Havel (1975)."

There is a threat to both public water supply, vegetation and their associated ecosystems, and environmental flows supporting the aquatic ecosystems which must be addressed.

It is clear that the level of action taken over the past 37 years has not allayed this threat. The DFMP has raised the choice between:

(1) A passive approach of doing nothing and accepting the impact of reduced water availability on the environment and on public water supply; and
(2) An active approach of manipulating the forest through measures predicted to increase ground water and stream flow.

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[4] Davies, S. and A. Storey (July 2012). Wungong Catchment Trial. Temporal persistence in northern jarrah forest aquatic macroinvertebrate communities Preliminary investigation of response to declining rainfall. July 2012

[5] Havel, J. J. (1975). *Site vegetation mapping in the northern jarrah forest (Darling Range) 2. Location and mapping of site vegetation types*, Forests Department of Western Australia.

[6] Mattiske Consulting Pty Ltd. October 2012 *Interim Summary of Field Surveys undertaken in the 31-mile Brook Catchment* Report to FPC and DEC

It is necessary that any prescribed management actions (including doing nothing) should be governed by the precautionary principle (CALM Act Section 19). It is now apparent that there is starting to be, and likely to be further, significant change to the ecosystem. There have already been major reductions in stream flow. While the extent of these changes is not fully appreciated, there is a clear threat to critical forest values, for which there is a plausible solution. As the 'solution' can only practically be implemented on a fraction of the forest – the thinning proposal covers at most only 3% of the forest - most of the forest will be managed without specific intervention. As a consequence it is considered the approach outlined in the DFMP is a precautionary one in acting on a threat in the absence of complete knowledge.

(a) Forest thinning for water

The threats to important forest values are described above. Thinning the forest is one of the few active measures available to protect the values at threat.

The silvicultural prescription prepared for implementation in the Wungong catchment provides an intensive level of forest treatment to recover stream flow. This prescription ignores future timber values. By thinning and retaining the forest at such low densities (8–12 m^3 per hectare) it is difficult to visualise a viable option for future timber management. It should be acknowledged that the silviculture is still in the process of development, and that it needs to find a balance between the needs of providing for values derived from the retained forest and the values to be protected by thinning that forest. For timber production a focus on continuing to grow high value timber products is appropriate.

The objective of thinning to restore stream flow is put at risk if consideration is not also given to the management of stream zones. Under current proposals these informal reserves remain untouched. They are therefore likely to be major users of any additional water that is available, and could compromise the benefit of thinning upslope. As a consequence it is essential that the management of stream zones be reconsidered, particularly where there is real threat to water flows.

The process of preparation of individual catchment management plans appears to require a further layer of detailed evaluation and approval. If layers of detailed approval are required, it would appear less likely that any action will occur. The thinning of the forest is very unlikely to proceed without a significant commercial market to harvest and use the trees. Establishing such a market requires certainty of timber access to invest in the capital required. If there is not a clear statement that the resource is available for at least ten years, then new investment will not occur.

In the interests of acting against the drying threat and promoting early action, FMP 2014 should provide the approval for the thinning of the catchments. This will provide certainty for access to an additional timber resource. Detailed planning approvals, as proposed in Appendix 15 of the DFMP, will define how that resource will be made available.

The rate of thinning needs to be balanced against the existing sawlog production. If more sawlog is produced by thinning in the north it would have an adverse impact on the southern industry. The haulage distance would result in an unacceptably high log cost. The northern logs are also considerably smaller than in the south and this would have considerable flow on effects on sawmill viability. Silviculture needs to be adjusted to minimise sawlog production from the north.

RECOMMENDATION 10:

The program for forest thinning is supported in principle. Silvicultural prescriptions for thinning should be designed to maintain future growth of high value forest products.

Thinning regimes need to consider the management of the forest catchment as a whole, including stream zones, to provide for the best overall outcome.

To ensure the commercial viability of being able to thin forest catchments, the FMP must serve as an approval for the proposal. Catchment management plans, as outlined in the DFMP, then provide finer scale project design and integration of values acting as an approval for how the thinning is to be conducted.

(b) The salvage of dead trees arising from drought or fire

Death of mature trees and resultant losses to timber resources can occur due to a number of factors. It has not generally been practice to recover all high value logs arising from major disturbance events. Most frequently these trees and their associated timber products are not harvested. The potential impact of drought became very apparent with the loss of 16,000 hectares of mature trees in the jarrah forest in autumn 2011. No attempt has been made to use this resource.

In a similar event, a major fire killed large areas of karri forest (Babbington fire) and it was found that there was no incentive from either the regulators or industry to salvage that resource. As a consequence the dead trees are still standing and can no longer be considered as sawlogs. That forest is now degraded and will be rehabilitated at considerable public expense.

It is in the interests of sustaining long term yield from the forest that the resource available in dead trees is used (where not required for ecological purposes). If not used there will be an impact on future sustained yields. FPC understands that there are nominal allowances of timber losses included in the sustained yield calculations. If the climate change predictions are true it seems likely that these losses will increase, with the possibility of catastrophic losses as occurred with the drought in the northern jarrah forest.

The FMP objective should be to enable salvage wherever practical. There is considerable uncertainty in predicting the level of such damage that is likely to occur. The proposition in the DFMP that relates to mortality allowances is difficult to reconcile with the reality that dead trees will not contribute to future sustained sawlog yields. If they are salvaged today they will contribute to current yields, and the focus of policy should be given to support that outcome.

It would be preferable to provide a greater incentive to the recovery of dead trees. For example where there is a catastrophic loss of trees and there is a benefit in removing them, the resource should be considered as additional to the sustained yield.

Other key issues that should be addressed are salvage from informal reserves, and the need for a rapid approval process to facilitate salvage.

RECOMMENDATION 11:

Sustainable use of timber resources should be encouraged by supporting the salvage of dead trees by:

- **Excluding the salvage of dead sawlog material from sustained yield calculations;**
- **Providing access to informal reserves to salvage sawlogs following major disturbances;**
- **Providing for a system of forest access which would allow for the rapid approval of salvage harvesting of areas of forest substantially killed by fire or drought; and**
- **The rehabilitation of areas degraded by fire or drought being undertaken by FPC following salvage.**

`Attachment 1 : FPC comments on the Goals and proposed actions under the DFMP

BIOLOGICAL DIVERSITY	
Draft Forest Management Plan	FPC Comments
GOAL : The plan seeks to conserve biodiversity and self-sustaining populations of native species and communities, and seeks to allow for the recovery of biodiversity from disturbance operations. This overarching goal is supported by a number of subsidiary goals for which the plan proposes a range of corresponding activities, as set out under 'Operations proposed to be undertaken (management activities)', below	The subsidiary goals are not clearly stated. For other goals these need to be in balance for an ESFM outcome.
CAR formal reserve system The plan proposes the following actions 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 maintenance of a system of reserves that is comprehensive, adequate and representative.	The proposed system does not meet the adequate standard. It is is in excess of CSR requirements Refer to FPC Recommendation 3

1 The Department will initiate the processes required for the land category changes proposed by the Draft plan by; 1.1 undertaking fine scale reserve design for the formal reserves proposed in this Draft plan 1.2 consulting with the Conservation Commission and then advising the Minister for the Environment on final reserve boundaries. Minor amendments to the boundaries of reserves shown in Map 3 and Map 4 may result fine scale reserve design and consultation processes required to establish these reserves	Fine scale reserve design should not increase the area of reservation. Area of reservation is already in excess of CAR requirements. FPC to be consulted in any changes.
2 The Department will manage the areas vested in the Conservation Commission and proposed by Appendix 5 for inclusion in a national park, nature reserve or conservation park consistent with their proposed land use category and purpose and relevant Departmental policies until such time as they are formally created.	Supported
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 *Bush Forever* and other relevant programs.	Supported
Forest conservation areas and informal reserves The plan proposes the following 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	

4 The Department will manage areas vested in the Conservation Commission and proposed by Appendix 5 to be classified as forest conservation areas consistent with their proposed classification and purpose and relevant Departmental 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.	The areas of proposed as forest conservation areas in the Karri Main Belt, Blackwood, Southern and Sandy forest ecosystems are significantly in excess of the requirement for a CAR reserve system. Review as proposed in recommendation 3, as well as examining management of informal reserves as proposed in recommendation2.
The plan will establish informal reserves referred to in Appendix 12 and proposes the following activities at a local scale for the purpose of seeking to conserve biodiversity outside of formal reserves and forest conservation areas:	
5 The Department, FPC and other proponents where required by the Department, will conduct their operations within the informal reserve types shown in Appendix 12, in accordance with the Department's *Guidelines for the Protection of Values of Informal Reserves and Fauna Habitat Zones.*	FHZ's are in excess of CAR requirements and should not be continued. If they are continued, a review of the management of Informal reserves is appropriate in face of the threat of climate change. Thinning should be considered an option. Salvage of trees killed in fires and through drought should be considered.
6 The Department will: 6.1 publish a map each year on its website depicting the extent and status of old-growth forest, that identifies and explains any changes arising during the previous year 6.2 review planning processes for disturbance processes on all land categories to ensure a uniform approach for assessment of old-growth status, consistent with that used in areas subject to proposed timber harvesting	Supported The process for checking old growth status needs to be consistent between agencies. A nomination process for removing areas from old growth status should also be included.
Integrating biodiversity management across the plan area The plan proposes the following activities at the whole of forest, landscape and/or local scales, for the purpose of promoting resilient ecosystems, including 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 this 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	
7The 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: 7.1 seeking to minimise the permanent loss of native vegetation and/or impacts on its integrity as a result of development 7.2 seeking the replacement of native ecosystems permanently lost to development, in line with the 2011 *WA Environmental Offsets Policy* 7.3 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.	Supported Where such developments do occur and result in the loss of trees, those trees should be made available to for timber production, irrespective of land tenure
8 The Conservation Commission and the Department will: 8.1 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 8.2 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 8.3 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 8.4 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.	Supported 8.3 should also include impacts of values, not just conservation
9 The Department will maintain a list identifying threatened and priority species of flora and fauna, and	Supported

threatened and priority ecological communities.	
10 The Department will where practical, develop, review and implement recovery plans for selected threatened species and ecological communities.	Supported Greater attention needs to be given in the preparation of recovery plans for the identification and measurement of the threats to individual species.
11 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.	Supported This should be extended to cover other disturbance activities.
12 (Plantations) The FPC will advise the Department of its harvesting and management activities within plantations, and where those activities may impact on threatened species and threatened or priority ecological communities, the Department will establish conditions for access (also see activity 66 in the 'Productive capacity' chapter).	Supported – Add FPC to propose conditions, DEC to approve. Conditions of access need to ensure that the State's commitments to supply timber under State Agreement Acts and contracts can be met.
13 The Department will: 13.1 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 13.2 conduct its operations having regard to *Goals for Understorey Structural Diversity*, which are to be prepared by the Department in consultation with the Conservation Commission 13.3 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 other forest values	Not supported The objectives of a broad range of forest ages, structures and compositional diversity are ill-defined and subject to wide interpretation. While it is not stated, these measures only affect timber production on State forest and are open to significant value judgment as to the various risks and benefits. With the very high levels of reservation the re should be a demonstration of a need for this measure. ForestCheck appears to contradict the need for major changes to practice. These measures should only be introduced where they are demonstrated to have a significant benefit to the protection of biological diversity at a whole of forest scale, and where the impact on timber production is assessed by FPC to be acceptable. In other words there needs to be balance with the social and economic objectives.

14 The Department, FPC and other proponents where required by the Department, will: 14.1 revise standards for the protection of key habitat requirements for listed threatened species in relevant codes of practice and other guidelines 14.2 apply agency procedures so that the presence and type of biodiversity values is appropriately recorded, accessible to staff and considered prior to operations taking place 14.3 apply procedures and set appropriate conditions to ensure that biodiversity values are effectively protected during permitted disturbance activities 14.4 promote awareness and understanding of the importance of protection and appreciation of the value of biodiversity amongst staff, proponents, operators and visitors.	14.1 Not supported FPC does not have ownership of the Codes of Industry Practice. The remaining points are supported
15 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.	Supported
16 The Department will: 16.1 finalise the location of fauna habitat zones according to the *Guidelines for Selection of Fauna Habitat Zones* 16.2 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.	Not supported FHZ's are not required given the high level of reservation. If they remain, the location of FHZs should be as defined on the indicative locations. The past practice has seen interference in the process of locating FHZ's outside of the guidelines. .
17 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*.	Not supported The option of thinning and salvaging dead trees in FHZ's where there is extensive death as a result of fire, fire control activities, drought or storm should be included in the Guidelines .
Increasing knowledge The plan proposes the following 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:	

18 The Department will undertake biological surveys, which will be: 18.1 of priority areas 18.2 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.	There needs to be greater attention to the assessment of the benefits of the formal and informal reserve system and fauna habitat zones. A number of measures are proposed based on theory but not demonstrated to provide any additional benefit. Far more important that the biological surveys should look at climate change impacts in existing reserves. Additional reservation may not be the appropriate response to threats.
19 The Department will seek to: 19.1 maintain the species, community and process monitoring program, *FORESTCHECK*, and seek to extend it 19.2 maintain a research program on ESFM.	Supported Delete "seek to"

Ecosystem health and vitality	
Goal An overall goal of the plan is to seek to maintain ecosystem health and vitality.	
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.	
20 The Department will: 20.1 maintain a competent capability in fire management, prescribed fire, bushfire risk mitigation, detection and suppression 20.2 seek to maintain a fire science capability and work collaboratively with other agencies and institutions on matters of mutual interest 20.3 consult with stakeholders and interested community members on the planning and implementation of prescribed burning and other fire management programs to: • develop community understanding of, support for and collaboration in, fire management • enable constructive discussions and deliberations on fire management approaches 20.4 undertake an annual prescribed burning program in a manner that: • 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 • considers any specific ecological, silvicultural, social, cultural and other identified management objectives in areas subject to planned burning • seeks to minimise emissions of greenhouse gases while achieving fuel reduction objectives so as to avoid major emissions arising from periodic catastrophic bushfires • 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	Supported

