FOREST REGENERATION AFTER LOGGING – *JARRAH*

MISSION AND OBJECTIVES – 1999-1997

CALM Annual Report 1998/1999. 1999
CALM Annual Report 1997/1998. 1998
CALM Annual Report 1996/1997. 1997

NOTE: REFER TO ENTRY UNDER ANNUAL REPORT 1992/1993 – SIMILAR WORDING

SILVICULTURAL GUIDELINE - 1997

Silvicultural Guideline 4/97: Jarrah Regeneration Surveys

"*Silvicultural objectives in the jarrah forest vary in response to the structure and stage of development of the stand. The first priority when considering silvicultural objectives is to thin the forest, however where insufficient crop trees exist to permit thinning, then regeneration is required.* […]" (p. 2)

"*Deciding on the appropriate regeneration treatment requires a knowledge of the status of the advance growth. This guideline provides a survey technique which can be used to assess the status of advanced growth and standards to be applied when selecting the appropriate regeneration treatment.*

It is also a useful tool for identifying areas unsuitable for harvesting and non forest prior to treemarking." (p. 2)

Objectives

"* *To evaluate the status of advance growth as a guide to planning and treemarking the jarrah forest prior to harvesting.*
* *To provide information on forest structure as a guide to planning and treemarking the jarrah forest prior to harvesting.*
* *To identify areas not suitable for harvesting within the coupe before treemarking commences, eg. areas of diversity.*
* *To monitor the post harvesting development of regeneration in the jarrah forest.*" (p. 2)

2. Preharvesting Surveys

"*These surveys are to be undertaken prior to treemarking so that the most appropriate silvicultural treatment can be determined, i.e. whether there is sufficient regeneration to warrant release or if the area should be marked to establish regeneration.*

Pre-harvesting regeneration surveys need to be carried out in any area which:

- *Is a site type likely to have insufficient regeneration (Specification 1.95).*
- *Areas which have marked variation in regeneration status. Visual assessment is not adequate in these situations.*" (p. 2)

2.1 Survey Method

2.1.1 Timing of Surveys

"[…] *Burning in spring will allow surveying to take place in approximately 6 months, less on some sites.*" (p. 3)

"*Where this has not been possible and surveys are planned to be completed closer to the time of harvest, the timing of any advance burning will need to consider the lead time required to allow for full ground coppice expression to occur.*" (p. 3)

2.1.2 Purpose of Sampling
"*At any sample point the aim is to determine what level of stocking is present and at which stage of development.*
[…]
Note: - If the forest structure assessed at the point lends itself to retention of crop trees, ie. (thinning), then the stocking of advance growth becomes irrelevant." (p. 3)

2.1.3 Sampling Intensity
"*Extremes of regeneration stocking are readily visible where they occur and the treemarker will require only limited sampling in such areas to confirm this visual assessment and decide upon the appropriate silviculture to apply.*

Where regeneration is visually variable or only apparent at very low levels a formal assessment is a necessity.

Where formal assessment is necessary, the sampling intensity to be used will be as follows:
- *Sample on a grid of 50m x 20m within the proposed boundary of the coupe (approximately 10 sample points per ha).*" (p. 4)

2.2 Sampling Procedure
2.2.1 Avoiding Bias
"*Care must be taken to avoid bias when selecting sample points, eg. avoid looking specifically for advance growth until the sample point is located and marked. Sampling on a grid ensures that sample points are located with a minimum of bias and spread evenly across the proposed harvesting coupe.*" (p. 4)

2.2.2 Selecting Acceptable Advance Growth
"*Advance growth may exist in a number of different stages of development on the one site. These different stages of development, which relate largely to advance growth age, respond differently when the overstorey of mature trees are removed.*

Older stages will be released by overstorey removal and commence dynamic growth. Younger stages will not respond to overstorey removal and will remain as advance growth following harvesting." (p. 4)

2.3 Mapping and Calculations
"*Following completion of the survey, harvest coupe maps indicating stocking status must be prepared.* […]" (p. 6)

"*In conjunction with the above map, stocking calculations must be completed as follows:*
- *Subdivide the coupe into cells at approximately 100 hectares based on roads/creeks or other definable boundaries. Within each cell, define the regeneration stocking as follows:*
  - ***Large Understocked Areas***
    Outline any understocked areas of 0.5 ha or more. For a 50 x 20 m grid this represents approximately 5 or more immediately adjacent sample points. These areas will need to be treated with the objective of regeneration establishment (shelterwood).
  - ***Smaller Understocked Areas***
    For the remainder of the cell calculate the percentage of stocked points, ie. (exclude those points identified as being understocked above).

    If this percentage exceeds 65% then the cell is satisfactorily stocked for regeneration release, (gap).

If the percentage stocking is less than 65%, the cell will need to be treated for regeneration establishment." (p. 6)

2.3.2 Species Mix
"*For each area defined in (2.3.1) above as being stocked, sum the number of jarrah and marri recorded on the survey sheet. Calculate the number of jarrah as a percentage of the total number of jarrah and marri recorded. Where the existing overstorey is predominantly jarrah but less than 20% of the regeneration is jarrah, the stand is to be marked as a shelterwood with preference for retention given to jarrah. Regular burning can then be used to encourage the development of jarrah regeneration in an attempt to restore the previous species mix.*" (p. 7)

3. Initial Establishment Surveys
"*The aim of this survey is to measure the quantity of regeneration which has become established in areas cut to shelterwood and determine whether it meets the regeneration standards, and if not, to prescribe remedial measures.*" (p. 7)

3.1.1 Timing of Survey
"*Assessment of regeneration in shelterwood areas is to be carried out approximately 12 months after the establishment burn (November-December) so that:*
- *regeneration is readily visible, and*
- *infilling can be arranged before scrub competition is excessive*" (p. 7)

3.1.2 Initial Establishment Standards
"*A sample point is recorded as stocked if it meets any of the following standards:*
- *1. 500 or more spha of jarrah or marri saplings, or*
- *2. 1 000 or more spha of jarrah ground coppice or marri advance growth, or*
- *3. 1 000 or more spha of a combination of jarrah or marri saplings, jarrah ground coppice or marri advance growth and lignotuberous seedlings or seedling coppice.*
- *4. 5 000 or more spha of a combination of jarrah or marri saplings, jarrah ground coppice or marri advance growth and lignotuberous seedlings or seedling coppice*
- *5. 5 000 or more spha of lignotuberous seedlings or seedling coppice.*" (p. 7)

3.2 Sampling Procedure
"*The method for estimating point densities is given in Section 2.2.*

Lignotuberous seedlings and seedling coppice are included in this assessment since young regeneration will not have developed to an advanced stage 12 months after the burn.

Estimates of density are to be made in the following order:

1. *Saplings.*
2. *Saplings + ground coppice*
3. *Ground coppice*
4. *Saplings + ground coppice + lignotuberous seedlngs / seedling coppice.*
5. *Lignotuberous seedlings / seedling coppice.*

These estimates need only be made until a stocked point is obtained." (p. 8)

3.4 Infill Requirements
"*All areas defined as large understocked areas will require total infill planting.*

For the remainder where stocking is less than 65% stocked (Sapling & G.C. Stocking + Total column) infilling is required.

Infill planting must be undertaken in the planting season immediately following the year of establishment.[…]

[...] *Where infilling is required, infilling will aim at obtaining full stocking across the surveyed area.*

Full stocking is defined as 1000 stems per hectare. To achieve this the planting rate will be 1300 seedlings per hectare." (p. 8)

4. Monitoring Regeneration in Shelterwood Areas
"*The aim of this survey is to monitor the development of regeneration in areas cut to shelterwood to determine when the site is available for gap creation.*

The procedures and standards used are the same as for pre-harvesting survey, (Section 2.0). The removal of the shelterwood overstorey may be undertaken once sufficient ground coppice or saplings are established." (p. 9)

NOTE: REFER TO ACTUAL DOCUMENT FOR THE FOLLOWING –
Appendix 1 : Stages of Jarrah Regrowth Development
Appendix 2 : Prepared Table of Density Estimates
Appendix 3 : Jarrah Regeneration Survey Sheet
Appendix 4 : Completed Preharvesting Regeneration Survey Map
Appendix 5 : Jarrah Regeneration Survey Sheet

SILVICULTURE GUIDELINE - 1997

Silviculture guideline 1/97 : Fire as a Silvicultural Tool in the Jarrah forest

NOTE: THIS GUIDELINE SUPERSEDES SILVICULTURE GUIDELINE 1/91

"*This guideline seeks to link burning strategies with silvicultural objectives by defining:*

- *how burning can achieve silvicultural goals;*
- *the range of burning intensities to meet specific burning objectives;*
- *where fire exclusion should be adopted*." (p. 1)

3. Types of Burning
3.2 Post-Harvesting Burning
"***(a)Tops disposal burning*** *is carried out to reduce hazard by the removal of flash fuels and woody material up to 2.5 cm in diameter.* […]

"*Tops disposal burns are usually low intensity. To protect existing trees these burns must also take account of the soil dryness index (Table 1).*" (p. 2)

(b) Release burning *is carried out to enhance the development of regeneration. It is particularly important where there has not been an advance burn. This burn is also of value in fuel reduction. The silvicultural objectives include:*
- *the removal of scrub competition*
- *the stimulate of dynamic growth of lignotubers*
- *removal of poorly-formed saplings*

Release burning must occur within 2 years of harvesting. Burn intensity will vary with the condition of the advanced growth. A low intensity is sufficient to stimulate ground coppice, but a fire of moderate intensity will be required where deformed saplings need to be burnt back to reshoot from ground level. […] (p. 2)

"***(c) Establishment burning*** *is carried out in the jarrah forest where the objective is:*
- *the removal of scrub competition*
- *the creation of suitable seedbed*
- *the stimulation of seedfall*

These objectives are pursued on all areas cut to shelterwood as a means of establishing regeneration. There is also significant fuel reduction benefit.
[…]
Establishment burning in shelterwoods needs to be of moderate intensity (Table 1) in order to achieve maximum seedbed preparation. Crown scorch is therefore acceptable." (p. 2)

3.3 Rotational Fuel Reduction Burning
"*Rotational burning is excluded from stands where regeneration has been released but still remains vulnerable to fire damage (Section 4.2).*

Regular rotational burning is of advantage in shelterwood stands to enhance the development of seedlings into ground coppice." (p. 3)

3.4 Strategic Fuel Reduced Buffers
"*Strategic fuel reduced buffers are located to restrict the spread of a major wildfire.*

"[…]*Where the silvicultural objective is thinning or shelterwood, harvesting in the strategic fuel reduced buffers can proceed without conflict.* […]" (p. 3)

"*- Prescribe for the most sensitive component of the silvicultural burn, eg, in a stand with mixed objectives, prescribe for thinning areas, in a stand of TEAS and gaps prescribe for the TEAS.*
- Prescribe for nominal 6 metre scorch height in Spring.
- Prescribe for nominal 4 metre scorch height in Autumn." (p. 3)

4. Fire and Silvicultural Strategies
4.1 Thinning
Silvicultural Objective:
"*In stands where there is an adequate stocking of crop trees (trees capable of growing rapidly into higher quality products), the objective is to increase the growth of those trees by thinning. In some cases thinning is carried out for aesthetic reasons or to increase streamflow.*" (p. 4)

Burning Objective
"*Hazard reduction: Rotational prescribed burning is compatible with the thinning objective provided that it is conducted within acceptable limits of fire intensity and SID. The acceptable fire intensity increases with the age and development of the stand. The acceptable fire intensity increases with the age and development of the stand, guidelines are as follows:* [...]" (p. 4)

4. Fire and Silvicultural Strategies
4.2 Regeneration
Silvicultural Objective:
"*In stands comprising mature and overmature trees where there are few crop trees but an adequate stocking of advance growth (ground coppice and saplings) the objective is to remove the overstorey to allow the development of vigorous regrowth.*[…]" (p. 4)

Burning Objective
Post-harvesting: Regeneration Release/Hazard Reduction
"*After harvesting release or tops burning must be completed within 2 years. The intensity of such burning will vary according to stand conditions* [...]