• creates and utilises new knowledge in an adaptive management framework • is assessed against stated objectives for the program and stated objective(s) and success criteria for individual burns 20.5 undertake bushfire suppression and recovery operations in a manner that has regard to fire operations guidelines, that are periodically revised 20.6 ensure staff and contractors are competent to assist with management of environmental issues associated with bushfire suppression and recovery operations, including through training programs, where appropriate.	
21 The FPC will: 21.1 collaborate with the Department in determining appropriate risk mitigation strategies to be applied to land managed by the Department, and in particular, the State's native and plantation timber resources 21.2 as agreed between the agencies, provide to the Department funding to enable the Department to control the risk to acceptable levels, so far as is reasonable and practicable	Not fully supported The funding of DEC for fire control measures is determined by Treasury, FPC does not fund DEC for these activities. FPC's support for fire protection relates to plantations
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.	
22 The Department, and other proponents where required by the Department, will: 22.1 maintain surveillance and recording systems for weeds that are known to have a significant impact on ecosystem health and vitality 22.2 work collaboratively with other agencies and land managers, as appropriate, to identify priority weeds using risk-based procedures for determining their relative importance 22.3 work collaboratively with other agencies and land managers, as appropriate, to prepare	Supported

	incursion management plans for priority weeds which are not yet present 22.4 use planning procedures, and operational controls, to identify the relative importance of areas for protection, and to minimise the risk of spread and impacts from priority weeds already present 22.5 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.	
23	The Department will seek to maintain a weed science capability and work collaboratively with other agencies and institutions on matters of mutual interest.	Supported
24	**(Plantations):** The FPC will seek to: 24.1 work with DEC to maintain surveillance and recording systems for priority weeds, compatible with those of the Department 24.2 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~~ 24.3 take appropriate steps to control the spread of plantation species beyond plantation boundaries into adjacent native vegetation 24.4 take appropriate steps to ~~ensure that~~ minimises the risk of the seedlings it obtains from its own and other nurseries are free from weeds that could be transported into the forest with planting stock.	Supported, although FPC does not accept that it has responsibility to implement control programs for priority weeds, other than the spread of plantation species beyond plantation boundaries. Add words as indicated
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		

25	The Department, and other proponents where required by the Department, will: 25.1 maintain surveillance and recording systems for pests that are known to have a significant impact on ecosystem health and vitality 25.2 work collaboratively with other agencies and land managers, as appropriate, to identify priority pests using risk-based procedures for determining their relative importance 25.3 work collaboratively with other agencies and land managers, as appropriate, to prepare incursion management plans for priority pests which are not yet present 25.4 use planning procedures, and operational controls, to identify the relative importance of areas for protection, and to minimise the risk of spread and impacts from priority pests already present; 25.5 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 25.6 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.	
26	The Department will seek to maintain the *Western Shield* program so as to reduce predation pressure on threatened and priority species of fauna.	Supported
27	The Department will seek to maintain a pest science capability and work collaboratively with other agencies and institutions on matters of mutual interest.	Supported
28	(**Plantations**): The FPC will: 28.1 in conjunction with other agencies, maintain surveillance and recording systems for the presence of *Sirex noctillio*, European house borer and other priority pests, compatible with those of the Department 28.2 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 28.3 seek to identify and protect, including through use of planning procedures, and operational	Supported with amendment, amend 28.4 as for 24.4

controls, individuals and populations that show resistance to pests 28.4 take appropriate steps to ensure that the seedlings it obtains from its own and other nurseries are free from pests that could be transported into the forest with planting stock.	
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.	
29 The Department, and other proponents where required by the Department, will: 29.1 maintain surveillance and recording systems for forest diseases and syndromes that are known to have a significant impact on ecosystem health and vitality 29.2 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 29.3 work collaboratively with other agencies and land managers, as appropriate, to prepare incursion management plans for identified causal agents which are not yet present 29.4 use planning procedures, and operational controls, to identify the relative importance of areas for protection, and to minimise the risk of spread and impacts from priority forest diseases and syndromes already present 29.5 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 29.6 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	Supported

	29.7 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.	
30	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.	Supported
31	(**Plantations**): The FPC will: 31.1 maintain surveillance and recording systems for priority forest diseases and syndromes, compatible with those of the Department 31.2 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 31.3 seek to identify and protect, including through use of planning procedures, and operational controls, individuals and populations that show resistance to disease 31.4 take appropriate steps to ensure that the seedlings it obtains from its own and other nurseries are free from pathogens that could be transported into the forest with planting stock.	Supported, amend 31.4 as for 24.4
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.		
32	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: 32.1 recommending, where practicable and economically feasible, the inclusion of a formal requirement for the rehabilitation of areas subject to those activities, based on agreed rehabilitation standards and completion criteria that are subject to review and reflect the	Supported

	intended future management emphasis 32.2 seeking confirmation from the relevant agency, either directly or through independent verification by suitable parties, that rehabilitated areas meet agreed completion criteria 32.3 exploring mechanisms for payment by proponents of appropriate environmental performance bonds that would be refundable on satisfactory 'hand-back', on a pro-rata basis.	
33	The Department, and other proponents where required by the relevant agency, as appropriate, will undertake their rehabilitation operations by: 33.1 using natural regeneration where reasonable and practicable, or 33.2 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 33.3 where natural regeneration is not reasonable and practicable, and where the information referred to in 33.2 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 33.4 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.	Supported
34	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 33.2 and 33.3 have been used in their rehabilitation operations.	Not supported. No reason to provide such reports to the Commission
35	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: • be revised from time to time to be consistent with contemporary 'good practice'	Supported

	• specify species composition, with the aim of ensuring 'representativeness', and state overstorey stocking and stand density levels to be achieved prior to 'hand-back' • 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) • 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 • define agreed access conditions, including any road closures, taking into account future management requirements, including ongoing fire management.	
36	The Department will: 36.1 develop guidelines for the appropriate ongoing management of mine site rehabilitation 36.2 in the interim, consider and, as appropriate, approve the use of management intervention within mine site rehabilitation, to ameliorate the impacts of a changing climate on a range of forest values 36.3 encourage an active adaptive management approach to the management of mine site rehabilitation.	Supported

Soil and water	
Goal An overall goal of the plan is to seek to protect soil and water resources on land to which the plan applies.	This goal does not reflect the requirement to manage these resources, and implies that they are to be maintained, preferably in an unaltered condition.
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 soil disturbance.	
37 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*.	Manuals need to be changed to remove reference to age of thinning and other amendments as proposed
38 The Department will revise relevant subsidiary documents pertaining to rehabilitation requirements for major extraction tracks and landings, and roads and tracks no longer	
39 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.	
40 The Department, FPC and other proponents where required by the Department, will review subsidiary documents and training programs to ensure that procedures for containment of spills are adequately addressed.	This appears very operational and unnecessary in a strategic document
41 **(Plantations):** The FPC will: 41.1 conduct its operations: 41.1.1 in a manner having regard to the guidelines for soil protection in the *Code of Practice for Timber Plantations* (2006) 41.1.2 in accordance with Department requirements where the Department establishes these, and which are to prevail over those referred to in activity 41.1.1 41.2 rehabilitate damaged soil resulting from plantation operations: 41.2.1 in a manner having regard to the *Code of Practice for Timber Plantations* (2006)	It would be preferable if the Department were to seek to amend the Code so that FPC can operate to a single standard

	41.2.2 in accordance with new requirements where the Department establishes these, and which are to prevail over those referred to in activity 41.2.1.	
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.		
42	The Department, the 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*.	See previous comments on the Guidelines. Thinning in stream zones should be considered as an option.
43	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.	These actions should not just be confined to State forest. If there is an environmental benefit they might need to be implemented on all land tenures
44	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.	
45	The Department: 45.1 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 45.2 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 45.3 will take and use water sustainably from land to which the plan applies 45.4 may issue permits, after consultation with the Conservation Commission, for the sustainable	

	taking of water from land to which the plan applies.	
46	The Department, the FPC and other proponents where required by the Department, will undertake design, construction and maintenance operations for unsealed roads in a manner that: 46.1 has regard to the 2009 *Unsealed Roads Manual – Guidelines to Good Practice*, issued by the Australian Roads Research Board, prior to the approval of the policy and guidelines referred to in 46.2 46.2 is in accordance with Departmental policy and guidelines which are to be prepared by the Department.	Supported, 46.2 should be done in consultation with other agencies
47	**(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).	
48	**(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 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 Water Corporation. Approved catchment management plans will be made publicly available.	Not supported This needs to be balanced with other commitments It is unclear what a catchment management plan is in relation to a plantation, as in most instances plantations only occupy a very small part of the catchment

Climate change and carbon cycles		
Goal Within the constraints of a changing climate, the plan proposes the following activities at the whole of forest scale, for the purpose of 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.		
49	The Department will: 49.1 remain abreast of current knowledge and contemporary management approaches in relation to climate change and its possible impacts on native ecosystems and sustained yield 49.2 seek to maintain a forest carbon science capability and understanding of climate change and its impact on ESFM and work collaboratively with other agencies and institutions on matters of mutual interest 49.3 report on carbon stores in the next draft FMP 49.4 incorporate climate change prediction into future planning for the management of land to which the plan applies, where reasonable and practicable 49.5 contribute to State and national policy development on climate change adaptation and mitigation 49.6 investigate opportunities that may arise from an emerging carbon economy 49.7 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.	
50	The FPC will: 50.1 **(Plantations):** remain abreast of current knowledge and contemporary management approaches in relation to climate change and its possible impacts on plantations 50.2 seek to encourage the use of wood harvested from native forests and plantations to maximise greenhouse mitigation benefits.	Supported

Productive capacity	
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.	Amend
Goal The plan proposes the following activities at the whole of forest and local scales for the purpose of ~~seeking to~~ maintaining the net area of native forests and plantations available for wood production.	
51 The Conservation Commission, the Department and the 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: 51.1 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 51.2 seeking the replacement of native forests and plantations not replanted or permanently lost to development, consistent with relevant legislation and government policies 51.3 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.	
52 **(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 at Gnangara, Pinjar, Yanchep and other areas determined consistent with the agreement ratified under the *Wood Processing (Wesfi) Agreement Act 2000*.	Amend
53 **(Plantations)**: The FPC ~~will~~ may elect to replant areas of clearfelled hardwood plantation to softwood plantations.	There should not be an obligation on FPC to do this

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).		
54	The Department will prepare rolling three-year indicative timber harvesting plans, which will satisfy the requirements of commitments to existing customers, that are to be: 54.1 developed in consultation with the FPC 54.2 consistent with the allowable cut to be included in the next FMP 54.3 approved by the Department's Director General 54.4 made publicly available.	There needs to be a timescale when DEC should provide these plans, otherwise there failure to provide these plan may disrupt harvesting operations Is the allowable cut the same as the sustainable yield?
55	The FPC will prepare annual timber harvesting plans, which will satisfy the requirements of commitments to existing customers, that are to be: 55.1 developed in consultation with, to the requirements of, and approved by the Department's Director of Sustainable Forest Management 55.2 consistent with the allowable cut to be included in the next FMP 55.3 made publicly available.	There needs to be a timescale when these plans are approved, otherwise there failure to provide these plan may disrupt harvesting operations. Is the allowable cut the same as the sustainable yield? There could also be some reference to satisfying the demand of local industry as proposed
56	The FPC will prepare coupe level timber harvesting plans using the Department's planning checklist for disturbance activities, which are to: 56.1 be consistent with annual timber harvesting plans referred to in activity 55 56.2 provide sufficient information to enable the Department to evaluate the proposed operations 56.3 be approved by the Department's relevant Regional Manager prior to disturbance operations commencing.	There needs to be a timescale when DEC should provide these plans, otherwise there failure to provide these plan may disrupt harvesting operations
57	The FPC and the Department will: 57.1 monitor the ~~volume~~ quantity of all log categories removed from native forest in each year,	FPC measures by weight

	separately recording for each of the commercial species the equivalent volume of first and second grade sawlogs, and other log grades 57.2 periodically monitor the grading and removal of sawlogs.	
58	The FPC, and other proponents where required by the Department, will monitor and record the areas 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.	
59	The Department will maintain a process to verify the information and retain the data referred to in activity 58.	This action could be rolled into 58
60	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 volume, if any, taken under the contract.	Amended
61	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.	
62	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.	
63	The Department will facilitate the salvage of 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.	This should include action in informal reserves. Forest produce so produced should be made available to the timber industry
Goal 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.	
64 **(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.~~	Delete. This should be included in the recreation section
65 **(Plantations):** The FPC will prepare annual timber harvesting plans that are to be consistent with the supply requirement referred to in activity 64	
66 **(Plantations):** ~~Where required by~~ In advising the Department, the FPC will prepare ~~compartment~~ plantation 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: 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's relevant Regional Manager prior to disturbance operations commencing.	Amended There needs to be a timescale when DEC should provide these plans, otherwise there failure to provide these plan may disrupt harvesting operations
67 **(Plantations):** The FPC will: 67.1 monitor the volume of all log categories removed from plantations in each year, separately recording each of the main commercial species and log grade 67.2 periodically monitor the grading and removal of sawlogs.	Supported The grading systems are for all log categories, not just sawlogs
68 **(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.	Supported
69 **(Plantations):** The FPC will monitor and record the areas over which each different silvicultural treatment is achieved in each year.	Supported

70	**(Plantations):** The FPC will continue to refine the data and methodology used for the yield calculations by maintaining and enhancing the quality and coverage of the datasets, and the methodology, used in yield calculations.	Supported
71	**(Plantations):** The FPC will: 71.1 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 71.2 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.	Not Fully Supported FPC does not accept that it has responsibility to rehabilitate plantations areas where the decision has been made by the Department or government policy to not allow FPC to replant.
72	**(Plantations):** The FPC will seek to ensure that appropriate tree breeding programs are maintained to achieve desired plantation outcomes.	Not relevant to FMP
73	**(Other exotics)**: Where operations are proposed, the FPC, and other proponents where required by the Department, will: 73.1 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 73.2 assess stand development before silvicultural or other treatments are scheduled, with a view to determining whether those treatments are then required 73.3 undertake or reschedule those proposed silvicultural or other treatments, according to the assessment referred to in activity 73.2 and prevailing and expected market conditions, where relevant.	Not Supported Areas of exotics are generally the Department's responsibility, not FPC's.
74	**(Other exotics)**: The FPC, and other proponents where required by the Department, will monitor and record the areas 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.	Supported
75	**(Other exotics)**: The Department may seek proposals to facilitate the rehabilitation of these areas to native vegetation.	Unclear as to what this refers

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.	
76 The Department will: 76.1 regulate the supply of other forest produce through the administration of relevant licensing legislation 76.2 maintain and, where appropriate, prepare guidelines for the management of other forest produce 76.3 where reasonable and practicable, monitor supply patterns for signs of non-sustainability 76.4 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.	Supported Timber to be removed under 76.4 should in the first instance support the existing timber industry
77 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.	Supported
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.	
78 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.	Supported
79 The FPC and other proponents will undertake native forest regeneration operations by: 79.1 using natural regeneration where reasonable and practicable, or	Supported

	79.2 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 79.3 where natural regeneration is not reasonable and practicable, and where the information referred to in 79.2 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 79.4 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.	
80	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 79.2 and 79.3 have been used in their native forest regeneration operations.	Delete not relevant to the FMP
81	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.	Supported
82	The FPC and other proponents where required by the Department, in consultation with the Department will: 82.1 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 82.2 assess stand development when silvicultural treatments are scheduled, with a view to determining whether those treatments are then required 82.3 undertake or reschedule those proposed silvicultural treatments, according to the assessment referred to in activity 82.2 and prevailing and expected market conditions, where relevant.	Supported
83	The FPC will monitor and record the areas over which each different silvicultural treatment is achieved in each year and provide suitable information on this to the Department in a format and at times	Supported

required by the Department.	