Following Regeneration: Fire Exclusion:
"*Stands requiring protection from fire are:*

(a) Those coupes containing areas which have been cutover for regeneration and contain adequate advance growth (Guideline 1/95), and
(b) All previously cutover coupes less than 10 years old." (p. 4)

"*These stands will require complete protection from fire until:*
- *tall enough (usually 6 metres) so that the growing tip will not be damaged, and;*
- *the bark is thick enough to insulate the cambium from the heat (once the diameter is 10cm) in a fire of low intensity. (Burrows, 1987)*

Figure 1 outlines an idealised fire management regime for stands requiring regeneration." (p. 5)

4.3 Shelterwood – (Establishment of Advanced Growth)
Silvicultural Objective
"*These stands are similar in structure to those described in 4.2 except they lack a sufficient stocking of advanced growth to adequately regenerate the site. The initial aim of management is to establish seedlings and 'grow' them into suitable ground coppice and saplings. This is achieved by a partial removal of the canopy, removal of competing understorey rootstock species, burning to create ashbed and spreading seed or planting where poor natural seed stock exist.*" (p. 5)

Post-harvesting: Establish Regeneration
"*After harvesting, burning is essential as a means of creating ashbed, reducing competition, stimulating seedfall and reduction of fuel quantities. If possible this burn should be timed to coincide with an adequate seed crop, however burning soon after harvesting is the best opportunity for seedling establishment due to the disturbance by harvesting machinery.* […]

Subsequent low intensity prescribed burning is compatible with a shelterwood objective as it will enhance the development of lignotubers. […]" (p. 5)

4.4 Single Tree Selective Harvesting
"*In some stands effective regeneration cannot be achieved due to the inability to market a significant proportion of overstorey trees. The number, size and potential value of such trees makes regeneration (as defined in section 4.2) difficult to achieve commercially and expensive to attain non-commercially. Currently vigorous trees are retained and small gaps are created by removing several trees.*" (p. 5)

"*In general regeneration is not effectively released by harvesting in selectively cut stands and hence no special protection measures are warranted – except where specifically nominated following a post-harvesting inspection and recorded on SILREC.*" (p. 6)

4.6 Crop Tree Protection
"*The burning of harvesting tops has the potential to damage the retained components of the forest (crop trees, habitat trees, habitat logs). Their protection by the removal of woody material (> 7.5 cm diameter) to a distance of at least 1 metre reduces the risk of damage in subsequent burning. This task must be completed by harvesting contractors.*" (p. 6)

5. Integrated Fire Management of Harvested Areas
"*Most areas recently harvested will contain a mosaic of the stand types described in section 4.* […]

As a general rule once an area has been harvested and burnt then the entire area must be protected from fire until the regeneration is old enough to withstand fire unless the areas of regeneration can be isolated.

This section discusses the management of stands with mixed objectives." (p. 6)

5.1 Regeneration Release and Uncut Patches or Strips
"*Fire management regime can proceed as described in figure 1.*

Prior to Harvesting:
Rotational prescribed burning. Advance burn to assist identification of advanced growth where it is suspected to be poor.

After Harvesting:
If the stand was not advance burnt, release burning is required. It is optional where there are only scattered tops and the area has been advanced burnt. Burning to be completed within 2 years of the commencement of harvesting.

Protection and Burning:
Following the tops disposal burn, fire is to be excluded from the regeneration until regrowth is 6 metres in height and 10 cm in diameter. […] *Where this is required the first rotational burn must be completed within 5 years of the regeneration release burn. At this time there will be limited fuel in the gap and 5 leaf falls in the uncut patches of forest or retained strips. This burn should be undertaken at low intensity (<250 kW/m) and low SDI to minimise the risk of a significant fire run in the regeneration, hence it is vital that the flash fuels have been effectively removed from the gap in the tops burn.*" (p. 6)

5.2 Regeneration and Thinning
"***Prior to Harvesting:***
Rotational prescribed burning; advance burn to assist identification of advanced growth where it is suspected to be poor.

After Harvesting:
Following crop tree protection, tops disposal burning for hazard reduction is essential where there has not been advance burning or where required for hazard reduction. It must be completed within 2 years of the commencement of harvesting. Tops burning is optional where there are only scattered tops and the area was advance burnt. Burn intensity must be geared to ensure the retained stands are not damaged by the burn." (p. 7)

Rotational Prescribed Burning:
"*As for 5.1.*" (p. 7)

5.3 Regeneration and Shelterwood
Prior to Harvesting
"*Rotational prescribed burning and advance burning is essential where there exists the possibility of poor advance growth stocking.*

After Harvesting
A regeneration burn is required in the shelterwood. The timing of the burn will be critical if there is an existing seed crop.

Tops in the gap must be burnt.

Protection and Burning
This stand containing shelterwood and young regrowth requires both ongoing protection (in the gaps where regeneration has been released) and regular burning (in the shelterwood area)." (p. 7)

Rotational Prescribed Burning
"*As for 5.1.*

For areas which have been harvested to shelterwood only, the Fire Management regime can proceed as in Figure 2." (p. 7)

6. Prescribed Burning and Herbicide Treatment
"*Burning can occur immediately before or at least 9 months following herbicide treatment. If burning before treatment the fire intensity must be low to ensure minimal crown scorch – otherwise notching will need to be delayed until crown flush.*" (p. 8)

7. Records
"*The following silvicultural records are required to ensure achievement of objectives:*

(1) SILREC
Location of silvicultural stand types (print 10)
Follow-up treatment required and completed (SILREC)
Monitoring of regeneration development in shelterwoods

(2) MASTER BURN PLAN
Record location and date of regeneration and their predicted period of protection. Location of shelterwoods, and when next due for burning." (p. 8)

NOTE: REFER TO ACTUAL DOCUMENT FOR THE FOLLOWING –
FIGURE 1 : STAND CONTAINING ADEQUATE ADVANCED GROWTH
FIGURE 2 : STAND WITH INADEQUATE ADVANCED GROWTH

OPERATIONS MANUAL – 1997

NOTE: FOR UPDATES ISSUED IN 1997 REFER TO THE ENTRIES UNDER THE FOLLOWING –

Fire Operations Manual : Volume 1. 1993
Fire Operations Manual : Volume 3 : Fire Protection Instructions. 1993

MISSION AND OBJECTIVES – 1996

CALM Annual Report 1995/1996. 1996

NOTE: REFER TO ENTRY UNDER ANNUAL REPORT 1992/1993 – SIMILAR WORDING

TIMBER HARVESTING … 1996 ED. – 1996

Timber Harvesting in Western Australia … 1996 Ed. 1996

PART ONE : CODE OF HARVESTING PRACTICE

Preface
NOTE: REFER TO ENTRY UNDER 1993 EDITION (SIMILAR WORDING)

Section 2 : General
NOTE: REFER TO ENTRY UNDER 1988 EDITION (SIMILAR WORDING)

Section 3 : Felling, Trimming and Crosscutting
NOTE: REFER TO ENTRY UNDER 1988 EDITION (SIMILAR WORDING)

Section 4 : Extraction

NOTE: REFER TO ENTRY UNDER 1988 EDITION (SIMILAR WORDING)

PART TWO : MANUAL OF HARVESTING SPECIFICATIONS

Section 1 : Planning and Monitoring

Specification 1.1 : Harvesting and Regeneration Plans

1. Responsibilities

NOTE: REFER TO ENTRY UNDER 1990 EDITION (SIMILAR WORDING)

2.3 Short Term Integrated Harvesting and Regeneration Plan

"*This is the tertiary level integrated harvesting plan which shows in detail proposed harvesting areas over a one or two year period. The short term plan takes into account the principles contained in 'Guidelines for Integrated Forest Harvest Planning and Design'.*" (p. 16)

NOTE: THE LISTING HAS BEEN EXPANDED TO INCLUDE THE FOLLOWING –

"*These plans shall include:*

[…]

(3) 1:25, 000 plans showing, when available:

[…]

- *lignotuber status.*

[…]" (p. 16)

7. Field Plans

"*In most cases it is necessary for the forest Officer in Charge of a harvesting operation to be in possession of a relatively large scale field plan. The field plan is used to record the progress of cutting and extraction, and the progress of any silvicultural treatments.* […]" (p. 17)

8. Records

"*SFRBU or District staff must maintain up-to-date field records of areas cut over and silviculturally treated. Forms for inputs into the computer system 'SILREC' will be collated every six months with assistance from Forest Management Branch.*" (p. 17)

Section 3 : Silviculture

Specification 3.1 : Current Specifications

NOTE: REFER TO ENTRY UNDER 1989 EDITION (SIMILAR WORDING)

Section 4 : Coupe Management

Specification 4.2 Felling (Including Tree Marking Techniques)

NOTE: REFER TO ENTRY UNDER 1989 EDITION (SIMILAR WORDING)

Section 5 : Environmental Protection

Specification 5.4 : Protection of Crop Trees

NOTE: REFER TO ENTRY UNDER 1987 EDITION (SIMILAR WORDING)

MISSION AND OBJECTIVES – 1995

CALM Annual Report 1994/95. 1995

NOTE: REFER TO ENTRY UNDER ANNUAL REPORT 1992/93 – SIMILAR WORDING

SILVICULTURAL SPECIFICATION - 1995

Silviculture Specifications 1/95 : Silvicultural Practice in the Jarrah Forest

NOTE: SUPERSEDES SILVICULTURE SPECIFICATIONS 2/91

2. Regeneration Survey
"*Detailed planning of the regeneration requirements will facilitate treemarking in areas of uncertain regeneration status.*

Treemarking decisions will be significantly assisted by the early identification of shelterwood areas.[...] *Where regeneration status is uncertain, broadscale ground surveys are necessary*." (p. 1)

3. Integrated Harvesting and Regeneration Plans
"*Prior to harvesting, detailed plans will be developed for each coupe, as detailed in 'Timber Harvesting in W.A.'.*

From these plans appropriate silvicultural practices will be determined necessary to sustain appropriate values within the coupe (see Appendix 2).

Coupe planning is refined in the field as more accurate and detailed information becomes available through site inspection. It is important to field check those structural and species characteristics which will affect the prescription to be applied.[…]" (p. 2)

4. Treemarking
4.1 General
"*Before marking commences, the management zones appropriate to each part of the coupe must be clearly shown.*

Marking guidelines will vary in accordance with these zones. (See Appendix 2).

One silvicultural objective will be determined for each group or patch. These are:
- *Thinning - to promote growth on retained trees*
- *Release regeneration (gap creation) - jarrah regeneration will be encouraged to develop unimpeded into saplings, poles and mature trees by the removal of competing overstorey.*
- *Establish regeneration (shelterwood) - seedlings will be encouraged to establish and develop into ground coppice by reducing the competition of the overstorey. A forest canopy is maintained to provide a continuity of forest values until the ground coppice is developed and capable of response to release.*" (p. 2)

"*Only after the objective has been identified for each patch can individual trees be marked.*

Marking habitat trees and logs for retention is the first priority in each group or patch." (p. 3)

Diversity
"*To maintain diversity, up to 10% of the retained trees may be 'non crop tree' marri. Mark to protect native pear, river banksia and examples of snoddygobble, peppermint, large blackboys etc. Additional diversity of size and density of retained trees is required in the first 150 metres of VLM Zone A. (Appendix 2).*" (p. 3)

4.3 Marking to release regeneration (gap creation)
"Regeneration release by gap creation will be sought where there are insufficient crop trees to merit thinning (ie. less than 50% of required stocking), but where the stocking of ground coppice and saplings will adequately regenerate the gaps created by harvesting." (p. 4)

Diversity
"*Mature secondary storey species (eg, sheoak) will also be marked and retained undisturbed, preferably in clumps, to enhance stand diversity.*" (p. 5)

4.4 Marking to establish regeneration (shelterwood)
"*The shelterwood overstorey is retained to provide seed for regeneration and a continuity of forest values until ground coppice has developed to the stage where it is capable of rapid growth following release.*

Technique
Virgin Stands - *mark to retain 50% of the overstorey.*
Cutover Stands - *retain 10-15 m2/ha.* […]" (p. 5)

5. Silvicultural Treatment
5.1 Timing
"[…]*Machine treatments must be done before post-harvest burning.* […]." (p. 6)

Following harvest
"*The aim of these operations is to complete the objectives of treemarking, which could not be achieved by commercial operations alone. Unless a stand is fully marked to indicate the silvicultural objective, interpretation for follow-up treatment will be difficult.*

Where the silvicultural treatment cannot be fully achieved during the commercial harvesting operation separate treatments following harvesting are required." (p. 6)