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

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 Aboriginal 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; and
• at the local scale, protect Aboriginal cultural sites.	

84 The Department, and other proponents where required by the Department, will seek to prevent material adverse effects on Aboriginal culture and heritage in the plan area by: 84.1 where required, working with appropriate and representative Aboriginal groups and relevant agencies to identify cultural and heritage values and sites and gain their input into the management of these 84.2 facilitating access by Aboriginal people for Aboriginal customary purposes subject to the CALM Regulations 84.3 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 85 84.4 ensuring compliance with the provisions of the *Aboriginal Heritage Act 1972* 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	Supported

are to be developed as required by activity 85.	

85 The Department will develop, or maintain and update policies and guidelines on joint management, customary activities and Aboriginal heritage, and will work with appropriate and representative Aboriginal groups to identify appropriate opportunities for joint management of areas within the plan area.	Supported
86 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 Aboriginal culture and heritage values.	Supported
87 The Conservation Commission and the Department will develop a program for assessment of areas of the plan area for their importance for Aboriginal heritage, and the Department, and other proponents where required by the Department, will progressively undertake this assessment, in consultation with relevant stakeholders and agencies.	Supported
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.	
88 The Department will: 88.1 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 88.2 use agency procedures that ensure that the presence and type of heritage places are appropriately recorded, accessible to staff and considered prior to operations taking place 88.3 maintain a central database of other Australian heritage places and values 88.4 use agency procedures and set appropriate conditions as a part of Department approval	Supported

	processes to ensure that heritage places are effectively protected during permitted disturbance activities 88.5 promote awareness and understanding of the importance of protection and appreciation of the value of heritage places among staff, proponents, operators and visitors.	
89	The Department, FPC and other proponents where required by the Department, will: 89.1 conduct their operations in a manner that has regard to approved heritage management policies, guidelines, manuals or instructions 89.2 cooperate with Commonwealth and State agencies, local governments and non-statutory organisations in relation to other Australian cultural heritage identification and conservation.	Supported

Socio-economic benefits	
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.	This goal should reflect the desirability of gaining access to sufficient forest area of a quality and location that can sustain the industry. At present this is not reflected in the process of preparing the DFMP
Goals The plan proposes the following activities at the whole of forest scale for the purpose of seeking to maintain the current and the long-term viability of the forest products industry and to maintain and increase the ~~provide~~ regional socio-economic benefits.	Amend as shown If there is only a focus on a 'long term' goal there is no need for action to do something about current issues. DFMP currently does not address the existing industry viability.
90 The Conservation Commission and the Department will work with the FPC as appropriate and ~~seek to~~ provide input into decision-making processes that may result in a reduced land base or restricted access to land available for timber harvesting activities. I	Supported Management actions have in the past resulted in a later restriction of access to the forest for timber production
91 The Department will work with the FPC to plan for a log product, location and wood quality mix that ~~supports~~ maintains a viable forest products industry.	Supported. This should also be reflected in the FMP decisions, not just in implementing the FMP. This should also take into account the log delivery cost arising from haulage distances
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.	
92 The Department will: 92.1 maintain understanding of visitor and recreation demand including the knowledge, attitudes and activities of visitors in the area covered by the plan 92.2 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	Supported The Department should also plan its recreation developments so that they are either located in land tenures where future disturbances are minimal or where the disturbing activities are able to be

seeks to meet demand and minimise conflicts with other ESFM values 92.3 consider possible additional areas for off-road vehicle use, in consultation with relevant stakeholders 92.4 work with relevant water agencies and utilities in planning for and managing tourism and recreation activities in water catchment areas 92.5 monitor and manage visitor use, including through regulating and licensing of appropriate commercial activities 92.6 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.	managed around the disturbances.
Goal The plan proposes the following activities at the landscape and local scales for the purpose of seeking to protect visual landscapes.	
93 The Department, the FPC and other proponents where required by the Department, will: 93.1 maintain and implement a visual landscape classification and management system 93.2 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 93.3 make submissions in relation to development proposals that may impact on visual landscapes on land to which the plan applies that are forwarded to them for comment or advice, with a view to seeking to reduce the effect of any proposed activity on the visual quality of the landscape.	FPC implements this system, however it is DEC's system
94 **(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.	Not supported Managing plantations for VRM is largely impractical and not cost effective

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.	
95 The Department will continue to review the access network in consultation with relevant stakeholders	Supported
96 The Department will continue to seek resources to fund essential access infrastructure.	Supported
97 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.	Supported
98 The Department, and 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.	Supported
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.	
99 The Department will seek to ensure that all BRM removals from lands vested in the Conservation Commission: 99.1 comply with relevant legislation, and policies and guidelines which will be reviewed 99.2 contribute to the ongoing implementation of the State Gravel Supply Strategy 99.3 are sourced from a network of (fewer) strategic pits, which it will identify in consultation with relevant government agencies and BRM users.	Supported, on the understanding that haulage is no greater than 20 km.
100 The Conservation Commission will require that all BRM removal from land vested in the Conservation Commission is subject to the provision of certified returns to the Department for removals by the	Supported

government agency or local government authority which has access to and is removing the BRM.	
101 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.	Supported
102 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.	Supported
103 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: 103.1 the timely rehabilitation of all pits to acceptable standards as set by the Department, developed in consultation with relevant stakeholders 103.2 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.	Supported
Goal The plan proposes the following activity 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.	
104 The Department will issue and administer leases and licences for facilities, activities and uses in accordance with the provisions of the CALM Act.	Supported
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 associated with bioprospecting.	
105 The Department will:	Supported

105.1	continue to administer the current agreement with the bioprospecting company	
105.2	contribute to the development of modern bioprospecting legislation.	

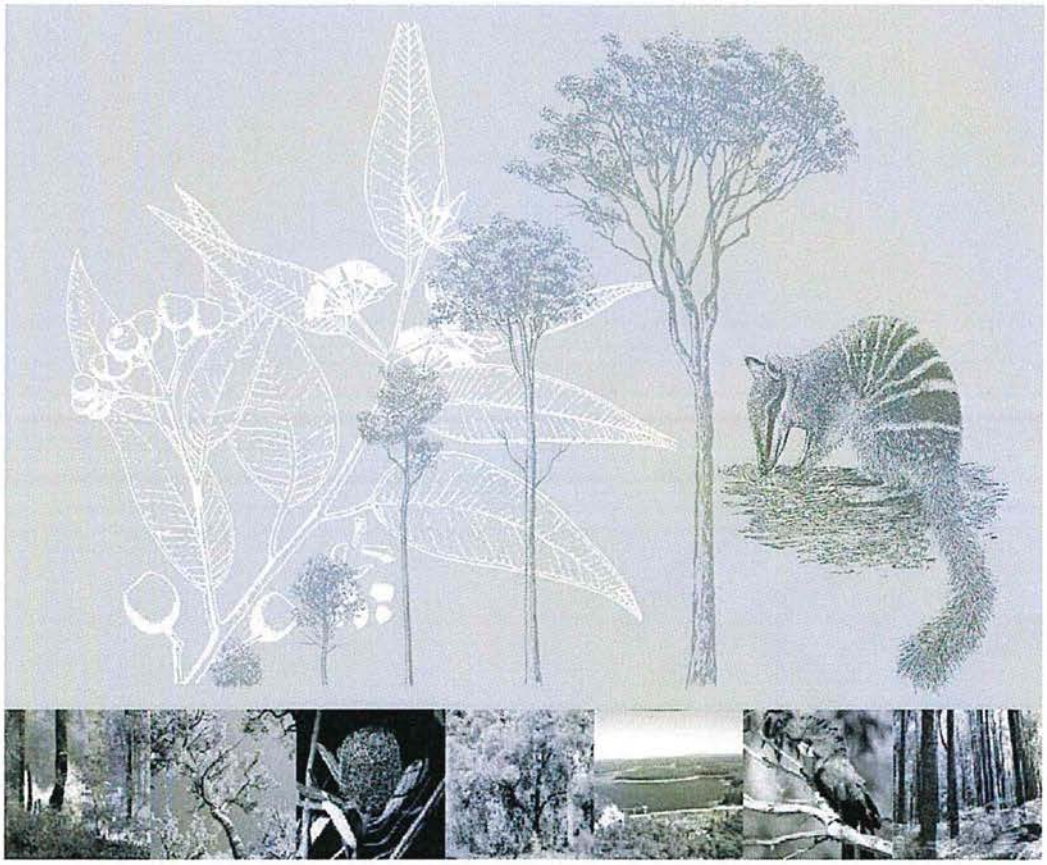
Plan implementation	
Goal The plan proposes the following activities for the purpose of seeking to ensure that management is undertaken in accordance with the plan and is continually improved so as to achieve desired outcomes.	
Goal The plan proposes the following activity at the local scale for the purpose of seeking to ensure potential environmental impacts are identified and addressed in planning for (other) disturbance operations. (For harvesting in plantations and native forest, see the 'Productive capacity' chapter).	
106 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 are to provide sufficient information to enable the Department to evaluate the proposed operations.	Supported
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.	
107 The Department will: 107.1 as the regulator of timber harvesting activities on the area that is subject to this plan, prepare a regulation policy to confirm the regulatory framework 107.2 in conjunction with the FPC, develop and implement formal working arrangements, 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	Supported
108 The Department, FPC and other proponents where required by the Department, will ensure that staff and contractors involved in regulation, supervision and implementation of disturbance	Supported

	operations are competent, including through common training and accreditation programs, as appropriate.	
109	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*.	Supported Where those documents affect FPC's operations, the Department should consult with FPC
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.		
110	The Department, in consultation with the Conservation Commission, will develop a protocol for each key performance indicator in the plan to specify how the measurement of the key performance indicator will be undertaken.	Supported
111	The Department and the FPC will cooperate with the Commonwealth in the implementation of the Montreal Indicators program.	Supported
112	The Conservation Commission, Department and the 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.	Supported. The Conservation Commission should publish its audit results
113	The Department will report audit results to the Conservation Commission and the FPC and publish a summary of audit results.	Supported
114	The FPC will report audit results to the Department and the Conservation Commission and publish a summary of audit results.	Supported
115	The Department, and other proponents where required by the Department, will: 115.1 seek to address knowledge gaps, including through relevant 'benchmarking' activities and	The requirements by the Department of other proponents must be reasonable and practical.

	research programs, as appropriate 115.2 work collaboratively with other agencies and institutions on matters of mutual interest 115.3 maintain programs and activities that seek to ensure the expeditious transfer of new knowledge and understanding into improved management approaches and operational practices 115.4 conduct adaptive management projects in a manner that has regard to an adaptive management policy, to be prepared by the Department.	
116	**(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.	Supported
Goal The plan proposes the following activities at the whole of forest scale for the purpose of seeking to ensure that the plan operations, policies and guidelines maintain their currency		
117	The Conservation Commission and the Department will: 117.1 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 117.2 amend the plan if required according to the CALM and EP Acts 117.3 take action that is reasonable and practicable to address problems identified in management systems	Supported
118	The Department will initiate an expert review of silvicultural practices during the second half of the term of the next FMP. Among other things, the review will have regard to the results from *ForestCheck* and other research monitoring, audits, and adaptive management projects.	An expert silvicultural panel should also examine the silviculture for water and for ecological health.
119	The Conservation Commission will undertake mid-term and end-of-term performance reviews of the extent to which management of land to which the plan applies has been undertaken in accordance	Supported Where a revision of management practices has an

	with the plan, which will include consideration of the extent to which all key performance indicator targets have been achieved. Where performance targets have not been achieved, 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 report to the Minister for Environment. The Conservation Commission will evaluate the need for revision of management practices in the context of its assessment and auditing function, in consultation with the Department, and will provide its advice through the reports on the mid-term and end-of-term performance reviews to the Minister for Environment.	implication for FPC the Conservation Commission should also consult with it.
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.		
120	The Department, and other proponents where required by 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*.	Supported
121	The Department will: 121.1 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 121.2 maintain public consultation processes 121.3 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 121.4 provide a range of opportunities for volunteers to be involved in land management activities.	Supported

ATTACHMENT 2 : Annotated Draft Silviculture Guideline for Jarrah Forest



Sustainable Forest Management Series

Department of Environment and Conservation

Draft SFM Guideline No. 1

Draft - August 2012

Department of
Environment and Conservation

Our environment, our future

1. Table of Contents

2. Framework for this guideline

Purpose

The purpose of this document is to provide guidance on the application of silvicultural practices in those parts of the jarrah forest that are subject to timber harvesting. Guidelines are not prescriptive, but provide the intent and guidance for forest managers.

Scope

This guideline deals with the management of the forest available for timber harvesting and applies to State forest, timber reserve and freehold land that contains indigenous vegetation and which is held in the name of the CALM Act Executive body. The guideline does not cover the identification of informal reserves or other areas from which timber harvesting is excluded, this process occurs prior to the application of silviculture and is referred to in this document as the coupe planning process.