5.2 Priorities for Treatment
"*i.* *Only treat those areas which are secure from disturbance, (eg. outside the 25 year bauxite mining envelope), and will remain available for timber production.*
ii. *Only treat those areas which are either secure dieback free and uninterpretable.*
iii. *Areas of high quality forest where the potential for growth is greatest.*
iv. *Areas of shelterwood have highest priority. Regeneration must be established now so that it will be ready for release in the next felling cycle. Areas of thinning have second priority, areas of regeneration release have third priority.*" (p. 6)
"*v.* *Locate treatment in areas where minimal culling of potentially valuable trees would occur and to allow for a larger area to be completed with the available financial resources.*
vi. *Areas of high landscape sensitivity where treatment is essential to meet the VLM objective.*" (p. 7)

5.3 Techniques for culling
[…]
"*The technique for establishing regeneration will depend on the availability of seed.*" (p. 7)

5.4 Treatment of thinning groups
"*Remove all competing 'non-crop' trees (J, M, Allocasuarina) within 4m of a crop tree.*
Remove trees by:
- *notching with an approved herbicide [see Herbicide Manual, Technical Instructions]*
- *felling and stump poisoning*" (p. 7)

"*Where trees appear to share a common root system with adjacent retained trees, fell without poisoning the stumps. In all other instances, stumps must be poisoned.* […]
[…]
Do not individually release around retained trees which are not of crop tree standard." (p. 8)

5.5 Treatment of Gaps
"*The object is to encourage regeneration by the removal of competing culls, and in some cases coppicing of malformed stems. This can be done either by:*

- *immediately removing all culls after harvesting, or*
- *initially removing sufficient culls to allow regeneration to develop into saplings and then in 20-25 years removing remaining culls and releasing saplings to grow into poles.*

[…]" (p. 8)

Techniques
Gap Size 0.25-2ha
"*Remove any unmarked non-crop trees <50cm in diameter and mature Banksia grandis by felling, pushing down or notching. Do not treat within 5 metres of habitat trees.*" (p. 8)

Gap Size >2ha
"*As for the above, but only remove the following unmarked culls:*
- *DBH 20-50cm only if within 15 metres of other trees, including crop or habitat trees or other remaining culls.*
- *DBH 10-20 cm if within 7 metres of other trees.*

Consider trees less than 3 metres apart as one tree. See Appendix 6 for interpretation." (p. 8)

5.6 Treatment of Shelterwoods
"*The objective is to establish regeneration by competition removal, soil disturbance and seedling establishment.*

Remove mature Banksia grandis and unmarked sheoak." (p. 8)

"*Where regeneration is adequate in number but too small for immediate release, no additional treatment is required.*
[…]
In areas where there is severe understorey rootstock competition, remove competing rootstock understorey in swathes at least 3 metres wide and not more than 10 metres apart. Preferably use a tracked machine with a rake blade. Do not establish swathes within 3 metres of retained trees. This work must only be done in dry soil conditions to ensure that a receptive seedbed results. Install erosion barriers at the appropriate intervals (See 'Timber Harvesting in W.A.').

Soil disturbance must be done in dry soil conditions immediately prior to the tops burn. Pushing of banksia must not be done more than 12 months prior to the burn." (p. 9)

Natural Seedfall
"*Examine the seed crop in late summer and where there is a viable and plentiful crop, aim to burn in autumn (See Silviculture Specification 1/91).*" (p. 9)

Artificial Seeding
"*Where there is a poor seed crop or poor success by natural seedfall, broadcast seed is an alternative. Use a cultivator to lightly scarify the soil along the prepared swathes. Simultaneously seed and fertilise using a mixture of:*
- *20, 000 viable jarrah seed per ha, and*
- *450 kg/ha No. 1 superphosphate.*

Apply seed and fertiliser to disturbed soil during autumn after burning." (p. 9)

Planting
"*If necessary plant at the rate of 1000 spha.* […]" (p. 9)

Establishment Survey
"*For both natural seedfall and artificial seeding undertake regeneration survey in the following February, (Specification 1/91).*

Even where regeneration is established by planting in shelterwood areas, continue to burn on a regular cycle in the same way as seeded establishment." (p. 9)

6. Burning and Protection
"*Burning and protection requirements vary according to silvicultural objectives.* […]" (p. 10)

7. Records
"*Good silvicultural records are essential for future managers to ascertain the condition and needs of the forest without having to undertake detailed assessment. The aim is to have an accurate description of the condition of the forest when the operation is completed. This will allow subsequent adjustments to be made to management if required.*

The silvicultural objective of harvesting and completed operations are entered in the GIS database annually as a basis for performance recording and silviculture planning." (p. 10)
NOTE: REFER TO ACTUAL DOCUMENT FOR –
APPENDIX 1 : A GUIDE TO SILVICULTURAL OBJECTIVES
APPENDIX 2 : JARRAH SILVICULTURAL SPECTRUM
Appendix 3 : Criteria for Selection of Crop Trees
"*Select crop trees to retain using the following considerations:*

- *Crop tree selection is based on the following species priority:*
  (a) Jarrah/Blackbutt (referred to as jarrah in the text)
  (b) Marri
  (c) Sheok
- […] *Crown vigour is much more significant than bole length.*

Eg

Original diameter	*30cm*	*30cm*
Bole length	*5m*	*10m*
Crown condition	*Deep, broad*	*Shallow, narrow*
Diameter in 20 years	*50cm*	*34cm*
Volume on 20 years	*.63cu.m*	*.5cu.m*
Time taken to reach		
Sawlog size (50cm)	*20 yrs*	*100 yrs*

[…]
In general, larger diameter trees will increase in diameter faster than smaller ones.
[…]
Minimum bole length of 1.8m with at least 50% of the diameter defect free." (p. 14)

Appendix 4 : Jarrah Thinning Intensity

MEAN DBHOB OF BEST 150 STEMS/HA AT FIRST THINNING	***CROP TREE BASAL AREA (m2/HA)***	***SCHEDULE***
Less than 20cm	***N/A***	*Release 200 jarrah stems/ha from overtopping and crown abrasion.* *The objective is to maintain healthy crown development on future jarrah crop trees without promoting a permanent low crown break.*
20-25cm	*#*10m2/ha*	*This will usually be a non-commercial thinning. It will leave more than 150 stems/ha but ensures that the stand is not left understocked. A further thinning will be required before the crop trees reach 50cm dbhob*
25-30cm	*#*10m2/ha*	*This is likely to be both a commercial and non-commercial thinning. The remaining trees are capable of reaching 50cm dbhob without the stand becoming overstocked (50 years). More conservative thinning in the future will maximise sawlog volume/ha*
40cm	*18m2/ha*	*Thin again when crop trees reach 50cm dbhob. Above comments apply*
50cm	*20m2/ha*	

**An additional 5m2 of the following may be retained:*
Trees within 5cm of becoming an power transmission pole or sawlog
Sheoak crop trees
Second grade sawlogs in areas which will have follow-up non-commercial thinning.

 # In the Intermediate Rainfall Zone - 15m2/ha
In the Low (<900mm) Rainfall Zone - 15m2/ha – 30% TEAS
- 10m2/ha – 70%" (p. 15)

NOTE: REFER TO ACTUAL DOCUMENT FOR –
APPENDIX 6 : FIGURE 1 : TREATMENT OF CULLS IN GAPS OVER 2HA
FIGURE 1A : GAP CONTAINING 2-3m2/ha CULLS WHICH ARE WIDELY SPACED AND DO NOT REQUIRE TREATMENT
FIGURE 1B : GAP CONTAINING ABOUT 8m2/ha OF CULLS, X INDICATING THOSE TO BE REMOVED
FIGURE 1C : GAP WITH A DENSE GROUP OF CULLS (>12m2/ha) WHICH SHOULD NOT BE TREATED.

GUIDELINE - 1995

Guidelines For Forest Landing & Snig Track Design & Management. 1995

Construction

- "*No woody debris will be pushed closer than 1 metre to retained vegetation. No debris will be heaped within 5 metres of retained vegetation. Retained vegetation refers to vegetation planned for retention, i.e. – crop & habitat trees, visual amenity vegetation, etc.*" (p. 3)

Protection Of Retained Landscape Elements

- "*Damage to retained trees, including vegetation screens, rock outcrops and landform immediately surrounding landings and in-coupe roads is to be avoided.*" (p. 3)

MISSION AND OBJECTIVES – 1994

CALM Annual Report 1993/94. 1994

NOTE: REFER TO ENTRY UNDER ANNUAL REPORT 1992/93 – SIMILAR WORDING

MANAGEMENT PLANS - 1994

Forest Management Plan 1994-2003. 1994.

1. Managed Forest Values

Harvesting Timber from State Forests

"*The quantity of timber which can be harvested from publicly owned native forest in Western Australia is constrained to be within the overall growth capacity of the forest. This means that the timber yield may be sustained in perpetuity.*" (p. 35)

Ecological Processes

"*This Forest Management Plan will ensure that the ecological processes continue to be maintained by:*" (p. 42)

- "*ensuring that there is no loss of soil by disturbance (other than that associated with mining) or no net loss of nutrients from forest ecosystems;*
- *ensuring that all areas of forest which are harvested or disturbed by other activities are regenerated with the same mix of forest species which was present prior to the disturbance.*" (p. 43)

Biological Diversity

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

- *maintaining a balanced forest structure, including a significant component of the mature and senescent stages of forest development, in perpetuity;*

[…]" (p. 43)

National Estate Values Outside Reserves

"*The planning and operational guidelines designed to minimise impacts on national estate values which are sensitive to timber production operations include:*" (p. 47)

- "*Ensuring that silvicultural operations do not prevent the re-establishment of the original structure of the forest type.*" (p. 48)

2. The Strategies for the Sustainable Management of Native Forests

Jarrah Forest Structural Strategies

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

1. Minimal disturbance

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

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

2. Low disturbance

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

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

3. Moderate disturbance

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

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

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

"*The structural goals for the minimal, low, moderate and high disturbance classes will be adopted and implemented as described above.*" (p. 11)

Silviculture in the Jarrah Forest

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

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

2.The maximum gap size will be approximately 10 hectares […].
[…]
4.Within each coupe, a minimum of three age or size classes, representing the development stages of the forest, will be present. This may not be immediately possible when harvesting forest with a predominantly single age class (e.g. extensive regrowth forest near Dwellingup).

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

7. Regrowth stands will be thinned to a minimum density of 10 square metres per hectare of basal area except in areas with a high risk of discharging saline groundwaters, where the minimal basal area will be 15 square metres per hectare." (p. 12)

GUIDELINES – 1994

Guidelines for Integrated Forest Harvest Planning & Design. 1994

Special Areas
Exclusion Areas
"*These are areas set aside from harvesting and are often linked to natural lines and forms eg. rock outcrops and stream zones. Often, however, for silvicultural purposes and the protection of habitat, these exclusion areas are not often linked to such natural lines. It is important that the most natural position is found for these link reserves and that natural lines and forms are followed where these reserves need to be located. (Fig. 5.1.1)*" (p. 5)

MISSION AND OBJECTIVES – 1993

CALM Annual Report 1992/93. 1993

"***CALM's mission :***

We conserve and manage Western Australia's wildlife and the lands, waters and resources entrusted to the Department for the benefit of present and future generations." (p. i)

"*In keeping with our mission, the Department of Conservation and Land Management has the following objectives.*

Conservation: *To conserve indigenous plants, animals and ecological processes in natural habitats throughout the State.*

Value and Use of Resources: *To optimise the value and economic return to the community of wildlife, lands, waters and resources entrusted to the Department without compromising conservation and other management objectives.*

Tourism and Recreation: *To identify and provide opportunities and services to the community which allows them to enjoy the wildlife, lands, waters and resources entrusted to the Department without compromising conservation and other management objectives.*

Knowledge: *To seek and provide an up-to-date and sound scientific and information basis for the Department's conservation and land management activities.*
[…]" (p. i)

MANUALS – 1993

Fire Operations Manual Instructions : Volume 1. 1993

NOTE: INCLUDES UPDATES ISSUED 1997

1.3 Burning Plans
1.3 (iii) Fire Exclusion Areas
"*Protection will be afforded to 'No Planned Burn Areas' as specified in Management Plans, or Interim Guidelines for Necessary Operations. Other areas to be protected include:*
[…]

- "*Regenerated hardwood areas where tree saplings or poles do not have sufficient bark thickness to withstand mild intensity fires.* […]" (p. Chapt 1 – Page 2) Issued 14/1/97

7. Prescribed Burning and Fuel Reduction
7.1 Prescribed Burning on CALM Lands
"*Prescribed burning can be used to achieve a wide variety of land management objectives, for example:*
[…].
2. To achieve silvicultural objectives, eg. regeneration, clearing
[…]." (p. Chapt 7 – page 1) Issued 14/1/97

7.2 Types of Burning
7.2 (5) High Value Buffers
"*These are located to keep fires out of such high value areas as town sites, schools, sawmills, isolated settlements, plantations, research areas, regeneration, recreation and ecologically valuable or sensitive areas.* […]." (p. Chapt 7 – page 2) Issued 14/1/97

7.2 (iv) Maintenance of Buffers
"*Within designated buffers, fuel reduction is the priority activity. No other activity is permitted which will prevent fuel reduction being carried out during the period the buffer is so designated.*

Logging within buffers is not permissible except for the following operations.