Context

This guideline provides the framework for operational practices which meets those goals of the *Forest Management Plan* (FMP) that are implemented through silvicultural practice. Measures to protect soil, including suitable times to conduct timber harvesting operations, are addressed in SFM Guideline 5, *Soil and water conservation guideline* and subsidiary documents. Detailed guidance on the application of fire to meet silvicultural objectives to promote regeneration and protect established growing stock from damaging bushfires can be found in the *Jarrah Silvicultural Burning Manual* – SFM Manual 4.

The purpose of this document is to provide guidance on the application of silvicultural practices in those parts of the jarrah forest that are subject to timber harvesting. This guideline provides guiding principles, rationale and strategies, and supporting manuals are intended to provide detail regarding operational practices.

Separate guidelines apply to the karri forest and to the wandoo forest. Silvicultural practices for mixed jarrah / karri / marri forest are covered in the karri guideline.

Custodianship and management of this guideline

This guideline is a controlled document. The custodian is the Manager of the Forest Policy and Practices Branch of the Sustainable Forest Management (SFM) Division of DEC.

Scale and application of silviculture

As in the FMP, this guideline recognises three scales of management which are as follows:

- Whole of forest – all land categories that are subject to the plan.
- 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 block or an aggregation of forest blocks. Landscape scale could span a few thousand to more than many tens of thousands of hectares..
- 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.

Comment [BG1]: The range in scale of the local management area makes it diffcult ot understand its application in specific strategies

Silviculture is usually applied at the local scale with a silvicultural objective selected appropriate to the condition of the local forest. However, silviculture is also guided by the condition of the forest at the landscape scale and seeks to provide for sustainable forest management at the whole of the forest scale.

This document includes twenty four guiding principles that provide the framework of silvicultural practice in the jarrah forest. A guiding principle is a statement that communicates a basis for management decisions. This guideline will be finalised in parallel with the finalisation of the Forest Management Plan 2014-2023 and will be consistent with the settings adopted for the final Forest Management Plan 2014-2023.

3. Legislative requirements

The legislative controls in relation to silviculture in Western Australia are found in the relevant State and Commonwealth Acts and regulations. The following table summarises the State government legislation.

Title of Act or Regulation	Relevance of legislation	Responsible agency
Aboriginal Heritage Act 1972	Under this Act the Department is required to report Aboriginal heritage sites and ensure that sites are protected.	Department of Indigenous Affairs
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 "off label" permits for unregistered pesticide. Regulations related to pesticide application will be covered through compliance with the *Code of Practice for the use of agricultural and veterinary chemicals in Western Australia.*	Department of Agriculture and Food
Bush Fires Act 1954	Regulates the control of bushfires and the use of prescribed fire	Fire and Emergency Services Authority
Conservation and Land Management Act (CALM Act)	DEC's activities are exempt from requiring a clearing permit where the management is in accordance with the CALM Act. This exemption applies to all land within the FMP area that is managed in accordance with an approved management plan.	Department of Environment and Conservation
Country Areas Water Supply (CAWS) ***Act 1947***	This act governs the construction, maintenance and administration of reticulated supplies of water to country areas, to safeguard water supplies, and influences the Department's activities in gazetted catchments.	Department of Water
Environment Protection and Biodiversity Conservation Act 1999 (Commonwealth)	Provides for the protection of the environment, particularly those aspects considered to be of national environmental significance (NES matters). Seeks to promote ecologically sustainable development through conservation and ecologically sustainable use of resources. Promotes conservation of biodiversity. The Act exempts RFA forestry operations from environmental approvals under Part 3 of the Act dealing with actions that will or are likely to have a significant impact on NES matters, e.g. listed threatened species, when done in accordance with a Regional Forest Agreement.	Department of Sustainability, Environment, Water, Population and Communities (Commonwealth)
Environmental Protection Act 1986 *(EP Act)*	This act provides for the protection of the environment across the State. Relates to the prevention, control and abatement of pollution and environmental harm. It is to ensure the conservation, preservation, protection, enhancement and management of the environment, and may relate to any contamination caused by hydrocarbons from machinery and pesticides.	Department of Environment and Conservation and Environmental Protection Authority

Title of Act or Regulation	Relevance of legislation	Responsible agency
Forest Products Act 2000 *(FP Act)*	Clearing of vegetation maintained, or established and maintained, under the FP Act, or native forest harvested under a production contract or road contract, is exempt from the EP Act clearing permit requirements.	Forests Products Commission
Health Act 1911	Applicable to any pesticides used by the crown within a PDWSA. The restrictions on pesticide use are specified in Public Sector Circular 88 (PSC 88).	Department of Health
Heritage of Western Australia Act 1990	This Act provides for the registration and protection of places of historic interest on lands as 'heritage places'.	Heritage Council of Western Australia
Metropolitan Water Supply, Sewerage and Drainage Act 1909 (MWSSD Act)	This Act and the CAWS Act (above) and their associated by-laws are used to proclaim Public Drinking Water Source Areas (PDWSA). These may be referred to as water reserves, catchment areas or underground water pollution control areas. There are also requirements that relate to the use of pesticides in PDWSA (see *Health Act*, above). All operations in PDWSA are required to comply with *Statewide Policy No.2 Pesticide use in PDWSA*.	Department of Water
Rights in Water and Irrigation Act 1914	This act relating to rights in water resources, to make provision for the regulation, management, use and protection of water resources, and influences the Department's activities in relation to the taking and storage of water.	Department of Water
Soil and Land Conservation Act 1945	Provides for the conservation of soil and land resources. It includes the mitigation of the effects of erosion, salinity and flooding. This Act covers crown land. The Commissioner may advise a Government department or public authority in regard to the care or use of Crown lands which have lead to land degradation.	Department of Agriculture and Food
Wildlife Conservation Act 1950	Relates to the conservation and protection of indigenous flora and fauna on all lands and waters within the state. Provides for protection of threatened species.	Department of Environment and Conservation

4. Summary of guiding principles for silviculture in the jarrah forest

Guiding principles for biological diversity	
1.	Key structural features that provide biological legacies will be retained in silviculturally managed forests.
2.	Knowledge of natural disturbance regimes will be used to guide the size and intensity of silvicultural practices to ensure they contribute to the maintenance of landscape heterogeneity.
3.	Silvicultural practices will contribute to maintenance of landscape connectivity.

Guiding principles for ecosystem health and vitality	
4.	Promote resilient stands on sites with high levels of overstorey mortality.
5.	Promote resilient ecosystems on sites infested with *Phytopthora cinnamomi*.
6.	Fire will be used to reduce high fuel loads that may occur as a result of silvicultural practice.
7.	Maintain forest nutrient cycling processes.
8.	Promote ecosystem health and vitality through silvicultural treatment.

Guiding principles for soil and water	
9.	Water and quality and availability will be maintained or enhanced by silviculture treatment.
10.	Soil values will be maintained and protected in silviculturally managed forests.

Guiding principles for climate change and carbon cycles	
11.	Forests will be managed to ensure that local actions will contribute to global carbon cycles.

Guiding principles for productive capacity	
12.	Ensure the most appropriate silvicultural objective is selected for each stand.
13.	Regeneration and tree growth will be enhanced through actions to alleviate competition on regeneration and selected trees.
14.	Endemic regeneration will be used wherever possible.
15.	Silvicultural methods will reflect the site potential and developmental stage of the forest.
16.	Where the canopy is removed in gaps the forest will be regenerated in a timely manner.
17.	A grouped forest structure will be perpetuated at the local scale.
18.	Trees to be retained will be marked and protected from damage.
19.	Fire sensitive regeneration will be protected from fire.
20.	Forest areas that are killed or damaged by fire or other vectors may be restored or salvaged where necessary.

Guiding principles for heritage	
21.	Minimise disturbance to Aboriginal cultural heritage sites.
22.	Minimise disturbance to other Australian cultural and natural heritage sites.

Guiding principles for socio-economic benefits	
23.	Visual landscape management will be used to reduce the impact of silvicultural treatments on visual amenity.
24.	Post-harvest treatments will be prioritised according to the benefits likely to be realised.
25.	A commercially viable timber industry

Comment [BG2]: Unclear why this is a socio-economic principle

5. Guiding principles for biological diversity

Overall objective

Conserve biodiversity and self–sustaining populations of native species and communities, manage disturbance to a scale across the landscape which enhances overall biodiversity and facilitates the recovery of biodiversity form disturbance operations.

Within the area covered by the FMP, biological diversity is supported through formal reserves, selected to be comprehensive, adequate and representative of communities, the multiple use forest area and informal reserves and fauna habitat zones. Together these areas represent a significant continuous area of forest cover. The small proportion subject to annual disturbance operations , disturbance has some impact on the biodiversity, including enhancing habitat values for some species and disadvantaging others. Over time the disturbed area will move towards the biodiversity composition of undisturbed forest (Abbott quote) This can be readily colonised from surrounding forest through the maintenance of the structural complexity and heterogeneity of the forest at multiple spatial scales, which facilitates the movement of genetic material(?) and individuals.

Disturbance should not be considered as being adverse to biodiversity as it provides opportunities for some species. However the scale and intensity of disturbance are important dimensions to the rate of restoration of the long undisturbed condition.

The key aspects of this objective are to manage the scale of any disturbance event within a landscape context, and to assist the transition following disturbance by retaining sufficient of the ecosystem components which take a long time to replace.

Guiding principle 1

Key structural features that provide biological legacies will be retained in silviculturally managed forests. Forest components and features which are slow to be replaced (>25 years) are retained at a rate to assist in the development of biodiversity following disturbance

Comment [BG3]: it should also be recognised that disturbance enhances biodiversity. Being a part of the forest ecology disturbance creates opportunities for a number of species.

Comment [BG4]: In some cases recolonisation is unnecessary as the species are not displaced.

Comment [BG5]: This term is unclear. Suggest it is reworded.

Rationale

The occurrence of late structural stage or long-lived structural elements of the forest such as over-mature trees (over-storey trees which have begun to senesce and are likely to contain or develop hollows), mid-storey trees and shrubs; and large coarse woody debris can be reduced in areas subject to timber harvest. Attention is required to ensure the retention of these important elements of forests. These elements, referred to as legacy elements, are important contributors to structural diversity, connectivity and heterogeneity at the local scale.

Over-mature trees with hollows provide perching, nesting and roosting sites for a wide range of hollow dependent species. To retain a supply of hollow bearing trees, mature trees beginning to senesce must also be retained to supply tree hollows when the current cohort of over-mature trees collapse. This creates a cycle with collapsed trees providing ground hollows, habitat for fauna and substrate for saproxylic communities and cryptograms. All are important in maintaining the species richness of the forest.

Retention of legacy elements can mitigate the impact of the application of silviculture, by supplying a continuity of mature habitat across the landscape and reducing the recovery time following harvesting for fauna and flora populations reliant on these elements. Retention of these elements requires that they are clearly identified so that they can be protected both during harvesting and in post-harvest silvicultural treatments. Significant physical damage to retained elements could reduce

hollow numbers or threaten tree survival. Conversely, some damage to the crown of potential habitat trees may increase the likelihood of trees developing hollows.

Mid-storey trees and shrubs contribute to food resources and habitat for fauna and contribute to structural diversity. The silvicultural methods developed for jarrah often involve mechanical disturbance to vegetation and soil to reduce competition with jarrah advance growth, or to enable jarrah seedlings to establish. These disturbances can have short term impacts on understorey species richness and abundance. Avoiding unnecessary disturbance to the soil and the understorey helps to ensure a balance between achieving regeneration of the overstorey and the impact on other vegetation.

Strategies

1. Retain a selection of trees that have a moderate to high probability of bearing hollows ensuring that the pattern of marking includes a variety of arrangements (habitat trees).
2. Retain selected trees ~~that have a low to moderate probability of bearing hollows at the time of treemarking, but provide for the sustained availability of hollows through time in areas where regeneration is released by creating a gap~~ that will in the future have potential to qualify under 1 (potential or future habitat trees).
3. Retain a selection of large standing dead trees where they do not pose a safety risk.
4. Retain patches of standing dead trees in areas ~~where sawlogs are to be salvaged~~ in forest salvaged following natural disturbance.
5. Retain a selection of hollow logs and large diameter logs.
6. Retain large balga (*Xanthorhoea preisii*) where present and exclude balga thickets from silvicultural treatments.
7. ~~Physical or chemical removal of the~~ Retain mid-storey shrubs and small tree species (such as Persoonia *spp., Banksia spp. and Allocasuarina fraseriana*) ~~will only be undertaken~~except where their removal ~~it~~ is important for the establishment and survival of regeneration of overstorey tree species or for the continued growth of crop trees.
8. Identify and protect selected underground cavities suitable as fauna refuges.
9. Remove debris away from habitat elements when the combination and arrangement of fuels are such that the risk of damage threatens their long term survival.
10. Preference to habitat treemarking will be given to trees that include nests of threatened fauna species where these have been identified during pre-harvest checks or observed by the tree marker on-site.
11. Retain large marri (> 70 cm diameter with a senescent crown) additional to other requirements for habitat tree retention. In areas of the jarrah forest where large marri are relatively low in abundance, retain marri 50-70 centimetre diameter with a healthy crown and marri > 70 cm diameter, where practicable. Provided not additional to total habitat tree numbers

Comment [BG6]: This is of some concern as to how these are to be located and marked.

Comment [BG7]:

Comment [BG8]: very unclear as how this is to apply or the basis for requiring additional marri. Perhaps we should just be saying that where they exist they should be preferred for 1.

Guiding principle 2

Knowledge of natural disturbance regimes will be used to guide the size and intensity of silvicultural practices to ensure they contribute to the maintenance of landscape heterogeneity

Rationale

The natural or virgin jarrah forest occurs as a multi-aged forest with stands or individuals of different regeneration age generally occurring as a fine mosaic (what does this mean?). Even-aged stands are usually relatively small in area, however there are exceptions. Past silvicultural practices

and/or large scale disturbances such as bushfires have created some large areas of even-aged regrowth. (even these will have remnant mature elements, and 'legacies') For the most part, natural disturbances have helped to create diversity in forest structure at a range of spatial and temporal scales. Today, most of the forest consists of a mosaic of stands at different structural stages, resulting from previous natural and human disturbances. This complex diversity of structures across the landscape contributes to the biological diversity of the forest, with some species favoured by the habitat of early development structures, others by the later stages and others by a combination of two or more. Providing a mix of structural types across the landscape can encourage a wide variety of habitats and plant and animal communities, and thus, enhance ecosystem resilience.