- *Thinning which retain adequate stocking and does not create gaps.*[…]
- *Cutting to shelterwood of jarrah where a deficiency in lignotubers requires seedling establishment, overstorey cover to inhibit advance growth development and regular burning to develop lignotubers (see Silviculture Specification 2/91).*

Logging which creates regeneration is to be avoided. Even where it is planned to sacrifice resultant regeneration difficulties will arise. […]" (p. Chapt 7 – page 2) Issued 14/1/97

7.2 (v) Fire Management Areas
Prescribed burning of large areas outside of designated buffers may be programmed to meet various objectives such as: to minimise the impact of wildfires on forest values (eg, timber); to facilitate the control of wildfires; to facilitate achievement of a range of silvicultural objectives; to enhance wildlife; to study fire effects; to provide structural diversity of vegetation associations. The application of this system depends on the land-use objective, the burn objectives, the vegetation/fuel types, the rate of fuel build-up together with seasonal weather, manpower availability and other local circumstances." (p. Chapt 7 – page 2) Issued 14/1/97

7.2 (vi) Advance Burning
These are applied prior to logging operations, for the protection of the residual stand and the safety of the logging crews. In jarrah forest advance burning is also recommended as an aid to the identification of

lignotubers during lignotuber surveys (see Silviculture Specifications 3190 and 1191). It is desirable to program normal rotational burns in such a way that the timing fulfils the requirements of fuel reduction and advance burning." (p. Chapt 7 – page 2) Issued 14/1/97

7.2 (vii) Regeneration Burns
"*Regeneration burns (often called Slash Burns) are conducted following logging of forests to meet several objectives: removal of logging debris; stimulation of seedfall in stands where seed trees have been retained; production of seed bed (ashbed) or suitable planting sites. Refer to Slash Burning Guidelines (17P1 37). These burns are often of high intensity and take place during the Prohibited Burning Time. (See also FPI 46 Slash Burning Prescription Preparation, and FP1 54 Standards for Coupe Preparation for Karri Regeneration Burning.)*

7.2 (viii) Tops Disposal Burns
"[…]. *The aim is to remove flash fuels and woody material up to 2.5 cm in diameter which have accumulated as a result of the logging operations. (See Silviculture Specification 1191.)*" (p. Chapt 7 – page 3) Issued 14/1/97

Fire Operations Manual : Volume 2 : Fire Protection Instructions. 1993
Fire Protection Instruction 1 : Master Burn Plan Review Process
Appendix 1 PLANNING STEPS
"*The following are Planning Steps that need to be considered and appropriately acted upon to properly implement the Prescribed Burning Planning Process.*" (Fire Protection Instruction 1 : p. 11) Issued 20/01/99

"*PLANNING STEP* *FP2*

Year Relative to Burn: -8 (Jarrah forest where interpretation required)

Issue:	*Regeneration in Burning Buffers. Exclude regeneration from 1st stage Burning Buffers. Regenerate 2nd Stage Burning buffers as early as possible.*
Action:	*Regional Operations Officer (in liaison with Districts) confirms current buffer plans are up to date. Provide this information to resource planner.*
Information:	*Location of 1st and 2nd Stage Burning Buffers and logging proposals.*
Custodian:	*Regional Operations Officer.*
Input by:	*Operations Officer, District Fire Protection Officer, FOIC, Resource Planner.*
Received by:	*District Fire Protection Officer, FOIC, Resource Planner.*
Critical:	*Yes, to ensure that Resource Planner identifies areas inside 1st Stage Burning Buffers that are deficient in Jarrah advance growth for shelterwood operations and directs release cutting / regeneration operations into 2nd Stage Burning Buffers.*
Other Options:	*No*" (Fire Protection Instruction 1 : p. 11) Issued 2109/93

"*PLANNING STEP* *S1*

Year Relative to Burn: -8

Issue:	*Protection of existing regeneration.*
Action:	*Prepare maps of regeneration status and suitability for burning.*
Information:	*Areas of regeneration requiring protection and its likely time of availability for prescribed burning. FMIS should contain year of regeneration information*
Custodian:	*Regional Silviculturalist/Regional Operations Officer*
Input By:	*Fire Management Branch, District Silviculturist or Fire Protection Officer.*
Received By:	*Regional Fire Protection Officer.*
Critical:	*Yes, loss of regeneration will lead to reduced future timber production, and reduced*

area burnt may increase risk unnecessarily.
Other Options: *Yes, can be done earlier.*" (Fire Protection Instruction 1 : Page 12) Issued 21/09/93

"*PLANNING STEP* *PL3*

Year Relative to Burn: *-4 (Jarrah forest where interpretation completed, or Karri Forest)*

Issue: *Regeneration in Burning Buffers (BB)*
Exclude regeneration from 1st Stage BB. Regenerate 2nd Stage BBs as early as possible.
Action: *Regional Operations Officer (in liaison with Districts) confirms current buffer plans are up to date. Provide this information to resource planner.*
Information: *Location of 1st and 2nd Stage Burning Buffers and logging proposals.*
Custodian: *Regional Operations Officer.*
Input By: *Operations Officer, District Fire Protection Officer, FOIC, Resource Planner*
Received By: *District Fire Protection Officer, FOIC, Resource Planning Officer.*
Critical: *Yes, to ensure that Resource Planner identifies areas inside 1st Stage Burning Buffers that are deficient in Jarrah advance growth for shelterwood operations and directs release cutting / regeneration operations into 2nd Stage Burning Buffers.*
Other Options: *No.*" (Fire Protection Instruction 1 : p. 14) Issued 21/09/93

"*PLANNING STEP* *S2*

Year Relative to Burn: *-2*

Issue: *Lignotuber survey scheduling.*
Action: *Schedule lignotuber survey for post burn period.*
Information: *If logging is to take place in area during the next 2 to 10 years then a survey may be required. If an advanced burn is to take place then the survey may be able to be done post advance burn, otherwise it must be after the last rotational prescribed burn.*
Custodian: *Silvicultural Officer.*
Input By: *Silvicultural Officer, Fire Protection Officers*
Received By: *Fire Protection Officers.*
Critical: *Yes, to allow for reasonable scheduling.*
Other Options: *If required, can be inserted into schedule at a later date.*" (Fire Protection Instruction 1 : p. 16) Issued 21/09/93

"*PLANNING STEP* *S4*

Year Relative to Burn: *-1*

Issue: *Objectives for silvicultural burns.*
Action: *Clear definition of silvicultural and other management objectives, assessment of stand conditions (including fuel).*
Information: *Silvicultural objectives, management concerns, protection values, time frame for burn success, seed status.*
Custodian: *District Silviculturist.*
Input By: *Prescribing officer usually the Coupe Silviculturist assisted by Forest Management Branch silviculturist where required.*
Received By: *District Silviculturist, Fire Protection Officer.*
Critical: *Yes, for successful and cost-effective regeneration.*
Other Options: *No, seed cycles in some species have a narrow window of opportunity.*" (Fire Protection Instruction 1 : p. 18) Issued 21/09/93

"*PLANNING STEP* *TS2*

Year Relative to Burn: -1

Issue: *Advance burn for logging.*
Action: *Ensure that demarcation has been completed prior to burning.*
Information: *When dieback demarcation is completed.*
When coupe preparation is planned.
Custodian: *District Fire Protection Officer.*
Input By: *District Logging Officer.*
Received By: *Regional Fire Protection Officer.*
Critical: *Yes, burn is required for silvicultural reasons (lignotubers), and safety of logging operation.*
Other Options: *No.*" (Fire Protection Instruction 1 : p. 19) Issued 21/09/93

"*PLANNING STEP* *FP4*

Year Relative to Burn: O(immediately following)

Issue: *Post Burn inspection and monitoring.*
Action: *Use post burn appraisal form.*
Information: *Area burnt, effect of fire, burn security, long term monitoring of species as required.*
Custodian: *District Manager.*
Input By: *Burn Supervisors.*
Received By: *As required.*
Critical: *Yes, allows for evaluation and ensures that burn is secure.*
Other Options: *No.*" (Fire Protection Instruction 1 : p. 20) Issued 21/09/93

"*PLANNING STEP* *S3*

Year Relative to Burn: +1

Issue: *Lignotuber Survey in areas that are to be logged.*
Action: *Assess lignotuber distribution by ground survey before scrub regeneration.*
Information: *Stratified map of lignotuber stocking as per silvicultural specification.*
Custodian: *Coupe silviculturist, District.*
Input By: *Coupe silviculturist.*
Received By: *Regional Forest Management Branch Officer.*
Critical: *Yes, determines cutting pattern, affects timber yield etc.*
Other Options: *Depending on vegetation may be done up to 4 years post burn.*" (Fire Protection Instruction 1 : p. 21) Issued 21/09/93

Fire Operations Manual : Volume 3 : Fire Protection Instructions. 1993
NOTE: INCLUDES UPDATES ISSUED 1997

Fire Protection Instruction 46 : Slash Burning Prescription Preparation

1.Scope
"*This prescription describes the procedures for preparing post harvest or regeneration for burning and is applicable to either clearfelled, seed-tree areas or areas of shelterwood.*" (Fire Protection Instruction 46 : p. 1) Issued 09/15/93

2.Objectives
"*To produce suitable seed bed for natural or artificial regeneration.*

To induce seed fall from seed trees.

To remove logging debris to:

- *allow safer access for planting.*
- *reduce damage to future crop trees.*

To meet these objectives, using the maximum fire intensity possible, within control, safety and cost guidelines."(Fire Protection Instruction 46 : p. 1) Issued 09/15/93

4.Material Required
- *Slash Burn Prescription (CLM 657 [1991]).*
- *CALM Environmental Checklist (CLM 32 [1991]).*
- *Blown up HOCS sheet of coupe (from treemarker).*
- *Latest aerial photo of coupe.*" (Fire Protection Instruction 46 : p. 1) Issued 15/09/93

5. Technique (Office)
"*From blown up HOCS sheet and aerial photo draw up a working sketch of the proposed burn including buffers and adjacent areas, especially showing areas of value that may be at threat during the proposed slash burn.*

On your plan indicate:

(a) Fuel Ages and Forest Types (after checking fuel age plans)
(b) Land Tenure (other than State forest)
(c) Water Points
(d) Stream Reserves, Water Reservoirs
(e) Road Reserves, DRA status
(f) Apiary Sites
(g) Public Use Areas (recreation sites, walk trails etc)
(h) Area in hectares
(i) Location
(j) Harvesting completion date" (Fire Protection Instruction 46 : p. 2) Issued 15/1/93

6. Technique (Field)
"*After consulting the data set for stream reserves, research trials, and other non burn areas, drive around the slash and buffer areas observing the following and noting on the plan:*

(a) Topography
(b) Road construction/ improvement requirements (for burning, plus future regeneration and protection needs). Allocate temporary names for unnamed roads and tracks. Points for vehicle turnarounds should be indicated at approximately 150m intervals on boundary tracks
(c) Locations where edges to be pushed in (advance mop-up) - where no burn or high value areas area adjacent is required
(d) Water supplies (existing and proposed)
(e) Danger points (for vehicles and lighters)
(f) Slash component - age, density, arrangement, type etc
(g) Consider desirable wind direction, lighting pattern/method, and burn quality required, commensurate with season desired.
(h) Stag failing requirements (within coupe and buffer)
(i) Location(s) of Control Points

(j) Special areas in buffers requiring protection (karri pole stands etc)
[…]" ((Fire Protection Instruction 46 : p. 1) Issued 15/09/93

"*(l) Environmental considerations - permanent creeks, steep slopes, Phytophthora (dieback) occurrences.*
[…]
(m) Log salvage within buffers
(n) Consider season of burn and timing of buffer burns
(o) Services - Telecom and SECWA lines, water pipes, bridges etc
(p) Problem areas (dense gullies near boundaries)
(q) Fuel sampling within buffers
(r) Allocate sectors along boundaries" […]" (Fire Protection Instruction 46 : p. 1) Issued 15/09/93

7. Slash Burning Preparation Prescription
"[…]. *All work must be discussed to ensure operators are fully conversant with location, standards, environmental constraints etc. Refer to stag failing guidelines and discuss safety etc before commencing this operation.*" (Fire Protection Instruction 46 : p. 3) Issued 15/09/93

10. Pre-Burn Checklist
"*Complete a Pre Burn Checklist (CLM 32) and complete action items identified.*" (Fire Protection Instruction 46 : p. 4) Issued 15/09/93

14. Post Burn Appraisal
"*Complete details as listed on P4 of Prescription Form (CLM 657)*

Ensure information is properly recorded and the prescription is stored for future reference. […]" (Fire Protection Instruction 46 : p. 5) Issued 15/09/93

Fire Protection Instruction 54 : Standards for Coupe Preparation for Post Harvest and Regeneration Burning
Scope
"*This prescription covers standards required for various components during the preparation of post harvest or regeneration burns. Location and quality of all operations during preparation of the burn are to be detailed in the Post Harvest or Regeneration Burn Preparation Prescription and Plan.*

The Forest Officer in Charge will ensure that all work is done to these standards. […]" (Forest Protection Instruction 54 : p. 1) Issued 21/09/93

2. Objectives
"*a) To ensure that the standards defined herein are applied uniformly.*
b) All proposed burns are prepared to these standards.
c) Satisfactory future access is assured.
d) The potential for future productivity is maximised." (Forest Protection Instruction 54 : p. 1) Issued 21/09/93

3. Preplanning and Training
"*With sufficient forethought and planning before and during logging operations many benefits will be assured.*

Coupe Shape – symmetrical preferred.
Coupe Location – avoid untrafficable boundaries if possible.
Forest types – cutting to adjacent forest types will avoid cutting poorly shaped coupes in the future. […]

[…]." (Forest Protection Instruction 54 : p. 1) Issued 21/09/93

"*High value/risk areas adjacent, eg karri regrowth stands, pines, private property etc. which must not be burnt under any circumstances, will require special preparation and protection considerations, such as preburnt buffers etc.*." (Forest Protection Instruction 54 : p. 1) Issued 20/1/99

5. Standards
"*Preparation standards are to be closely monitored as work progresses. The CALM Supervisor will have the final say on any work below standard and additional work required to rectify the problem.*" (Fire Protection Instruction 54 : p. 3) Issued 22/09/93

5.2 Cell Formation
"*Formation of these cells will provide;*
[…]
- *more flexibility of the lighting pattern to the fire boss.*
- *greater access during future regeneration operations.*
- *breakup the coupe for future prescribed burning/suppression activities.*
- *access for the future logging operations and other management needs.*" (Fire Protection Instruction 54 : p. 4) Issued 21/09/93

5.3 Scrub Rolling
"*This is the operation to roll green standing understorey scrub, unmarketable small trees, poles etc so that they will burn more readily and create a more suitable site for future regeneration.* […]

The sooner scrub can be rolled (even during logging operations) and allowed to dry the better so as to maximise the burn result. […]" (Fire Protection Instruction 54 : p. 4) Issued 21/09/93

5.5 Advance Mop-Up (Pushing In)
"*This is the pushing of logs and large debris away from any boundary (into the burn) before burning commences. This allows better control when burning adjacent to no-burn areas (stream reserves etc) and avoids costly and extensive mopping up after the burn.*

The location of any pushing in will be marked on the prescription plan and will need to be done where no buffer is proposed or recent burn exists." (Fire Protection Instruction 54 : p. 4) Issued 20/1/99

5.7 Flexibility
"*In some cases it may be desirable to push in logging debris, plus prepare for a buffer burn along a particular flank. This will allow a greater amount of flexibility in the 'when and how' the burn is to be conducted and reduce the risk of escapes and costs at the same time. Again it is preferable to burn the buffer out well in advance if possible.*" (Fire Protection Instruction 54 : p. 6) Issued 21/09/93

Fire Protection Instruction 61 : Objectives and Standards : Aerial Prescribed Burning : Southern Forest Region
Hazard Reduction Burning
Objectives:

Protection
[…]
To provide a reduced fuel zone to protect adjacent karri regeneration from wildfire.
To provide protection to established jarrah and karri regeneration within or adjacent to the burn
To provide a fuel reduced buffer between adjoining jarrah or karri regeneration cells as per the Regional Management Plan.
[…]
To burn out flats vegetation only, leaving forested areas unburnt for age diversity purposes." (Fire Protection Instruction 61 : p. 2) issued 14/1/97

Standards:
Jarrah:

"[…]
Roadside scorch along a public or nominated recreational or tourist road is not exceed 4 metres in height." (Fire Protection Instruction 61 : p. 2) issued 14/1/97

Silvicultural Objectives:

Jarrah:
Advance Burning:
"*To remove available fuels so as to prepare the coupe for improved access, safe falling operations, hazard reduction and evaluation of advance growth (if required).*" (Fire Protection Instruction 61 : p. 2) issued 14/1/97

"*To conduct the relatively low intensity burn(<350 kw/m) so as to avoid abortion of immature buds, or premature seed fall, or damage boles or crowns or trees that may need to be retained.*" (Fire Protection Instruction 61 : p. 2) issued 14/1/97

Tops Disposal Burning:
"*To achieve allow intensity burn in areas harvested to crop tree release by the removal of flash fuels up to 2.5cm in diameter and woody materials.*" (Fire Protection Instruction 61 : p. 2) issued 14/1/97

"*To reduce additional debris produced from harvesting operations subsequent to the advance burn in areas harvested to regeneration release.*" (Fire Protection Instruction 61 : p. 2) issued 14/1/97

Release Burning:
"*To remove the majority of available fuels within two years of harvesting operation (especially if no advance burn was conducted).*" (Fire Protection Instruction 61 : p. 2) issued 14/1/97

"*To enhance the development of regeneration by removal of scrub competition and poorly formed saplings, and stimulation of dynamic growth of lignotubers and suppressed saplings.*" (Fire Protection Instruction 61 : p. 2) issued 14/1/97

"*To burn 90% of the stocking of deformed saplings back to ground level with a moderate intensity burn, so as to allow them to reshoot cleanly*." (Fire Protection Instruction 61 : p. 2) issued 14/1/97

Jarrah Regrowth Burns (12 yo+):
"*To remove fuels accumulated since establishment with a low intensity burn, to protect the stand from the effects of a future wildfire.*" (Fire Protection Instruction 61 : p. 2) issued 14/1/97

Regeneration Burns:
"*To conduct a medium intensity burn in areas harvested for regeneration establishment to remove scrub competition, create suitable seed bed, stimulate seed fall and provide fuel reduction benefits.*" (Fire Protection Instruction 61 : p. 2) issued 14/1/97

"*To time the burn to take maximum advantage of available seed crops.*" (Fire Protection Instruction 61 : p. 2) issued 14/1/97

Standards:

Jarrah:
Advance Burns:
"*Burn intensity depends on crown seed availability or status …*" (Fire Protection Instruction 61 : p. 2) issued 14/1/97

Tops Disposal Burning:
"*To remove woody material <25 mm diameter, over 90% of the burn area with minimal butt and bole damage to retained crop trees.*" (Fire Protection Instruction 61 : p. 2) issued 14/1/97

Release Burning:
"*To remove flash fuels, scrub competition, and some woody material <50 mm diameter, over 90% of the burn area.*" (Fire Protection Instruction 61 : p. 2) issued 14/1/97

"*To burn 90% of deformed saplings back to ground level (<2 yo).*" (Fire Protection Instruction 61 : p. 2) issued 14/1/97

"*To achieve 50% crown scorch over 90% of the burn area.*" (Fire Protection Instruction 61 : p. 2) issued 14/1/97

Jarrah Regrowth Burns (12 yo+):
"*Sapling to be DBHOB >10cm.*" (Fire Protection Instruction 61 : p. 2) issued 14/1/97

"*Sapling total height >5m (as confirmed by sampling).*
Maximum scorch height 4m." (Fire Protection Instruction 61 : p. 2) issued 14/1/97

Regeneration Burns:
"*To remove flash fuels, scrub competition and some woody material <50 mm diameter, over 90% of the burn area.*" (Fire Protection Instruction 61 : p. 2) issued 14/1/97

"*To achieve 50% crown scorch over 90% of the burn area.*" (Fire Protection Instruction 61 : p. 2) issued 14/1/97

TIMBER HARVESTING … 1993 ED. – 1993

Timber Harvesting in Western Australia … 1993 Ed. 1993

PART 1 : CODE OF LOGGING PRACTICE

Preface
"*This new publication 'Timber Harvesting in WA' contains revised editions of the 'Code of Logging Practice' (the Code) and the 'Manual of Logging Specifications' (the Manual).*

The Code and the Manual form parts of a hierarchy of rules relevant to timber harvesting operations controlled by the Department of Conservation and Land Management.

- *Conservation and Land Management Act (1984)*
- *Forest Management Regulations 1993 (gazetted 9 February 1993).*
- *Code of Logging Practice.*
- *Manual of Logging Specifications.*
- *Bush Fires Act*
- *Individual Contracts to Supply negotiated between a logging contractor and CALM.*
- *Forest Produce Licence.*" (p. I)

Section 2 : General
NOTE: REFER TO ENTRY UNDER 1988 EDITION (SIMILAR WORDING)

Section 3 : Felling, Trimming and Crosscutting
NOTE: REFER TO ENTRY UNDER 1988 EDITION (SIMILAR WORDING)

Section 4 : Extraction
NOTE: REFER TO ENTRY UNDER 1988 EDITION (SIMILAR WORDING)

PART 2 : MANUAL OF LOGGING SPECIFICATIONS

Section 1 : Planning and Monitoring
Specification 1.1 : Harvesting and Regeneration Plans
Part A : Hardwood
"*Complete details are contained in the Department's 'Provisional Manual of Hardwood Logging Planning'. The following is a summary.*" (p. 20)

1.1 Responsibilities
NOTE: REFER TO ENTRY UNDER 1992 EDITION (SIMILAR WORDING)

7. Field Plans and Checklists
NOTE: REFER TO ENTRY UNDER 1990 EDITION (SIMILAR WORDING)

8. Monitoring and Records
NOTE: REFER TO ENTRY UNDER 1992 EDITION (SIMILAR WORDING)

Section 3 : Silviculture
Specification 3.1 : Current Specification
NOTE: REFER TO ENTRY UNDER 1989 EDITION (SIMILAR WORDING)

Section 4 : Coupe Management
Specification 4.2 Felling (Including Tree Marking Techniques)
NOTE: REFER TO ENTRY UNDER 1989 EDITION (SIMILAR WORDING)

Specification 4.5 : Logging Operation Inspections and Certifications
NOTE: REFER TO ENTRY UNDER 1987 EDITION (SIMILAR WORDING)

Section 5 : Environmental Protection
Specification 5.4 : Protection of Crop Trees
NOTE: REFER TO ENTRY UNDER 1987 EDITION (SIMILAR WORDING)

TIMBER HARVESTING … 1992 ED. – 1992

Timber Harvesting in Western Australia … 1992 Ed. 1992

PART 1 : CODE OF LOGGING PRACTICE

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" '*Timber Harvesting in WA' contains, under one cover, revised editions of the 'Code of Logging Practice' and the 'Manual of Logging Specifications'.*

The Code and the Manual are parts of a hierarchy of rules relevant to timber harvesting (logging) operations controlled by the Department of CALM:

* *CALM Act (1984) and other relevant Acts.*
* *Regulations under the CALM Act and other relevant Acts. (Note: Forest Resource Management Regulations under the CALM Act are currently being prepared. Until they are endorsed by Parliament, regulations under the Forest Act (1918) apply.)*
* *Manual of Logging Specifications, and other CALM guidelines relevant to timber harvesting.*

* *Log Supply Contracts between CALM and logging contractors, and Forest Produce Harvesting or Collection Licences.*" (p. i)

Section 2 : General
NOTE: REFER TO ENTRY UNDER 1988 EDITION (SIMILAR WORDING)

Section 3 : Felling, Trimming and Crosscutting
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7. Field Plans and Checklists
NOTE: REFER TO ENTRIES UNDER 1990 EDITION (SIMILAR WORDING)

8. Monitoring and Records
"*District staff must maintain up-to-date field records of areas cut over and silviculturally treated. For each coupe, a Coupe Silvicultural Report (CLM 160) must be completed as quickly as possible following the completion of harvesting. (Refer Attachment 1.1.2)*

A Post Operation Checklist (CLM 813) must be completed between 12 and 24 months following the completion of harvesting. (Refer Attachment 1.1.3)" (p. 27)

Section 3 : Silviculture
Specification 3.1 : Current Specification
NOTE: REFER TO ENTRY UNDER 1989 EDITION (SIMILAR WORDING)

Section 4 : Coupe Management
Specification 4.2 : Felling (Including Tree Marking Techniques)
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Section 5 : Environmental Protection
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POLICY STATEMENT - 1992

Policy Statement No. 41 : Beekeeping on Public Land. 1992

Strategies

"*11. CALM will periodically use bees as a mechanism to achieve it's* [sic] *silvicultural objectives, for seed set, or seed collection.* […]" (p. 5)

LEGISLATION - 1991

Conservation and Land Management Act 1984 (Reprint with amendments)

"*AN ACT to amend the Conservation and Land Management Act 1984, and to consequently amend certain other Acts.*

[Assented to 25 June 1991.]" (p. 1)

Section 5 amended

"*5. Section 5 of the principal Act is amended by inserting after paragraph (c) the following paragraph-*

' (ca) conservation parks;'." (p. 3)

Section 6 Repealed and a Section Substituted

"*6. Section 6 of the principal Act is repealed and the following section is substituted –*

Categories of Land Defined

' 6. (1) State forest comprises all lands that –

(a) immediately before the commencement of this Act were dedicated as a State forest under section 20 of the Forests Act 1918;

(b) after such commencement –
(i) are reserved under section 8; or
(ii) are acquired and set apart under section 15,
for the purpose of a State forest; or

(c) under any other Act become reserved for the purpose of a State forest.