Natural disturbances leading to changes in stand structures include stand replacing bushfire, storm damage, frost, drought, insect attack, and tree deaths in senescent stands. Adaptations to these natural disturbances enable the forest to respond and recover. Where canopy openings are sufficiently large, the forest regenerates and progresses to later developmental stages until the cycle starts over again.

The highest intensity disturbance in the forest is mining, converting the existing mosaic to a single development stage, with very little structural diversity and no legacy elements. Harvesting gaps to release regeneration also impacts on forest structure where the mature forest structure is converted to the establishment stage. However, the impact of disturbance from timber harvesting is mitigated by the application of a number of strategies to ensure structural diversity is maintained - as outlined in Guiding Principle 1. No disturbance or large or repeated stand replacing disturbances may reduce ecosystem resilience by simplifying the landscape. Silvicultural management strategies ensure that the forest landscape continues to provide a mosaic of development stages to maintain biological diversity. The intensity and size of disturbances and ~~combined extent and interval between disturbances~~their separation in space and time are considered.(considered what?)…are important considerations in managing for maintaining biodiversity at a landscape scale.

Use of temporary exclusion areas (TEAS) together with the formal, informal and fauna habitat zone reserve systems ensures that mature refuges are available. Once the forest has developed sufficiently to allow species to re-occupy the regenerating forest, then structure modifying disturbance in the TEAS can occur.(Not sure what this means, TEAS were originally a mechanism for restricting gap size, if they are mechanism for ecosystem recovery how do we judge the time scale?)

~~There are currently limited markets for non-sawlog logs that can arise as a consequence of harvesting sawlogs. There is a possibility that some markets may become available and as a result, harvesting disturbances could intensify~~ While currently areas which would otherwise be regenerated are selectively harvested, if markets become available much larger areas could be more intensively disturbed and gaps created.~~.~~ In this case TEAS can be used to ensure that the local impact of more intensive harvesting is reduced to an acceptable level.

Strategies

General forest area

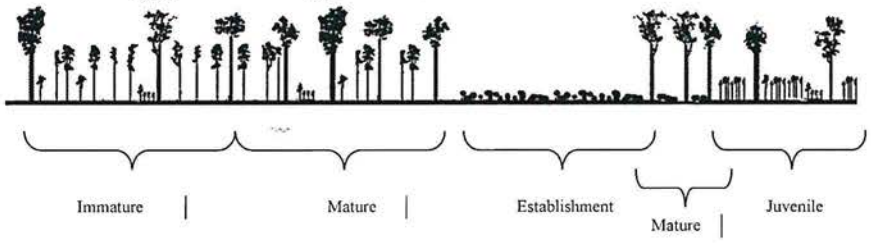
- Existing heterogeneity, structural diversity and connectivity of the jarrah forest will be maintained through the application of a range of silvicultural methods. Silvicultural objectives will be selected for each stand based on the structural development stage, regeneration status, existing impact of disease and practicality of management (this will also contribute to maintaining an uneven-aged structure at the local scale and will contribute to Guiding Principle 2 & 3).
- Gaps will be limited in size to no more than 10 hectares (this strategy also contributes to Guiding Principle 2 & 3). In areas of forest where the predominant silvicultural objective applied was shelterwood (regeneration establishment) and where regeneration could be released

across wide areas, structural diversity will be provided by TEAS to limit gap size. Harvesting of TEAS may occur once the regeneration is at least 10 years old depending on the visual landscape classification.

- Where harvest intensification from increased utilisation of non-sawlog material is likely over extensive areas, silvicultural treatment can be staged over time through the use of TEAS to ensure that no more than 60 per cent of a local scale management unit is reduced below the thresholds in Appendix 1, in any 10 year period.
- Reduction of competition from the mid-storey and small trees is only to take place where it is required to release overstorey regeneration and where this is undertaken, mid-storey and small trees may be reduced in numbers, but they must be retained as a component of the stand.√
- When reducing rootstock competition to assist establishment of overstorey regeneration, limit soil treatments to a maximum of 50 per cent of the harvested area, to ensure re-sprouting species are maintained as part of the flora composition of the stand.
- Where possible, silviculture burns will be planned to create a mosaic of burnt and unburnt patches and persistence of a diversity of understorey structures.
- Retain advance growth of varying ages in areas of gap creation. √
- Silvicultural treatments in forest isolated in agricultural landscapes will be staged over time to ensure the entire isolate is not subject to harvesting disturbance in any one harvesting event. A maximum of 50 per cent of each forest type that occurs in the isolate may be harvested at any one time. Where the isolated area is less than 400 ha, it will be managed in two approximate halves, with subsequent harvesting permissible after 10 years.√

Additional strategies for forest subject to mining

- The timing of silvicultural treatments will be managed to prevent greater than 40 per cent of the landscape scale area being in the establishment to immature developmental stages at any one time.
- Schedule thinning of the non-mined forest to reduce water use during times when more than 20 per cent of the landscape scale area is in establishment and juvenile stages during the mined site rehabilitation process.√
- Manage the local scale management unit to retain the structural indicators of biodiversity (see Guiding Principle 1).√
- Carry out variable density thinning on rehabilitated mine sites to increase structural diversity and reduce water use.
- Mining rehabilitation to encourage the preservation of legacy elements in mining rehabilitation (this goes in guiding principle 1)



Note: the developmental stage is the predominant age in that stand, for example there may be mature trees present, but if the predominant age of trees in the stand is juvenile, then the areas is classified as juvenile and vice versa. What is the diagram referring to?

Comment [BG9]: Is this suggestion that TEAS are required for shelterwood areas? Not supported.

Comment [BG10]: Not supported, significant management implications are possible

Comment [BG11]: This is critical to know what is a local management unit

Comment [BG12]: This compromises silvicultural objectioves. Where burn is essential for silviculture it should not be planned on a mosaic basis

Comment [BG13]: In principle agree

Guiding principle 3

Silvicultural practices will contribute to maintenance of landscape connectivity

Rationale

Landscape connectivity is the degree to which the landscape facilitates or impedes movement among resource patches??(unsure of this term). Connectivity is achieved by creating functional or structural linkage of habitats, communities and ecological processes. The exchange of individuals or genes among populations in different habitat patches influences both dispersal and genetic diversity and is an important consideration for persistence and resilience of populations, as well as for recolonisation following disturbance. Connectivity is particularly important in light of human induced climate change, as species or communities may need to reposition themselves in the landscape. Connectivity can be supported in the multiple use forest area through maintaining habitat at multiple spatial scales. Patches of forest to which silvicultural treatments are not applied are retained in the form of informal reserves such as stream zones, fauna habitat zones and other areas excluded from operations (this sentence is back to front). Heterogeneity at the landscape scale avoids the creation of barriers to biological and ecosystem processes, including the physical movement of species or their propagules within the landscape. Connectivity is also maintained through the imposition of limits to the application of silvicultural treatments. Some species have a preference for particular structural elements, so large areas of a single structure within the forest should be avoided. Therefore, silvicultural practices seek to mimic the size and intensity of natural disturbances to which native flora and fauna have evolved to withstand (see strategies listed against Guiding Principle 2).

The scale and intensity of disturbance that would represent a barrier to biological and ecosystem processes varies from species to species, and the degree to which the disturbance alters the structure of the forest at the local scale. At the local scale, silvicultural treatments retain structural complexity to encourage the persistence and recolonisation of treated forest (for example, the retention of habitat trees, logs, understorey and overstorey elements see Guiding Principle 1). The retention of these elements provides habitat for species which may have limited dispersal, such as endemic saproxylic communities occupying large diameter logs.

A significant risk to connectivity in the multiple use forest area is mining, which significantly alters the structure and function of the forest for many decades. Connectivity can be supported by managing the forest surrounding mined areas to offer a means of dispersal around the disturbance, until connectivity is re-established. Avoiding harvesting to a regeneration objective in the vicinity of recently rehabilitated minepits. The strategic location of TEAS can ensure opportunities to retain structural diversity and heterogeneity at the local scale, supporting connectivity.

Strategies

- TEAS will be established to provide structural diversity and heterogeneity within the landscape. They may act as both a refuge and source of individuals or genetic material for recolonisation of treatment areas (this strategy also contributes to Guiding Principle 2).
- Habitat elements will be retained in harvested coupes to provide structural diversity and provide connectivity for species which require legacy elements for their life cycle (this strategy also contributes to Guiding Principle 1).√
- Where thinning is an appropriate silvicultural treatment to apply to large areas of even-aged forest, variable retention thinning may be used to increase heterogeneity and structural complexity.

- Shelterwood or dieback selective cut may only be applied to a maximum of 60 per cent of the local scale area.This is likely to have very substantial impacts on harvesting operations. Very difficult to see any benefit. Not supported.

6. Guiding principles for ecosystem health and vitality

Overall objective

Use silvicultural treatment to mitigate the impacts of abiotic, biotic and anthropogenic stressors on the health and vitality of the forest.

Threats to the health and vitality of the forest will be identified and prioritised. Where possible, threats or damage from stressors will be avoided or mitigated through silvicultural treatment.

Guiding principle 4

Promote resilient stands on sites with high levels of overstorey mortality or stress

Rationale

Climate change has the potential to impact on forest health. Competition for water may lead to drought related deaths of trees and other vegetation, particularly on shallower soils and others with low water holding capacity. The predicted increased incidence of extreme weather events may also lead to an increase in tree deaths from bushfire, storm and frost. Disease and insect attack may also have detrimental impacts on forest health. Water stress may predispose trees to insect attack and compromise their ability to recover from damage. Thinning stands subject to water stress increases the resources available to the retained trees and associated vegetation. This improves health and vigour and may reduce the risk of drought related deaths, and help enhance the trees natural defences in the face of insect and disease attack. Should myrtle rust enter Western Australia, both the increased vigour of trees due to thinning and the effect that a more open canopy has on relative humidity may reduce the incidence or intensity of infections.

Within any population there are individuals who display resistance or resilience to stressors. Silvicultural treatments should identify and retain these individuals to improve representation of resistant genes in the overall population.

Strategies

- Individual trees or groups of trees that exhibit resistance to disease or the effects of insect outbreaks (such as Jarrah Leaf Miner or Gumleaf Skeletoniser) should be marked and protected from damage during timber harvesting operations.√
- Select seed trees based on their form and vigour, together with their capacity to provide a crop of seed.√
- Reduce stand density in stands subject to water stress to assist with adaption to a drier climate.√
- Adaptive management trials to investigate the rehabilitation of sites with significant tree deaths may be approved by the Senior Silviculturist.√

Guiding principle 5

Promote resilient stands on sites infested with *Phytopthora cinnamomi*

Rationale

Timber harvesting that removes a proportion of the overstorey trees reduces site water demand and may lead to increased availability of soil water. It is hypothesised that this change in water availability, coupled with higher soil temperatures from reduced canopy cover, may increase *Phytophthora cinnamomi* lesion growth in infected trees. *Phytophthora cinnamomi* impacts on the forest vegetation differently depending on a number of factors, including the abundance of susceptible plant species present, soil characteristics, drainage and climate. These factors can be used to predict the likely impact of the pathogen in different vegetation types should it become established. The predictions of impact are classified as either low, moderate or high. Low impact sites are those where few susceptible species are present and if the pathogen was introduced, it would be evident as a few scattered deaths in the understorey. Moderate impact sites are those where deaths are predicted in most susceptible understorey species and up to 10 per cent of the overstorey. High impact sites are those with a major component of susceptible species, where deaths are predicted to occur in most susceptible understorey and more than 10 per cent of the overstorey trees.

It is thought that less intensive disturbance on potential high impact sites may reduce the likelihood of generating conditions favourable to the activity of the pathogen and contribute to resilience.

On sites where the current impact of the pathogen is high, the ability of the site to recover from disturbance is likely to be lower than in healthier areas of forest. Disturbance in these areas needs to be carefully planned and should be directed to ensuring that the site is rehabilitated with resistant species or genotypes.

Strategies

- On sites expressing high disease impact, restrict harvesting and vehicle access to exclude areas where the live basal area is less than 18 m2/ha. Not aware of evidence. This will have a significant impact on accessing these sites and timber yields. Not supported in the absence of any evidence
- Where site characteristics predict high disease impact on un-protectable forest areas, a basal area of at least 15 m2 of live trees will be retained. Retention preference will be for healthy trees, tree species that are not susceptible to Phytophthora cinnamomi, or individual trees that appear to be resistant to Phytophthora cinnamomi.
- Do not cull trees where the impact of dieback is predicted to be high.
- Where possible, encourage and protect natural regeneration on high impact disease sites and/or use dieback-resistant jarrah for regeneration.
- Adaptive management trials to investigate the rehabilitation of high impact sites may be approved by the Senior Silviculturist.

Guiding principle 6

Fire will be used to reduce high fuel loads that may occur as a result of silvicultural practices

Rationale

The quantity of combustible material on the forest floor after timber harvesting and silvicultural treatments is often increased above the range normally experienced through natural leaf litter and woody debris accumulation. Timber harvesting removes tree boles in the form of logs; however the tree crowns and other un-saleable material remain on the forest floor. The increased fuel load increases the risk of high intensity fire, which may be detrimental to biological diversity and other values.

Silvicultural practice in the jarrah forest involves fire exclusion and protection of developmental stages which are fire sensitive. The period of fire sensitivity for regenerating jarrah is variable and depends on the intensity of the fire. For a low intensity burn (< 120 kW/m), the regeneration should have reached the sapling stage and be at least 15 cm in diameter. This typically equates to a fire exclusion period of between 10 and 20 years. At the conclusion of this period, fuel loads are usually high and the canopy height is low, resulting in an increased risk of high intensity fire.

Strategies

- Tree felling to achieve silvicultural objectives will be followed by prescribed fire to reduce fuel loads. When cutting to gap or shelterwood fire should be introduced as soon as possible after harvesting ceases.
- Prescribed low intensity fire will be reintroduced into jarrah stands as soon as possible after the fire sensitive period for regrowth has passed i.e. at least 125 stems per hectare have developed sufficient height and bark thickness to tolerate fire.

Guiding principle 7

Maintain nutrient cycling processes

Rationale

The soils of the jarrah forest are generally infertile and growth of the forest is often limited by nutrients. Nutrient cycling within the forest conserves and recycles nutrients and prevents their loss from the system. Nutrient release from the breakdown of leaf litter occurs at a slow rate. Fire plays a positive role in the nutrient cycling, although some nutrient (mainly nitrogen) is lost to the atmosphere by the burning of litter and understorey. However, fire releases organically-bound nutrients in the litter into available inorganic form and promotes the regeneration of nitrogen fixing understorey, which not only fix nitrogen from the atmosphere but also increase the rate of decomposition and mineralisation of the litter. The removal of nutrients in sawlogs constitutes only minor losses to the system, relative to the stores of readily extractable nutrients in the soil. However, excessive removal of biomass from forest stands has the potential to impact on soil organic matter levels and may impact nutrient cycling. Proposals that include the removal of bark

and leaf material have greater potential to impact on soil nutrient and organic matter levels than those only removing bole material.

Strategies

- Planned fire will be used to manage fire regimes so as to minimise the extent of intense bushfires, which can result in large loses of nutrients from the ecosystem and accelerated soil erosion.
- Undertake silvicultural burns at a time after harvesting that allows leaf litter produced by the harvest to decompose prior to burning. (do you mean decompose or to allow leaching of nutrients?)
- Undertake prescribed burning operations in regeneration areas once the fire sensitive period has passed.
- ~~Prevent the removal~~Retain ~~of~~ leaf and fine branch material as residue products from forest harvesting operations.
- Prevent soil erosion by limiting soil disturbance and prevention of high intensity fire.

Guiding principle 8

Promote ecosystem health and vitality through silvicultural treatment

Rationale

This guiding principle is also referred to as 'silviculture for ecosystem health'.

Climate change is a significant threat to forest health.

Jarrah is a long lived species (up to 400 years) and the jarrah forest that occurs today is the product of past climatic conditions, natural events and past management. Over the last forty years, a marked drying trend is evident with average temperature increases of 0.8 ^{0}C and average annual rainfall reduced by around 15 per cent. Jarrah has evolved to be competitive for water and accesses water deep in the soil profile to survive the long dry period that occurs in summer and autumn each year. Therefore, on sites with a deep soil profile, the survival of jarrah is unlikely to be an early indicator of climate change.

Mitigating the effects of reduced rainfall and higher temperatures on the jarrah forest and associated ecosystems will require adaptive action. Water availability within the forest is one of the key drivers of vegetation patterns and the types and abundance of fauna. Groundwater monitoring shows that water tables in the northern jarrah forest fell by around 0.2 metres per year over the 35 years to 2011, and stream flow reduced by 12 to 50 per cent in the period 2004 – 2009 relative to 1975-2003 period. As a result, many permanent streams have become ephemeral and most ephemeral streams now rarely flow. There is also likely to have been an impact on ecotypes dependant on shallow water tables.

Both temperature and water availability are directly linked to the provision of refugia in the landscape. (don't understand) Action to align forest density with current and future climate is a practical way to assist forest ecosystems to adapt to climate change. Targeted action may retain water availability in some parts of the forest and allow for the persistence of ground and surface water dependent ecosystems in these areas.

A reduction in stand density has the potential to mitigate other risks associated with climate change. Reduced inter-tree competition improves tree vigour and reduces tree susceptibility to pest attack.

Concurrently, a reduction in stand density also makes more water available for the understorey and therefore assists the broader ecosystem to adapt to climate change.

~~The juvenile and immature development stages of jarrah may~~Unthinned even-aged stands of juvenile and immature regroath have been demonstrated to use more ~~greater~~ water ~~use~~ than older growth stages. Within a local land management unit the amount of regeneration ~~At a catchment scale~~ may be ~~another~~ an option to ~~increase~~ avoid reduced water availability ~~is to~~by limiting the amount of forest in the juvenile and immature development stages.

The strategies below are not proposed to be applied to the forest as a whole, but provide an option where it identified there is the potential and resources to protect an ecosystem or high value asset at risk. For example, thinning to reduce fire risk and prescribed burning could be used to help protect granite outcrops. Water dependent refugia could be identified and protected through targeted reductions in stand density to maintain or restore groundwater level or streamflow. Local areas subject to disease or insect attack could be thinned to help promote recovery.

Strategies

- Identify refugia, threatened flora communities and ecological communities at high risk of adverse impact from climate change and undertake 'silviculture for ecosystem health' in the surrounding area to protect and support their persistence, value and/or recovery.
- Identify catchments or Land Management Units (LMU) at high risk of adverse impact from climate change and undertake 'silviculture for ecosystem health' to protect and support these areas.
- Reduce stand density (Stand densities need to be significantly lower than those appendix 3) on mid and lower slopes of catchments with water dependent ecosystems which are subject stress from declining groundwater level or streamflow.
- In young stands with a high stand density, undertake early age thinning from below to promote tree development to more quickly attain characteristics of mature forest and a water balance in line with current and predicted future climate.
- Reduce stand density, if necessary with high levels of culling, in selective cut areas with a high stand density.
- Reduce stand density to promote recovery in high density stands that are subject to insect and disease damage (except dieback).

7. Guiding principles for soil and water

Overall objective

Protect soil and water resources in order to sustain the foundation for diverse, productive and healthy forest ecosystems, and to provide water for consumptive uses.

The effect of forest cover on soils and water quality is positive. By regenerating forests after harvesting, soils are stabilised, water and wind erosion is prevented and nutrient cycles are maintained. Water quality is maintained and water flow moderated. Disturbance, particularly roading, can be detrimental to soil and water values. Management controls on these operations should limit potential harm.

Guiding principle 9

Water quality and availability will be maintained or enhanced by silviculture treatment

Rationale

A drying climate affects water availability for both human needs and for natural ecosystems. It may become necessary or desirable to actively manage the water use of forested catchments in order to maintain water supply both for consumptive use, and for surface and groundwater dependent ecosystems of particular conservation value (GP 8). Water use by vegetation can be moderated by reducing the density of overstorey trees and understorey vegetation, and limiting the proportion of the catchment in young development stages, which typically have higher water use.

Reducing stand density provides for an increase in water availability by reducing water use for a period. In juvenile and immature stands, thinning is followed by increased growth of the retained trees and crown expansion, so following a single treatment the reduction in water use is temporary, but can be up to 25 years. The juvenile and immature stages of development may have higher water use than older growth stages. Where a large proportion of a catchment is in the juvenile and immature stages (i.e. approximately 9-120 years), higher water use may result in reduced surface and ground water availability for both biota and human needs. Active catchment management, through limiting the area of the catchment in juvenile and immature stages and/or thinning trees in these stages, can be used to reduce water use and increase water availability.

Areas lower in the landscape are frequently affected by dieback. In these cases there may be a conflict between the protection of the forest from an intensification of the disease and the objective of increased water yield. Where water production values are high or the disease impact is already high, measures to maintain a low stand density to improve water yield are considered acceptable.

Some forested catchments are sensitive to salinity and special measures need to be taken in these areas to protect water quality. Limiting the extent of timber harvesting in these catchments reduces the risk of subsequent stream salinity. Water quality can also be affected by contamination from chemicals (herbicides and fuel oils) if they are used incorrectly or spilled in the catchment. Care needs to be taken to ensure that chemicals are used in accordance with best practice.

Strategies

- Water availability may be managed in forested catchments by either thinning juvenile or immature stands and/or by limiting the proportion of the catchment in the juvenile and

immature stages of development. Catchment management plans will be required where any proposal seeks to reduce stand density below that provided for in this guideline or where it is considered that an excessive proportion of the catchment will be in the juvenile and immature stages of development. Catchment management plans will address all forest values.

- Protect water quality from salinity in high salt risk catchments through increased stream reserves, phased harvesting within second order catchments and a minimum cutting cycle interval of 15 years.
- Protect water quality from salinity in salt sensitive catchments through, phased harvesting within second order catchments and a minimum cutting cycle interval of 15 years.
- Use best practice when using or applying chemicals as guided by regulations and the Code of Practice for the use of agricultural and veterinary chemicals in Western Australia.
- Pesticides will only be used where there is, in the view of the Department, no practicable alternative.

Guiding principle 10

Soil values will be maintained and protected in silviculturally managed forests

Rationale

The success of shelterwood operations is dependent on having a viable seedbed to facilitate the germination of seedlings. Soil damage not rehabilitated after timber harvesting can reduce seedbed quality and reduce regeneration. Soil treatments such as scarification and/or ripping with a machine can be used to rehabilitate damaged soils and improve the area of receptive seedbed available for regeneration. However, care needs to be taken to ensure the rehabilitation operations do not cause adverse impacts on soil values.

Strategies

- Rehabilitation of soil damaged on extraction tracks will be timed to occur prior to the post-harvest burn for all shelterwood operations.
- When reducing rootstock competition to assist establishment of overstorey regeneration in shelterwood operations, limit soil treatments to a maximum of 50 per cent of the harvested area.
- Refer to the Soil and Water Conservation Guideline for further strategies for management of soil and water values.

8. Guiding principles for climate change and carbon cycles

Overall objective

Within the constraints of a changing climate, forests available for timber harvesting will be managed to sustain the contribution to global carbon cycles.

Wood production from native forests provides an opportunity to contribute to climate change mitigation through storage of carbon in forests, storage of carbon in forest products, replacement of fossil fuels and replacement of high-embodied energy alternatives.

Guiding principle 11

Forests will be managed to ensure that local actions will contribute to global carbon cycles.

Rationale

Forests, including forest products, have an important role in global carbon cycles, predominantly as sinks, but also as sources of carbon. Carbon stocks in forests include biomass (litter, woody debris, stumps, roots, dry standing stems) and soil carbon pools.

Forest products are also part of global forest cycles as both a source and sink for carbon. Forest products may reduce carbon emissions if they displace the use of materials which are more carbon intensive to produce, such as the use of timber rather than steel, concrete or aluminium in construction, or the use of non-sawlog material to replace fossil fuels to produce energy. Forest products store carbon, although the storage time of carbon in forest products varies, and is greatest in higher value timber products that typically have a long 'in-service' or 'end-use' life.

Natural disturbances affect the carbon cycle and these disturbances are a major cause of carbon fluxes in forests. Bushfire and damage from insects, diseases and storms may play a large role in the carbon cycling in forests. Forest management practices may increase or decrease these effects, however the aim is to ensure that forests continue to be carbon sinks, sequestering at least as much carbon as they emit at the whole of forest scale. Under the United Nations Framework Convention on Climate Change, harvested forests are considered carbon neutral as long as the area is maintained and regenerated.

The cumulative impact of practices implemented at a stand scale contributes to both the rate of accumulation of carbon in forests and the quantity of carbon emitted. Regeneration and rehabilitation ensure that the area of forest available to store carbon is not reduced and the preferential use of low impact forest harvesting practices can reduce the quantity of carbon emitted. There are situations however, where high carbon emitting practices are undertaken at the local scale. Forest management limits these practices to where they are necessary to achieve other forest management objectives.

Strategies

- Encourage the production of forest products with a long service life, and those that replace fossil fuels and high-embodied energy alternatives, from logs sourced from silviculturally treated forest.
- Sustain the pool of carbon stored in the forest by maintaining the area of forest, and regenerating areas that have been harvested and rehabilitating areas of soil damage, to maintain productive capacity.

- Culling trees by notching is the preferred method for post-harvest treatment in the jarrah forest. Felling will only be conducted in high value view sheds, where public safety concerns take precedence or there is a market for the material. (not sure why this is a carbon benefit)
- Culling of non-merchantable trees will not occur in those stands where achievement of the silviculture objective would require culling of $12m^2$/ha basal area or greater of trees, unless there is an over-riding consideration. Follow up silvicultural treatment may be undertaken where there is a market for the material that would have been culled. Where culling of less than $12m^2$/ha basal area of trees is required to achieve the silviculture objective, this will be undertaken.
- Plan prescribed fire regimes to reduce the risk and frequency of high intensity bushfires.

9. Guiding principles for productive capacity

Overall objective

Silvicultural management will be used to support the capacity of the forest to sustain a supply of goods and services in the long run.

Maintenance of productive capacity provides for the sustainability of the flow of some of the benefits from forests to society. Productive capacity includes both wood and non-wood resources. Maintaining productive capacity of forests available for timber harvesting involves maintaining the area of State forest and timber reserves and the area within State forest and timber reserves where harvest is permitted, and providing for harvesting on a sustained yield basis.

Guiding principle 12

Ensure the most appropriate silvicultural objective is selected for each stand

Rationale

Jarrah forest is essentially uneven-aged, with relatively small patch sizes. Application of a single silvicultural method is not usually appropriate to the condition of the forest, so a systematic process is used to guide decisions as to which silvicultural method to apply. Study and observation enabled the development of jarrah forest silvicultural methods, based on how the forest regenerates naturally after disturbance and how the trees grow and interact with each other and their surroundings. There are three key silvicultural methods which can be applied at different developmental stages; being thinning, gap and shelterwood.

Thinning can be applied to juvenile or immature stands, but first requires correct assessment of the developmental stage. If immature stands are identified as mature, trees may be felled when only part of their bole is of sawlog size and the full timber potential of the trees will not be realised.

Gaps are applied to mature and overmature stands where there is sufficient advance growth present to develop into a fully stocked regrowth stand. Where insufficient advance growth is present, shelterwood is applied to assist its establishment. Application of the correct silvicultural method is first dependent upon the identification of regeneration status.

Strategies

- Carry out advance burning prior to harvesting to facilitate the identification of regeneration stage and numbers. (this is generally impractical)
- Maintain maps of forest structure and use pre-harvest regeneration surveys to assist in the selection of the most appropriate silvicultural method.
- Mark vigorous trees, of good form with mature characteristics (dbhob>50 cm) and sufficiently spreading crowns to provide seed in shelterwood areas.
- Monitor treemarking against standards before harvesting to ensure that the most appropriate silvicultural method is selected.

Guiding principle 13

Regeneration and tree growth will be enhanced through actions to alleviate competition on regeneration and selected trees

Rationale

Competition for water, nutrients and light impacts on the survival and growth of all development stages of the forest and the quantity of forest products that can be produced. Silvicultural methods for the jarrah forest have been developed to alleviate competition at various development stages, to maximise tree vigour and sawlog production.