(2) Timber reserves comprise all lands that –

(a) immediately before the commencement of this Act were timber reserves under section 25 of the Forests Act 1918;" (p. 3)

"*(b) after such commencement –*
(i) are reserved under section 10; or
(ii) are acquired and set apart under section 15,
for the purpose of a timber reserve; or

(b) ***under any other Act become reserved for the purpose of a timber reserve***." (p. 4)

Section 33 Amended

"*21. Section 33 of the principal Act is amended –*
(a) in subsection (1) –
[…]

(dc) to promote the conservation of water, as to both quantity and quality, on land referred to in paragraph (a);

(ii) in paragraph (e) by deleting subparagraphs (i) and (ii) and substituting the following subparagraphs -

' (i) the management of land to which this Act applies;" (p. 12)

"*(ii) the conservation and protection of flora and fauna; and*
(iii) the taxonomy of flora and introduced plants,';
and
(iii) in paragraph (f) by inserting after 'other person' the following -
' , whether in the State or elsewhere';

(b) in subsection (3), by deleting paragraph (b) and substituting the following paragraph –

(i) in the case of nature reserves and marine nature reserves, in such a manner that only necessary operations, within the meaning in section 33A (1) are undertaken;

(ii) in the case of national parks, conservation parks and marine parks, in such a manner that only compatible operations, within the meaning in section 33A(2), are undertaken; or

(iii) in any other case, in accordance with the provisions of section 56 applicable to the land.'.
and

(c) by deleting subsection (4)." (p. 13)

Section 33A Inserted
"*22. After section 33 of the principal Act the following section is inserted-*

Definition of 'necessary operations' etc.
' 33A. (1) In section 33 (3) (b) 'necessary operations' means those that are necessary for the preservation or protection of persons, property, land, flora or fauna, or for the preparation of a management plan." (p. 13)

Section 55 Amended
"*27. Section 55 of the principal Act is amended by inserting after subsection (1) the following subsection (1) the following subsection-*

' (1a) A management plan for an indigenous State forest or timber reserve shall specify the purpose, or combination of purposes, for which it is reserved being one or more of the following purposes-
[…]
(c) timber production on a sustained yield basis;
[…]" (p. 17)

Section 56 Amended
"*28. Section 56 of the principal Act is amended-*

(a) in subsection (1)-

(i) by repealing paragraph (a) and substituting the following paragraph-

' (a) in the case of indigenous State forests or timber reserves, to achieve the purpose, or combination of purposes, provided for in the proposed management plan under section 55 (1a);';

(ii) in paragraph (c) by inserting after 'national parks' the following-

' and conservation parks';

and

(iii) in paragraph (d) by inserting after 'and fauna' the following-

' , and to preserve any feature of archaeological historic or scientific interest';

and

(b) by repealing subsection (2)." (p. 17)

STRATEGIC PLAN – 1991

CALM Annual Report 1 July 1990 to 30 June 1991. 1991

NOTE: THE STRATEGIC PLAN 1989-1993 IS REPRINTED WITH AN ADDITIONAL CLAUSE (THE FINAL ONE UNDER THE FOLLOWING HEADING) –

"*To achieve the primary objectives the Department will:*" (p. 11)

[…]

"***Prepare and implement management plans for lands and waters entrusted to the Department.***

This will involve:

- *Establishing priorities for management plan preparation according to set criteria.*
- *Preparing and implementing management plans according to agreed priorities.*
- *Developing and implementing 'Interim Guidelines for Operations', according to an approved procedure and format, where there is a need for protection of people, property, land, flora and where there is no approved management plan.*" (p. 14)

SPECIFICATION – 1991

Silviculture Specification 2/91 : Treemarking and Silvicultural Treatment in the Jarrah Forest

NOTE: THIS SPECIFICATION SUPERSEDES SILVICULTURE SPECIFICATIONS 5/89 AND 7/89

Introduction
"*The aim of silvicultural practice in the jarrah forest managed for multiple use purposes is to develop or maintain a forest structure that will achieve objectives for nature conservation, timber production, water quality and water production, heritage and aesthetics.*

This specification details:

the broad goals for each value,
requirements for integrated planning,

the standards to be achieved for all values, and
guidelines for field application.

and outlines the variation to silvicultural practice that will be made to cater for various forest values, recognising their relative importance in different areas. It deals with the application of these strategies at the coupe level in areas from which timber is harvested.

The broader strategy that deals with zoning of the forest and the location, arrangement and harvesting is established at the regional planning level. This includes determining where harvesting can best located to achieve the strategic goals, the allocation of zones (e.g. water, wildlife) from which harvesting is to be excluded and the establishment of relative priorities between values.

This specification relates only to dieback-free jarrah forest designated as multiple use in the 1987 Regional Management Plans. Dieback infected forest is to be managed in accordance with Specifications 3 and 4/89.

The treemarking and silvicultural treatments outlined in Sections 4 –7 of this specification do not apply to extensively managed areas of eastern and Sunklands jarrah forest (Sect. 3.2.3). A new specification is being prepared to cover these areas." (p. 2)

2. Management Objectives and Silvicultural Strategies
2.3 Timber Management and Supply
Management Objectives

"* *To manage native forests so that an efficient timber industry is able to be sustained indefinitely, based on the following principles:*

all cutover areas will be regenerated to a full stocking and all previously regenerated forests will be managed to optimise the attainment of all forest values.

harvesting will only occur where the potential productivity is sufficient to cover cost of regenerating, establishing and managing those forests.

the harvest from the forest will be regulated to levels that can be sustained indefinitely.

all forest management operations, including logging, will be controlled by the Department of CALM.

Silvicultural Strategies

- *Current timber supply will be achieved from trees which are not required for other purposes, including those retained for sustaining long term growth.*

- *Timber sustainability will be achieved by developing a grouped forest structure where the areas of regeneration are of a minimum sustainable size (ideally 4 tree heights). One silvicultural objective will be determined for each group. These are in order of preference:*

  Thinning – to promote growth on retained trees.

  Regeneration Release (Established regeneration released in patches);
  Jarrah regeneration will be encouraged to develop unimpeded into saplings, poles and mature trees by the removal of competing overstorey.

  Shelterwood (Establishment of regeneration).
  Seedlings will be encouraged to establish and develop into ground coppice by reducing the competition of the overstorey. A forest canopy is maintained to provide a continuity of forest values until the ground coppice is developed and capable of response to release.

- *Wherever possible implement silvicultural objectives through commercial removal and sale. Only when this process has been completed will non-commercial removal of trees be undertaken, and only then if they inhibit the silvicultural objective.*" (p. 4)

3. Planning For Harvesting
"*Coupes for logging are nominated within a strategic framework at the regional planning level. This section deals with the planning of silvicultural practices to be adopted within a coupe. Details of operational planning (e.g. roading, disease management) are contained within the Manual of Hardwood Logging Specifications.*

The aims of coupe planning are to:

(1) Identify the values present in the proposed cutting coupe, and
(2) Determine how the appropriate silvicultural practices will be implemented to the benefit of all values within the coupe.

Coupe planning is refined in the field as more accurate and detailed information becomes available through site inspection." (p. 6)

3.1 Inventory
"*The following are essential planning tools*

(1) Contour Maps showing watercourses
(2) Visual Resource Management Zones
(3) Rainfall Zones
(4) API Type maps, and other maps showing cutting histories and silvicultural treatments
(5) Streams and other permanent zones
(6) Wildlife Values

[…]
A coupe plan is prepared showing:

WATER: Harnesssed catchments
Rainfall Zones
Stream Zones=

VISUAL RESOURCE: VRM Zones (including seen area)
VRM Special Areas
Roadside Zones (Southern Forest Region)=

WILDLIFE: Significant values

TIMBER: Low Value/Non Productive Areas
Structural Types (where known)

= Note that these zones are currently subject to review" (p. 6)

3.2 Field Inspection
"*A field inspection of each coupe must be made to verify the values that are present.* […]" (p. 6)

4. Treemarking
4.1 General
"*Treemarking is the means by which stand objectives are marked out in the forest so that harvesting and tending operations can proceed. By making trees to be retained the forester provides a vision of the future development of the stand.*

Before marking commences, the forester must know:
the water, visual resource and wildlife objectives within the coupe, and the type of trees likely to be removed commercially.

Marking specifications will vary in accordance with the above objectives. (See Appendix 2).

The first task in marking a patch of trees is to determine the silvicultural objective (thinning, regeneration release, or shelterwood) and whether its boundaries are apparent. The process for making these decisions is outline in 'Treemarking and Silviculture in the Jarrah Forest' (1987)

Only after the objective has been identified for each patch can individual trees be marked.

Marking habitat trees and logs for retention are the first priority." (p. 9)

4.2 Marking to Promote Growth (Thinning)
"[…] *Thinning aims to increase the growth of selected crop trees. In the high rainfall zone it will also increase the yield of water.*" (p. 9)

Selection of Crop Trees
"*A crop tree is one with the capacity to grow vigorously into high value products. The key characteristics to look for are:*

- *an existing or potential for a well developed crown*
- *a bole capable of producing a high quality product of minimum specification.*

Appendix 3 details the criteria for crop tree selection." (p. 9)

Thinning Intensity
"*The desirable retained density of crop trees varies with their size. When crop trees are smaller the aim is to grow individual trees rapidly to sawlog sizes. Once crop trees are of sawlog size, the aim is to maiximise the growth of sawlog volume per hectare – therefore a relatively higher basal area is retained.*

Thinning regimes for different crop tree sizes are detailed in Appendix 4. […]

Diversity
"[…] *Mark to protect native pear, river banksia and examples of snottygobble, peppermint, large blackboys etc. Additional diversity of size and density of retained trees is required in the first 150 metres of VRM Zone A. (Appendix 2).*" (p. 9)

Technique
"*Mark to retain the desired density of crop trees (Appendix 4), fauna habitat trees and logs (Appendix 5) and elements for diversity.* […]

The retained basal area must be regularly checked with a 2-factor prism." (p. 9)

Partially-stocked Stands
"*Where the stocking of crop trees is less than specified in Appendix 4, but at least 50% of that density, all crop trees must be retained and sufficient non-crop trees to keep the stand at a minimum basal area of 10m^2ha (1.5m^2/ha in the salt sensitive parts of the Intermediate Rainfall Zone)*" (p. 10)

4.3 Marking To Release Regeneration (Gap Creation)
"*Regeneration release by gap creation will be sought where there are insufficient crop trees to merit thinning but where the stocking of ground coppice and saplings will adequately regenerate the gaps created by harvesting.*" (p. 10)

Technique
"*Where it is evident that insufficient crop trees exist to enable a thinning, the forester must check that the stocking of ground coppice/saplings is adequate, (Specification 3/90) then determine the boundaries of the gap. In general only mark fauna habitat trees in gaps over 1 hectare in size, however where good examples occur in small gaps they should be retained. Sub-merchantable crop trees with very good growth potential shall also be marked for retention if they can be fully protected during logging and burning operations.*" (p. 10)

Gap Size
"*Where the gap would exceed the maximum dimension (See Appendix 2) temporary exclusion areas of uncut forest are required to confine the gap to that maximum. These must be at least 50-100 metres across depending on VRM zone (Appendix 2) and will not be available for timber harvesting until the next cutting cycle.*" (p. 10)

Diversity
"*Mature secondary storey species (e.g. sheoak) shall also be marked and retained undisturbed, preferably in clumps, to enhance stand diversity.*" (p. 10)

4.4 Marking to Establish Regeneration (Shelterwood)
"*A shelterwood is created where there is inadequate stocking of crop trees for thinning and where there is insufficient ground coppice available for immediate release.*

The shelterwood overstorey is retained to provide seed for regeneration and a continuity of forest values until ground coppice is capable of rapid growth following release.