To establish regeneration using the shelterwood method, stand density and sometimes understorey density is reduced to increase the chance of seedling survival, particularly in the first summer. Seedlings that develop under a canopy become part of the pool of lignotuberous advance growth and do not proceed through later development stages until a gap is formed in the canopy, either from death or decline, or by removal of the trees during silvicultural treatment and/or harvesting. Release of regeneration by cutting a gap in the overstorey should not be carried out until a sufficient number of ground coppice or later advance growth forms of regeneration are present. Because of competition effects, the size of the gap must be sufficiently large to allow regeneration to progress to maturity.

Silvicultural thinning reduces stand density, usually to avoid stand stagnation and aims to keep trees actively growing and prevent severe competition or stand 'lock-up'. The juvenile stand experiences significant competition from the time of crown closure, at about 8 years after release, and this continues throughout the life of the stand. When the stand experiences severe competition, growth rates decline and many trees cease to grow, some die. This natural thinning process occurs at a slow rate. Silvicultural thinning hastens the natural thinning process to improve growth of the retained trees and reduces the time taken for retained trees to reach maturity and sawlog size. Thinning in uneven-aged stands may require variable density thinning practices to be adopted, to ensure that each tree has sufficient space to develop.

Regeneration patch size and shape influences the level of competition experienced by individuals within the patch. Small gaps experience the highest level of influence from edges, so competition reduces as patch size increases. Similarly, retained legacy elements compete with adjacent trees and regeneration and this is influenced by the density and pattern of these legacy elements. The footprint of competition is greatest from wide spaced individual trees, compared with trees with a clumped distribution, for a given density of legacy elements.

Strategies

- Undertake post-harvest treatment in areas cut to gap, targeting a reduction in the overstorey to less than 20 per cent crown cover.
- Retained habitat trees should be marked in groups wherever possible, so as to reduce the suppression of regeneration.
- The diameter of gaps ~~should~~ are preferred to be at least four times tree height to reduce edge competition. The ~~absolute~~ minimum diameter is two tree heights, but this should not be ~~commonly~~ used unless the stand structure suggests this option..
- Where necessary, reduce competition from understorey, midstorey and overstorey to prevent suppression of ~~overstorey~~ regeneration release.
- Promote growth on retained trees by thinning. Variable density thinning will be applied to uneven-aged stands to ensure that each tree is released from competition.

Guiding principle 14

Endemic regeneration will be used wherever possible

Rationale

Natural regeneration is the preferred method of regeneration in the jarrah forest. Silvicultural management encourages the production of seed crops *in situ* and promotes the growth of existing seedling, lignotuberous seedlings and ground coppice where they exist. Where natural regeneration is not possible or natural regeneration requires supplementation, endemic species are seeded or planted. Regeneration aims to restore the area to a self sustaining ecosystem, with a similar species composition to that which existed prior to disturbance.

Traditionally, regeneration operations requiring the use of supplementary seed or seedlings have strived to use 'local' seed. More recently, guidelines for seed collection for regeneration (and rehabilitation) have moved away from the requirement for only using 'local' material, as the scientific basis for this has been increasingly questioned, and additional considerations for optimal regeneration outcomes are now recognised. Factors considered to be important for any seed collection strategy include: matching topographic and edaphic features; allowing for expected changes in climatic conditions between seed collection sites and regeneration sites; and the need to use good quality seed with sufficient genetic variability to help enhance the resilience of regeneration.

Seed collected for regeneration is usually collected from the same landscape management unit (LMU) as the area to be regenerated. However, flexibility may be required to facilitate 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 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, allowing for greater potential to adapt to new perturbations such as disease or environmental change.

Strategies

- Use natural regeneration where reasonable and practical.
- Where natural regeneration is not reasonable and practical, use only species endemic to the area being regenerated.
- Fire will be used in gap creation operations to prepare a receptive seedbed and encourage the germination of soil stored seed. Is this appropriate? Gaps should only be established where there is sufficient ground coppice.
- Stool coppice will be used in preference to the use of artificial seeding or planting, wherever the stocking of jarrah regeneration is marginal.
- Where there is knowledge of population genetic structure or it can be inferred from life history traits, use this to guide seed collection areas.
- Where population genetic structure is unknown and cannot be inferred, use seed collected from the same LMU (or neighbouring LMU) as the area being regenerated.
- Where a broader seed collection is required for successful regeneration, this will be based on criteria agreed between the Department and the Conservation Commission.

Guiding principle 15

Silvicultural methods will reflect the site potential and developmental stage of the forest

Rationale

Site potential refers to the maximum density of forest that can be supported before it becomes limited by nutrients and water. Areas of high site potential exist where rainfall is high, soils are deep and relatively fertile and evaporation is low. Lower site potential is found in areas with lower rainfall, shallower soils or soils with lower nutritional value, and where evaporation is high. The jarrah forest occurs over a geographically large area and site potential varies across its distribution, particularly from west to east, reflecting changes in the soil type and available water. Changes in site potential are often reflected in changes in vegetation. Broad scale structure mapping of the jarrah forest has provided height categories which can be used to infer the site potential.

The degree to which site potential is utilised depends on stand age. Young stands have less access to available water than mature stands, because root systems are not fully developed. The total biomass is limited during the younger development stages and increases as the stand matures (i.e. a uniform juvenile stand consisting of trees at the sapling stage would be expected to support less biomass than a fully stocked uniform stand consisting of pole sized trees). Thinning schedules take stand development stage into account and target density will vary between stages.

Strategies

- Regeneration stocking schedules will recognise that the forest has areas of high, moderate and low site potential (Appendix 2).
- Use historical maps of stand top height to indicate site potential for the application of relevant thinning schedules.
- Thinning schedules for even-aged regrowth ~~and retained densities in shelterwood~~ will recognise that the total biomass that can be supported increases as the stand progresses from one development stage to the next (Appendix 3). Should not be applied for shelterwood.
- Periodically review classification of site potential in light of forest inventory to ensure the correct stocking and thinning schedules are applied.

Guiding principle 16

Where the canopy is removed in gaps, the forest will be regenerated in a timely manner

Rationale

Where the gap silvicultural method is applied, timely regeneration is required to ensure that productive capacity is maintained.

Time delays between harvesting and regeneration extend the time to reach stand maturity, reduce the ability to achieve prescribed burn outcomes and may lead to reduced yields. Ensuring that areas are regenerated adequately and within target timeframes contributes to the provision of a range of forest values.

Strategies

- Post-harvest regeneration treatments should be completed as soon as practicable after the cessation of forest harvesting in that coupe.
- Post-harvest silvicultural treatments will be conducted prior to burning where possible.
- Regeneration stocking rates will be monitored to determine regeneration success (see Appendix 2 for stocking rates).

Guiding principle 17

A grouped forest structure will be perpetuated at the local scale

Rationale

Sustainable wood production is facilitated by a forest structure that protects or reduces the incidence of damage to regrowth in successive harvest operations. Mature overstorey trees have large spreading crowns; which when felled can damage other trees and vegetation in their path. Where regrowth stands are small, trees within the stand are likely to become damaged when adjacent trees are fallen.

Harvesting damage may range from complete removal of the above ground portion of the regrowth, to the damage to the crown or cambium layer. Where saplings are snapped off at the base, all growth achieved in the interval between cutting cycles will be lost, increasing time to reach maturity. Damage to the crown of young sapling or poles may impact on growth and form, downgrading timber values. Managing areas of forest at a very fine mosaic poses safety risks to forest workers. When mature trees are fallen into stands of regrowth or other trees, there is increased risk of branches or debris striking and injuring the faller.

Strategies

- Maintain a grouped forest structure with a minimum desirable patch diameter of at least four times tree height and a maximum of ten hectares (this strategy also contributes to Guiding Principle 2).

Guiding principle 18

Trees to be retained will be marked and protected from damage

Rationale

Silvicultural practices in the jarrah forest involve the retention of trees for various purposes depending on the silvicultural method that is selected. Trees may be retained to grow on for future timber values, provide hollows for habitat, as a seed source or cover to protect water values.

Harvesting operations which remove mature trees have the potential to damage retained trees, both directly and indirectly. Direct mechanical damage to the cambium of a tree can result in wounds which facilitate the entry of borers and rot, degrading the timber value of the tree. Damage to

retained trees may also occur during post-harvest burns. The radiant heat generated by the combustion of fine fuel from tree crowns in combination with larger debris has potential to damage or kill trees. The likelihood of damage varies with the amount of heat exposure, the length of time the tree is exposed to the heat and the bark thickness of the tree.

Strategies

- Treemarking is to be undertaken in advance of harvesting operations and trees are to be marked for retention in accordance with the treemarking manual.
- In first thinning of regrowth stands, consideration may be given to the use of trained machine operators to identify trees for retention without prior marking.
- Monitor the level of damage to retained trees to ensure it does not exceed the allowable level.
- Remove debris away from the base of marked trees when the combination and arrangement of fuels are such that they risk damage to timber and other values during post-harvest burns.

Guiding principle 19

Fire sensitive regeneration will be protected from fire

Rationale

Regeneration in the jarrah forest is fire sensitive during its early development stages. During the establishment and juvenile development stages, until the bark thickness of saplings is sufficient to withstand mild fire and the leading shoot tall enough to escape damage, fire is likely to kill above-ground shoots. Lignotuberous seedlings, seedling coppice and ground coppice will resprout and continue to develop after fire. Ground coppice will resprout after all but very high intensity fire, however any growth achieved prior to the burn will be lost. The nominal rotation age will be extended as the burn effectively restarts the development cycle.

Strategies

- Fire will be excluded from regeneration during its early developmental stages for a nominal period of 10 years.
- The planning process for prescribed burns in juvenile stands will include an assessment of the stocking of saplings that will withstand mild fire. This assessment will include measurement of sapling height and diameter to gauge their fire sensitivity.
- Forest areas adjacent to fire sensitive regeneration will be burnt where possible to reduce the likelihood of high intensity bushfire in regrowth stands.
- The significance and sensitivity of regeneration will be used to prescribe fire in areas where multiple objectives exist.

Guiding principle 20

Forest areas that are killed or damaged by fire or other vectors may be restored or salvaged where necessary

Rationale

While it is ~~un~~likely that bushfire will not kill all healthy jarrah saplings or small poles, ~~it may~~there is a high risk that it will cause damage to the bole or the growing tip. Damage of this nature can seriously reduce the value of the tree for ~~sawlog~~ future log production in the future. ~~Fire~~ Fire-damaged trees are pre-disposed to insect, fungal and termite attack, which can also lead to mechanical failure in the tree, constituting a safety concern. The value of the damaged regrowth can be improved through coppicing the stems and allowing them to regrow. Alternatively, the yield calculations for the area can be amended with a reduced quality expectation to reflect the damage.

It is predicted that climate change will lead to more frequent instances of extreme fire weather conditions. Fires that occur during extreme weather conditions can result in the death of mature trees. Provision of forest products may be adversely impacted, both by increasing time to stand maturity where stand replacing fires occur and where fire damage reduces the volume of sawlogs available. Death and degrade may reduce sustained yields where they occur on State forest, but can be partially offset where salvage harvesting occurs.

Disease or insect attack may also affect sustained yield; however salvage is not as straight forward when there are underlying forest health issues. Care needs to be taken when considering salvage of these stands to ensure that the harvesting operation does not further reduce the resilience of the stand.

Strategies

- Fire damaged regrowth areas should be coppiced and managed to ensure that at least 125 stems (300 preferred) per hectare will be available for future sawlog production.
- Harvesting may be used to salvage ~~sawlogs~~ forest products in fire killed or drought killed stands.(or other disturbances)
- Harvesting to salvage ~~sawlogs~~ forest products in disease or pest killed stands may be approved by the Senior Silviculturist on a case by case basis. Measures to maintain stand resilience must be included in any proposal.
- Regenerate areas left understocked after fire or salvage harvesting.

10. Guiding principles for heritage

Overall objective

Protect and maintain Aboriginal and other Australian cultural heritage.

The value of heritage places relates to their historic, aesthetic, scientific or social significance. Heritage values can be threatened by inappropriate fire regimes, theft, vandalism, disturbance activities, structural decay, erosion, and failure to have proper procedures for their protection or failure to enforce those procedures.

Guiding principle 21

Minimise disturbance to Aboriginal cultural heritage values and sites

Rationale

The jarrah forest was traditionally occupied by the Noongar people, who are the original custodians of the land. In the Noongar dreamtime creation story, the responsibility of caring for everything was given to people. All of the other spirits of the dreamtime agreed to this so long as the people ensured that all the different elements of ecosystem were not used until nothing was left. Sustainability of the forest and all elements of biodiversity are therefore still very important to the Noongar people.

Scarred or modified trees that mark trails or other sites of significance to Aboriginal people occur throughout the forest. The locations of the trees that exist today are not all known or registered. Therefore, an important part of protecting heritage values and sites is to ensure adequate training of staff and contractors working in the forest, so that they are able to recognise sites and follow procedures for protecting and registering them. Staff conducting silvicultural operations should be able to recognise potential cultural heritage sites, report them and take action to avoid disturbing them until they have been assessed. Trees or sites encountered during silvicultural operations that have potential heritage value need to remain undisturbed until their suitability for registration can be formally determined.

Strategies

- Ensure staff and contractors receive adequate training in how to recognise, protect and register Aboriginal cultural heritage values and sites.
- Identify and protect all scarred or modified trees where they exist in areas of silviculture treatment.
    - Identify and protect all sites of significance in accordance with Department of Indigenous Affairs, Cultural Heritage Due Diligence Guidelines www.dia.wa.gov.au
- Consider use of seed from "bush tucker" plants in landing and track rehabilitation operations.
- Ensure that regeneration is established where gaps are cut (this strategy also contributes to Guiding Principle 16).

Guiding principle 22

Minimise disturbance to other Australian cultural and natural heritage values

Rationale

Throughout the forest there are places providing examples of early settlement and harvesting practices such as remnant tramways, cuttings, old bridges and loading ramps. Pre-harvesting checks of databases are conducted to conserve known cultural heritage sites. However, not all places with other Australian heritage value are currently known and staff conducting silvicultural operations should be able to recognise potential cultural heritage places, report them and take action to avoid disturbing them until they have been assessed. It is important to protect places of significant value when encountered in harvesting operations.

The Department maintains a Significant Trees Register. Listed trees can be identified through pre-harvest checks to ensure they are located and protected from disturbance. Trees encountered during silvicultural operations that have characteristics of significant trees need to remain undisturbed until their suitability for registration can be formally determined.

Strategies

- Retain trees of cultural significance in areas of silvicultural treatment. Vary silvicultural treatment within the curtilage of registered heritage places to protect heritage values.
- Identify and protect significant trees in areas of silvicultural treatment.
- Ensure potential significant trees remain undisturbed in areas of silvicultural treatment until they can be formally assessed for registration.

11. Guiding principles for socio-economic values

Overall objective

Sustain social and economic benefits, through the provision of a range of goods and services valued by the community

The jarrah forest provides a range of goods and services including clean and moderated flows of water, clean air, carbon sequestration (in the forest and forest products), minerals and petroleum, wood and non-wood forest products, nature based recreation and tourism, apiculture and wildflowers and seeds. Silvicultural treatments within the jarrah forest available for timber harvesting are designed to contribute to the provision of a range of goods and services valued by the community.

Guiding principle 23

Visual landscape management will be used to reduce the impact of silvicultural management on visual amenity.

Rationale

Priorities for management of visual amenity in forest areas are based on the mapping of visual resource values and visitation or road usage. Where a landscape has both high visual quality and high visitation, it is assigned a high priority for visual landscape management, and modified practices are used. Higher levels of landscape alteration are permitted where there are reduced visual resource values and lower usage patterns.

Silvicultural treatments can alter the landscape in terms of visual amenity. Well planned silvicultural practice can reduce visual impact by introducing variations of gap size, thinning intensity, felling cycle, rotation length and treatment method.

Strategies

- Visual amenity from major roads and recreation sites will be mapped and allocated a visual management zone.
- Where necessary, limit gap size, or design gap shape to reduce the visual impact of harvesting.
- Where necessary, extend rotation length to allow mature forest characteristic to develop to ~~enhance~~ maintain visual amenity from major travel routes.
- Where necessary, extend the cutting cycle adjacent to major travel routes to allow the scenic quality to recover from previous disturbances.
- Limit gap size to no more than 10 hectares in all visual management zones.
- When conducting post-harvest treatment adjacent to major travel routes, do not create standing dead trees that would reduce the visual quality of the viewshed.
- Removal of harvest debris to have priority in VMZ A.

Guiding principle 24

Post-harvest treatments will be prioritised according to the benefits likely to be realised

Rationale

Timber harvesting has occurred in the jarrah forest since 1870, however past practices ~~did~~ have not ~~always~~ always clearly achieved a silvicultural objective either through the commercial or non-commercial phases. In general there have been insufficient markets to effectively thin or regenerate the forest and follow-up non-commercial treatment has been necessary. The availability of funding has been spasmodic and~~involve~~ the use of follow-up treatments to promote the grouped structure that is advocated in current silvicultural practice has frequently not occurred. As a consequence, there are areas of forest which have been selectively harvested for sawlogs and contain few trees with the potential to produce sawlogs and ineffective regeneration. The ~~royalties collected from log sales~~available funding ~~that are used~~ for regeneration, post-harvest treatment and fire protection operations is finite, and is currently not sufficient to treat areas with poor outcomes from past management. Priorities therefore need to be set to ensure the best return on investment of available funds.

Mining leases cover much of the northern jarrah forest. Mining involves the clearing of the forest and subsequent rehabilitation. Where timber harvesting occurs ahead of mining, there is potential for post-harvest treatments to use funds to regenerate or reduce competition in stands where the benefits of the work will not be realised, because the area is cleared for mining before the benefits eventuate.

Strategies

- When using culling to achieve thinning for a wood production objective, only release those trees of crop tree quality.
- Do not conduct regeneration or cull treatments in areas identified to be mined within 10 years of timber harvesting.
- The priority for follow–up treatments will be for those areas where the silvicultural objective can be achieved (i.e. gap, shelterwood and thinning) and where future mining or clearing for infrastructure development or dieback will not prevent the return on that investment.
- Use site productivity and knowledge of future infrastructure or mining operations to assist in prioritising follow up treatments.

Guiding principle 25

Viable timber production needs to be underpinned by efficient harvesting operations which implement practical and efficient guidelines.

Rationale

Achievement of the socio-economic objective requires that each step in the supply chain is able to function efficiently and profitably. Currently harvesting practices operate to meet long term timber production objectives as well as many to sustain other forest values. Most of these measures have the effect of reducing the efficiency of harvesting practice, in particular where they reduce the time available to harvest or limit the yield that can be attained from individual harvest areas. Most recently the 2004 FMP introduced a number of

soil management requirements. These procedures had not been tested and had a major effect on the available time for harvesting without achieving the desired soil protection outcome.

Maintaining a viable industry requires that the operating procedures take into account ensuring that the overall efficiency. Each measure therefore cannot be considered in isolation but as part of an operating system that balances the need to provide for all outcomes.

The implementationof guidelines should seek to both reduce the risk of long term 'damage' to forest values from harvesting and silvicultural disturbance, and improve the efficiency of those activities in achieving timber production and other outcomes.

Strategies

- Preference should be given to achieving silvicultural objectives through commercial rather than non-commercial means.
- Prior to the consideration of new 'control' measures, a risk assessment is undertaken in relation to threats to other values arising from timber harvesting and forest management.activities
- New procedures are to be assessed for their effectiveness in achieving the desired outcome and their impact on the overall management of harvested forests before becoming standard practice. The decision whether to implement new measures will be taken based on the overall benefit:cost of the process.
-

12. Appendices

Appendix 1: Jarrah harvest intensity thresholds

Development stage	Mean dbhob of crop trees/ha	High and moderate site potential jarrah	Low site potential jarrah
		Nominal stand density *	
		(m^2/ha)	
	(cm)		
Juvenile	<15	5	4
Immature	16 – 25	9	5
	26 - 35	11	6
	36 – 45	14	11
Mature	> 45	18	14

* Note – this includes habitat trees but does not include other species. Rules regarding retention of other species are as per other silvicultural treatments (see Guiding Principle 1).

Appendix 2: Jarrah regeneration targets

In areas where the crown cover has been reduced below 20 per cent or a basal area of approximately 10m^2/ha. Regeneration surveys are required at to be completed on a 20m x 50m grid.

generation stage	Acceptable stocking	
	High and moderate site potential jarrah forest	Low site potential jarrah forest
Seedlings	5000	2500
Lignotuberous seedling		
Seedling coppice		
Ground coppice	1000	350
Sapling	500	200
Stool Coppice		

In the western jarrah forest 65 per cent of sample points must be stocked to an acceptable level for the regeneration to be considered successful.

In the eastern jarrah forest 60 per cent of sample points must be stocked to an acceptable level for the regeneration to be considered successful.

Appendix 3: Jarrah thinning schedules

High and moderate site potential jarrah forest

Development stage	Mean dbhob of crop trees/ha (cm)	Target stocking (stems/ha)	Nominal stand density * (m^2/ha)	Spacing guide (m)	Comments
Juvenile	<15	600	7	4	Thin from below, non-commercial thinning
Immature	16 – 25	350	11	4.5	Thin from below, non-commercial thinning.
	26 - 35	250	13	6	Thin from above and below, commercial and non-commercial thinning.
	36 – 45	125	16	9	Thin from above, where sufficient crop trees occur, commercial thinning.
Mature	> 45	125	20	9	Thin from above, where sufficient crop trees occur, commercial thinning.

* = Includes habitat trees

Comment [BG14]: This is likely to a marginal decision between thinning and regeneration. Since the stem numbers are the same as 36 - 45 is thinning likely in any case? It would not be a viable commercial operation.

Low site potential jarrah forest

Development stage	Mean dbhob of crop trees/ha (cm)	Target stocking (stems/ha)	Nominal stand density * (m^2/ha)	Spacing guide (m)	Comments
Juvenile	<15	350	5	4.5	Thin from below, non-commercial thinning
Immature	16 – 25	200	6	6	Thin from below, non-commercial thinning.
	26 - 35	100	7	10	Thin from below, non-commercial thinning.
	36 – 45	100	13	10	Thin from above, where sufficient crop trees occur, commercial thinning.
Mature	> 45	100	16	10	Thin from above, where sufficient crop trees occur, commercial thinning.

* = Includes habitat trees

Comment [BG15]: As for above thinning is not possible after 26 m2

High site quality jarrah forest thinning guide for multi aged stands

Tree Diameter (cm)	Spacing guide (m)
15	4
20	5
25	5
30	6
35	6
40	9
45	9
50	9

Comment [BG16]: I think that once you get to matur stands spacing will be range, say 8 - 12, rather than 9

Low site quality jarrah forest thinning guide for multi aged stands

Tree Diameter (cm)	Spacing guide (m)
15	5
20	7
25	7
30	7
35	10
40	10
45	10
50	10

13. Glossary

Advance growth	A general term to describe tree regeneration that has developed beneath an existing canopy.
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.
Basal area	The sum of the cross-sectional areas of trees in a given stand measured at 1.3 metres above the ground. It is usually expressed as square metres per hectare.
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.
Bole	The tree trunk from the ground to the crown break. The bole does not include the major branches supporting the crown.
Catchment	The land area drained by a single stream, river, or drainage network.
Coppice (noun)	A shoot (or shoots) arising from adventitious buds at the base of a woody plant that has been cut near the ground or burnt back.
Coppice (verb)	The act of cutting near the ground or burning back a woody plant to encourage a shoot (or shoots) to arise from dormant buds at the base of the plant. Often completed to encourage the development of a new vigorous coppice stem.
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.
Crop tree	A tree selected to retain during a harvest operation, to be grown on for many years to become a component of a future commercial harvest
Culling	The reduction in the density of unwanted vegetation, usually to reduce competition to retained crop trees or for establishing or releasing regeneration.
Current FMP	The Forest Management Plan 2004–2013 currently in force.
Dbhob	Stem diameter measured at breast height over bark.

Department, or the Department	The Western Australian 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**	means the Draft Forest Management Plan 2014-2023 as released by the Conservation Commission for public consultation.
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.
Endemic	Flora or fauna that is confined in its natural occurrence to a particular region.
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 Wildlife Conservation 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.

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 mm 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 the frequency, intensity, season and scale of burning over a period of 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 Wildlife Conservation 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.
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.
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 products	As for the purposes of both the CALM Act and the Forest Products Act: (1) Subject to subsection (2) trees or parts of trees; timber, sawdust or chips; charcoal, gum, resin, kino or sap; and firewood. If they are located on public land or sharefarmed land. (2) When something referred to in subsection (1) has been removed under contract or arrangement entered into by the Commission, any residues that remain are not forest products for the purposes of this (FP Act) Act.
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.
Gap (regeneration establishment	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.
Ground coppice	A growth stage where the lignotuber and root system have grown to the point that if surrounding competition is sufficiently reduced, the plant is capable of dynamic growth into a sapling. In jarrah, the lignotuber may be between five and 10 centimetres in diameter and the plant may take 20 years to reach this development stage under native forest conditions.

Group selection	The removal or retention of trees in relatively small groups with the object of creating a gap or retaining a group of younger trees to grow on. While there is no specific size of the group, it is generally considered to be of a size below which the edge effects dominate
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.
Habitat tree	A tree selected to be retained in a coupe because it has features attractive to wildlife particularly for hollow nesting birds and animals.
Heritage	Something inherited from a past generation that is valued.
Hybrid	The progeny produced from a cross between two genetically different plants, usually different species.
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, are presumed to have the most intact aquatic ecosystems and consequently are the most environmentally sensitive to rises in saline groundwater.
Immature stand	The stand development stage beginning with the main lateral spread of tree crowns and finishing with the start of a mature stand.
Impact - dieback	The effect on vegetation from the presence of Phytophthora species, referred to as either predicted or current impact.
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.
Informal Reserve	See 'Reserve – Informal'.
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 1933 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 1997, 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.

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.
Lignotuber	A woody swelling formed at the base of some eucalypts that has the ability to produce new shoots when the existing ones are destroyed.
Local scale	A discrete area of land to which one or more operations have been or are planned to be applied.
Mature stand	The stand development stage beginning with the formation of large persistent branches forming the outline of the crown as the crown reaches its maximum size, and finishing with the commencement of a senescent stand.
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.
Next FMP (2014–2023), **or next FMP**	Means the Forest Management Plan approved by the Minister for Environment to begin operation on 1 January 2014 for a period of 10 years (2014-2023).
Patch	A group of trees resulting from a natural regeneration event or a past 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).
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.
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.
Proposed FMP	The Forest Management Plan 2014-2023 as forwarded to the EPA for assessment following modification (of the Draft FMP) as a result of the public consultation process.

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 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.
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.
Shelterwood (regeneration establishment)	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.
Site potential	The density of forest that can be supported before it becomes limited by nutrients and moisture. Site potential depends on site conditions such as climate, slope, landform, soils and geology Site potential is also influenced by stand age in that young stands reach maximum density, and undergo suppression and mortality at a lower density than older stands. Young stands exploit a smaller volume of soil and access less soil moisture than older stands.
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.

Stand structure	The horizontal and vertical distribution of the components of a forest stand including the height, diameter, crown layers and stems of the trees, shrubs, herbaceous understorey, stags and down woody debris.
Stool coppice	A growth stage where shoots have developed from a stump cut off at ground level.
Subsequent FMP	means the Forest Management Plan 2024 – 2033.
Suppression	The process whereby a tree or other vegetation loses vigour and may die when growing space is not sufficient to provide photosynthate or moisture to support adequate growth
Sustained yield, or Sustained timber yield	For the purpose of this plan, the first and second grade sawlog yield that a 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.
Temporary exclusion area (TEAS)	An area that is excluded from timber harvesting for a particular period of time.
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.
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.
Vegetation complex	A combination of distinct site vegetation types, usually associated with a particular geomorphic, climatic, floristic and vegetation structural association.
Variable density thinning	Type of thinning used to introduce structural complexity into even-aged regrowth stands by for example, leaving unthinned patches, retaining older trees and understorey elements, creating small gaps and varying the spacing of trees in thinned areas. In stands containing a range of size classes it can also be used to vary the spacing of trees and the retained basal area in response to variations in

	trees sizes.
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.
Wood products	All timber and other wood products, inclusive of sawlogs, firewood, chiplogs and other log products supplied to the wood products industry.
Yield	The amount of product produced from the forest by a particular management strategy.

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