Technique
Mark to retain 50% of overstorey (up to 15m-/ha) including habitat trees at a relatively even spacing. Preference for retention are jarrah trees which will grow vigorously for at least the next 20 years. In addition some elements of stand diversity, as outlined for gap creation, shall also be retained. The forester must endeavour to retain a stand which will sustain a harvesting operation in the future. Where the existing stand is of low density and a harvesting operation cannot be sustained, regeneration must be established before harvesting." (p. 10)

4.5 Marking In Stands With Small Groups
"*Frequently the existing stand structure consists of small groups of mature/overmature trees among small patches of thinnable forest, each below the minimum desirable size (i.e. 100m diameter).* […]" (p. 10)

"*Where gaps are small and cannot be extended without considerable loss of crop trees, retain trees and avoid creating a gap. These large trees will frequently be retained as habitat trees.*

Gaps as small as 50 metres in diameter (2 times tree height) are acceptable." (p. 11)

5. Control of Harvesting
"*This phase involves the removal of all unmarked merchantable trees. For restrictions on removal of products see Appendix 2. Details of harvesting control are contained in the Manual of Hardwood Logging Specifications.*" (p. 11)

Crop Tree Protection
"*Contractors are required to protect all marked trees during falling and skidding operations, and to remove debris larger than 7.5cm diameter to at least 1 metre away from marked trees. Where trees are wanted but not marked, contractors cannot be expected to protect them.*

A zone of 5 metres is to be retained undisturbed around all habitat trees and groups." (p. 11)

Silvicultural Treatment
"*Some silvicultural treatments (e.g. disturbance for shelterwood regeneration, banksia scrub rolling, Section 6) are better carried out during harvesting than as a separate operation. Some logging contracts make provision for this.*" (p. 11)

6. Treatment Following Harvesting
"*The aim of these operations is to develop the stand to meet the treemarking objectives. Unless a stand is fully marked to indicate the silvicultural objective, interpretation for follow-up treatment will be difficult.*" (p. 11)

6.1 Timing
"[…] *Machine treatments must be done before post-harvest burning.* […] *Where significant quantities of merchantable produce remain, do not treat until harvesting is completed.*" (p.11)

6.2 Priorities for Treatment
"*The resources required for silvicultural treatment following harvesting will not always be sufficient to complete the available work. In allocating resources the following priorities will be adopted:*

(1) *Only treat those areas which are secure from disturbance, e.g. outside the 25 year bauxite mining envelope, and will remain available for timber production.*

(2) *Only treat those areas which are either secure dieback free or low potential risk or of low dieback hazard.*

(3) *Areas of high quality forest where the potential for growth is greatest.*

(4) *Areas of shelterwood have highest priority as regeneration must be established now so they will be ready for release in the next felling cycle. Areas of regeneration release have second priority. Areas of thinning have third priority.*" (p. 11)

"*(5)* *Locate treatment in areas of highest utilzation where the management objective has not been fully achieved by harvesting. This will ensure minimal conflict by the culling of potentially valuable trees.*

(6) *Areas of high landscape sensitivity where treatment is essential to meet the management objective.*" (p. 12)

6.3 Treatment of Thinning Groups
"*Individually release crop trees by removing competing trees for a distance of 4 metres by removing all vigorously growing culls over 50cm DBH not required for habitat, and all mature <u>Banksia grandis</u> by notching with an approved herbicide (See Herbicide Manual, Technical Instructions). Where trees which appear to share a common root system with adjacent retained trees, fell without poisoning the stumps.* […]

[…] *Do not individually release around retained trees which are not of crop tree standard.*" (p. 12)

6.4 Treatment of Gaps
"*The object is to encourage regeneration by the removal of competing culls. This can be done either by:*

* *immediately removing all culls after harvesting, or*

* *initially removing sufficient culls to allow regeneration to develop into saplings and then in 20-25 years removing remaining culls and releasing saplings to grown into poles.*" (p. 12)

Gap Size 0.25-2ha
"*Remove any unmarked crop trees and mature Banksia grandis by felling, pushing down or notching. Do not treat within 5 metres of fauna habitat trees.*" (p. 12)

Gap Size > 2ha
"*As for the above, but only remove the following unmarked culls:*
DBH >40 cm – all cull trees.
DBH 20-40 cm only if within 15 metres of other trees, including crop or habitat trees or other remaining culls.
DBH 10-20 cm if within 7 metres of other trees.

Consider trees less than 3 metres apart as one tree. See Appendix 6 for interpretation.

Technique
"*Where stump coppice is needed, fell saplings (DBH <15cm) close to ground level. Otherwise remove all unwanted stems by pushing over with a machine or by notching with an approved herbicide. (See Appendix 2 and Herbicide Manual, Technical Instructions).*" (p. 12)

6.5 Treatment of Shelterwoods
"*Competition removal and soil disturbance where regeneration is absent.*

Remove competing rootstock understorey in swathes at least 3 metres wide and not more than 10 metres apart. Preferably use a tracked machine with a rake blade. Also remove mature Banksia grandis and unmarked sheoak. Do not establish swathes within 3 metres of retained trees. This work must be done in dry soil conditions to ensure that a receptive seedbed results. Install erosion barriers at the appropriate intervals (See Manual of Hardwood Logging Specifications)." (p. 12-13)

"*Where regeneration is adequate in number but too small for immediate release, no additional treatment is required.*" (p. 13)

Natural Seedfall
"*Examine the seed crop in late summer and where there is viable and plentiful crop, aim to burn in autumn (See Silviculture Specification 1/91)*" (p. 13)

Artificial Seeding
"*Where there is a poor seed crop or poor success by natural seedfall, it is necessary to broadcast seed. Use a cultivator to lightly scarify the soil along the prepared swathes. Simultaneously seed and fertilise using a mixture of:*
20, 000 viable jarrah seed per ha, and
450kg/ha No. 1 superphosphate.

Apply seed and fertiliser to disturbed soil during autumn after burning." (p. 13)

8. Records
"*Good silvicultural records are essential for future managers to assess the condition and needs of the forest without having to undertake detailed assessment. The aim is to have an accurate description of the conditions of the forest when the operation is completed.*" (p. 13)

NOTE: SEE ACTUAL DOCUMENT FOR –
APPENDIX 1 : A GUIDE TO SILVICULTURAL OBJECTIVES
APPENDIX 2 : JARRAH SILVICULTURAL SPECTRUM

Appendix 3 : Criteria for Selection of Crop Trees
"*Select crop trees to retain using the following considerations:*

Crop tree selection is based on the following species priority:
(a) Jarrah/Blackbutt (referred to as jarrah in the text)
(b) Marri
(c) Sheoak

[…] *Trees with primary crowns are capable of expansion to take advantage of the space available. Secondary crowns show less capacity for expansion.*

Trees with a deep, broad crown grow five times faster than trees with a narrow, shallow crown. Crown vigour is much more significant than bole length.
e.g.

Original diameter	*30cm*	*30cm*
Bole length	*5m*	*10m*
Crown condition	*Deep, broad Shallow, narrow*	
Diameter in 20 years	*50cm*	*34cm*
Volume on 20 years	*.63cu.m*	*.5cu.m*
Time taken to reach sawlog size (50cm)	*20 yrs*	*100yrs*

[…]

In general, larger diameter trees will increase in diameter faster than smaller ones.

[…]

Healthy, well structured deep but narrower crown.
Minimum bole length of 1.8m with at least 50% of the diameter defect free." (p. 16)

Appendix 4 : Jarrah Thinning Intensity

Mean DBHOB of best 150 stems/ha at first thinning	*Crop Tree Basal Area (m^2/ha)*	*Schedule*
Less than 20cm	*N/A*	*Release 200 jarrah stems/ha from overtopping and crown objective is to maintain healthy crown development on future jarrah crop trees without promoting a permanent low crown break.*
20-25cm	*#*10m^2/ha*	*This will usually be a non-commercial thinning. It will leave more than 150 stems/ha but ensures that the stand is not left under-stocked. A further thinning will be required before the crop trees reach 50cm dbhob.*
25-30cm	*#*10m^2/ha*	*This is likely to be both a commercial and non-commercial thinning. The remaining trees are capable of reaching 50cm dbhob without the stand becoming over stocked (50 years). More conservative thinning in the future will maximise s volume/ha*
40cm	*18m^2/ha*	*Thin again when crop trees reach 50cm dbhob. Above comments apply.*
50cm	*20m^2/ha*	

X An additional 5m^2/ha of the following may be retained:

Trees within 5cm of becoming an SEC pole or sawlog.
Sheoak crop trees.
Second grade sawlogs in areas which will have follow-up non-commercial thinning.

A further 1 sq.m/ha of potential pit props may also be retained where appropriate.
 # 15m^2/ha (including habitat trees) in the Intermediate Rainfall Zone." (p. 17)

NOTE: REFER TO ACTUAL DOCUMENT FOR –
APPENDIX 6 :
FIGURE 1 : TREATMENT OF CULLS IN GAPS OVER 2ha ;
FIGURE 1A : GAP CONTAINING 2-3 m^2/ha CULLS WHICH ARE WIDELY SPACED AND DO NOT REQUIRE TREATMENT
FIGURE 1B : GAP CONTAINING ABOUT 8m^2/ha OF CULLS, X INDICATING THOSE TO BE REMOVED.

FIGURE 1C : GAP WITH A DENSE GROUP OF CULLS (>12m^2/ha) WHICH SHOULD NOT BE TREATED.
GAP AT RIGHT MAY BE TREATED IF 50 METRES IN DIAMETER

SILVICULTURE SPECIFICATION – 1991

Silviculture Specification 1/91 : Fire as a Silvicultural Tool in the Jarrah Forest

1.0 Introduction
"*Fire is the most important management tool available for extensive application in the forest. It is most prominent in hazard reduction burning, but it also has significant silvicultural use – particularly for the regeneration process (e.g. for creating ashbeds and stimulating seedfall).*

Since the 1960's rotational fuel reduction has been a pre-eminent concern in the management of many jarrah stands, but burning practices and priorities are adjusted to accommodate a variety of specific fire management objectives, including ecological, silvicultural and hazard reduction needs. This specification seeks to link burning strategies with silvicultural objectives by defining:

(1) how burning can achieve silvicultural goals;
(2) *the range of burning intensities to meet specific burning objectives*
(3) *where fire exclusion should be adopted*" (p. 2)

2.0 Fire Characteristics
"*Fire intensity is useful as a measure of the behaviour of a fire and its potential impact on vegetation. The principle variables that determine fire intensity in the jarrah forest are the rate of spread of the fire and the amount of fuel consumed in the flaming zone.* […]

Fire intensity can also be used as a guide to the height of crown scorch and the level of stem damage resulting from a fire. The dryness of large woody fuels such as old logs, stumps and branchwood also has a major influence on the extent of stem damage during fire. Dryness varies according to the size of the material, the length of time that has been on the ground and the extent of the seasonal drought influence. The Soil Dryness Index (SDI) provides a good indication of the moisture content of woody material that has been on the ground for more than 2 years." (p. 2)

3.0 Types of Burning
"*The following types of burning are referred to in the text and their value for both silviculture and fire protection are discussed.*" (p. 2)

3.1 Pre-harvest Burning
"*A burn which is carried out immediately prior to a timber harvesting operation is termed an <u>advance burn</u>.* […]

Burn intensity will vary and is not usually an important silvicultural factor except where it may cause the abortion of buds from a shelterwood stand or may damage the bole or crown of trees to be retained. A low intensity burn (<350 kW/m) is generally preferred." (p. 2)

3.2 Post-harvesting Burning
"*Burning following harvesting can be divided into three types depending on the primary objective.*

(a) Tops disposal burning is carried out to reduce hazard by the removal of flash fuels and woody material up to 2.5 cm in diameter. […]

If regeneration is already established, tops disposal burning must occur within 2 years of harvesting.

[…]
Tops disposal burns are usually low intensity, the appropriate intensity is given on Table 1. To protect existing trees these burns must also take account of soil dryness index (Table 1).
[…]
(b) Release burning is carried out to enhance the development of regeneration. It is particularly important where there has not been an advance burn. This burn is also of value in fuel reduction. The silvicultural objectives include:

- *the removal of scrub competition*
- *the stimulation of dynamic growth of lignotubers*
- *removal of poorly-formed saplings*

Release burning must occur within 2 years of harvesting. Burn intensity will vary with the condition of the advanced growth. A low intensity is sufficient to stimulate ground coppice, but a fire of moderate intensity will be required where deformed saplings need to be burn back to reshoot from ground level. Appropriate intensities are given on Table 1. As hot burns in dry soil conditions will sometimes kill lignotubers these burns must conform with the constraints of the soil dryness index (SDI – Table 1).

(c) Regeneration burning is carried out in the jarrah forest where the objective is

- *the removal of scrub competition*
- *the creation of suitable seedbed*
- *the stimulation of seedfall*" (p. 3)

"*These objectives are pursued on all areas cut to shelterwood as a means of establishing regeneration. There is also significant fuel reduction benefit.*

[…] *Delaying this burn is acceptable where a seed crop will mature in the following year.*

Regeneration burning in shelterwoods needs to be of moderate intensity (Table 1) in order to achieve maximum seedbed preparation. Crown scorch is therefore acceptable." (p. 4)

3.3 Rotational Fuel Reduction Burning
"*Such burns are primarily for the purpose of hazard reduction.* […]

Rotational burning is excluded from stands where regeneration has been released but still remains vulnerable to fire damage (Section 4.2).

Regular rotational burning is of advantage in shelterwood stands to enhance the development of seedlings into ground coppice." (p. 4)

3.4 Strategic Fuel Reduced Buffers
"*Strategic fuel reduced buffers are located to restrict the spread of a major wildfire.*

Harvesting where a regeneration objective would be applied must be excluded from these buffers because of the consequent conflict between the fire exclusion and hazard reduction objectives. Where the silvicultural objective is thinning or shelterwood harvesting in the strategic fuel reduced buffers can be proceed. Inspection by staff from Fire and Silviculture Branches is required before coupes in buffers are included on the logging plan, or before regeneration areas are included in the buffers." (p. 4)

4.0 Fire and Silvicultural Strategies
4.1 Thinning
"* *Silvicultural Objective : In stands where there is adequate stocking of crop trees (trees capable of growing rapidly into higher quality products), the objective is to increase the growth of those trees by thinning. In some cases thinning is carried out for aesthetic reasons or to increase streamflow.*

* *Burning Objective : Hazard reduction : Rotational prescribed burning is compatible with the thinning objective provided that it is conducted within acceptable limits of fire intensity and SDI. The acceptable fire intensity increases with the age and development of the stand; guidelines are as follows:*

Table 2 : Acceptable Fire Intensity at Stages of Stand Development

STRUCTURE	*DIAMETER (CM)*	*FDI (m/hr)*	*MAXIMUM SPRING FIRE INTENSITY**
Saplings	*<15*	*12-17*	*120 kW/m*
Poles	*15-45*	*20-25*	*250 kW/m*
Mature trees	*>45*	*30-35*	*350 kW/m*

** Autumn fire intensities will need to be significantly less to remain at the same scorch height.*" (p. 4)

4.2 Regeneration

"* *Silvicultural Objective : In stands comprising mature and overmature trees where there are few crop trees but an adequate stocking of advance growth (ground coppice and saplings) the objective is to remove the overstorey to allow the development of vigorous regrowth. Stands suited to regeneration release are not cut if they lie within a strategic burning buffer.*

** Burning Objective*
Pre-harvesting : Hazard Reduction
Before the overstorey is removed rotational prescribed burning can proceed normally, but once cutting has released the regeneration it will rapidly develop into saplings and require complete protection from fire.

Post-harvesting : Regeneration Release/Hazard Reduction
After harvesting release or tops burning must be completed within 2 years. The intensity of such burning will vary according to stand conditions (Table1)

Following Regeneration : Fire Exclusion
Stands requiring protection from fire are:
(a) Those coupes containing areas which have been cutover for regeneration and contain adequate advance growth (Specification 7/89), and
(b) All previously cutover coupes less than 10 years old. Where it can be shown that the canopy cover of the residual overstorey is more than 20 per cent and gaps of less than 50 metres in diameter have been created burning may proceed. […]

These stands will require complete protection from fire until:
- *tall enough (usually 6 metres) so that the growing tip will not be damaged, and*
- *the bark is thick enough to insulate the cambium from the heat (once the diameter is 10cm) in a fire of low intensity. (Burrows, 1987)*

Figure 1 outlines an idealised fire management regime for stands requiring regeneration." (p. 5)

4.3 Shelterwood – (Establishment of Advanced Growth)

"* *Silvicultural Objective : These stands are similar in structure to those described in 4.2 except they lack a sufficient stocking of advanced growth to adequately regenerate the site. The initial aim of management is to establish seedlings and 'grow' them into suitable ground coppice and saplings. This is achieved by a partial removal of the canopy, removal of competing understorey rootstock species, burning to create ashbed and spreading seed where poor natural seed stocks exist.*" (p. 5)

"* *Burning Objective*
Pre-harvesting : Hazard reduction

Advance burning prior to harvesting in particularly important to readily identify where advance growth is present/absent and so determine the location of shelterwood stands. […]

Post-harvesting : Establish Regeneration
After harvesting, burning is essential as a means of creating ashbed, reducing competition, stimulating seedfall and reduction of fuel quantities. If possible this burn should be timed to coincide with an adequate seed crop, however burning soon after harvesting is the best opportunity for seedling establishment due to the disturbance by harvesting machinery. […]

Subsequent low intensity prescribed burning is compatible with a shelterwood objective as it will enhance the development of lignotubers. […]

Figure 2 outlines an idealised fire management regime for shelterwood stands." (p. 6)

4.4 Single Tree Selection Cutting
"*In some stands effective regeneration cannot be achieved due to the inability to market a significant proportion of overstorey trees. The number, size and potential value of such trees makes regeneration (as defined in section 4.2) difficult to achieve commercially and expensive to attain non-commercially. Currently vigorous trees are retained and small gaps are created by removing several trees.* […]

In general regeneration is not effectively released by harvesting in selectively cut stands and hence no special protection measures are warranted – except where specifically nominated following a post-harvesting inspection and recorded on HOCS." (p. 6)

4.6 Crop Tree Protection
"*The burning of logging tops has the potential to damage the retained components of the forest (crop trees, habitat trees, habitat logs). Their protection by the removal of woody material (>3 cm diameter) to a distance of at least 1 metre reduces the risk of damage in subsequent burning. This task must be completed by logging contractors.*" (p. 6)

5. Integrated Fire Management of Harvested Areas
"*Most areas recently cutover will contain a mosaic of the stand types described in section 4.* […]

As a general rule once an area has been cutover and burnt then the entire area must be protected from fire until the regeneration is old enough to withstand fire unless the areas of regeneration can be isolated.

This section discusses the management of stands with mixed objectives." (p. 6)

5.1 Regeneration Release and Uncut Patches or Strips
"*Fire management regime can proceed as described in figure 1.*

PRIOR TO HARVESTING Rotational prescribed burning. Advance burn to assist identification of advanced growth where it is suspected to be poor.

AFTER HARVESTING If the stand was not advance burnt, release burning is required. It is optional where there are only scattered tops and the area has been advanced burnt. Burning to be completed within 2 years of the commencement of harvesting.

FIRE EXCLUSION Following the tops disposal burn fire is to be excluded from the regeneration until regrowth is 6 metres in height and 10 cm in diameter. […]

ROTATIONAL PRESCRIBED BURNING When the regrowth is able to be burnt it should initially be of low intensity, usually obtainable within an FDI of 12-17 m/hr. As regrowth size and diameter increase, so can the intensity of fire. See Table 3." (p. 7)

5.2 Regeneration and Thinning
"*PRIOR TO HARVESTING Rotational prescribed burning: advance burn to assist identification of advanced growth where it is suspected to be poor*

AFTER HARVESTING Following crop tree protection, tops disposal burning for hazard reduction is essential where there has not been advance burning or where required for hazard reduction. It must be completed within 2 years of the commencement of harvesting. Tops burning is optional where there are only scattered tops and the area was advance burnt. Burn intensity must be geared to ensure the retained stands are not damaged by the burn.

FIRE EXCLUSION As in 5.1 – except that discrete areas of thinning may be burnt where, for example, there is fuel separation or different fuel levels.

ROTATIONAL PRESCRIBED BURNING As for 5.1" (p. 7)

5.3 Regeneration and Shelterwood
"*PRIOR TO HARVESTING Rotational prescribed burning and advance burning is essential where there exists the possibility of poor advance growth stocking.*

AFTER HARVESTING A regeneration burn is required in the shelterwood. The timing of the burn will be critical if there is an existing seed crop.

Tops in the gap ***must*** *be burnt.*

PROTECTION AND BURNING This stand requires both on going protection (in the gaps where regeneration has been released) and regular burning (in the shelterwood areas). This conflict can most easily be avoided by not harvesting both types in one area. However where it does occur, the first shelterwood burn must be completed within 5 years of tops burning. At this time there will be limited fuel in the gap and 5 leaf falls in the shelterwood. This burn should be undertaken at low intensity (<250 kW/m) and low SDI to minimise the risk of significant fire run in patches of regeneration; hence it is vital that flash fuels have been effectively removed from the gap in the tops burn.

[…]

Bradshaw (1986) discusses other burning and protection options in greater detail.

ROTATIONAL PRESCRIBED BURNING As for 5.1" (p. 7)

6.0 Prescribed Burning and Herbicide Treatment
"*Burning can occur immediately before or at least 9 months following herbicide treatment. If burning before treatment the fire intensity must be low to ensure minimal crown scorch – otherwise notching will need to be delayed until crown flush.*" (p. 8)

7.0 Records
"*The following silvicultural records are required to ensure achievement of objectives:*

(1) HOCS
Location of silvicultural stand types (print 10)
Follow-up treatment required and completed (CLM 160)
Monitoring of regeneration development in shelterwoods

(2) MASTER BURN PLAN
Record location and date of regeneration and their predicted period of protection. Location of shelter woods, and when next due for burning." (p. 8)

MANAGEMENT PLAN – 1990

Lane Poole Reserve Management Plan 1990-2000. 1990

"*The history of logging and regeneration operations has some importance in determining which areas of forest already logged are likely to be most similar to undisturbed areas, in terms of age-class structure. Selective logging removes trees from the middle and older classes of age-class distribution, and pole thinning removes trees from the younger classes.*[…]

Forest utilization and subsequent regeneration of these forests was extensive, and a range of age classes and structures dating from 1920s to the present day are now apparent. […]" (p. 62)

B13.2.4 Forest Utilization Constraints
"*The Regional Management Plans (1987) propose that the Conservation Zone becomes a Conservation Park and the Recreation Zone remains a 5(g) Reserve. Commercial harvesting is to be excluded from the Conservation Park but is permitted in the 5(g) Reserve in accordance with agreements drawn up with the timber industry and Alcoa when the Reserve was initiated.*" (p. 65)

Background
"*Timber cutting in the Recreation Zone will involve the temporary unavailability of some areas for recreational use. This is due to the reduction in conservation and recreation values, the need to protect regeneration areas from wildfires and the increased risk of environmental degradation (ie. dieback spread, soil erosion and stream turbidity) following logging and regeneration.*" (p. 119)

"*Fire must be excluded from regeneration areas. Jarrah regeneration must be protected for up to 15 years.* […]" (p. 119)

Silviculture
"*Silvicultural operations are designed to improve the forest by removal of overstorey trees to promote the development of regeneration and to concentrate growth on the better stems by thinning regrowth.*

Prior to any future silvicultural operations, management must consider the compatibility of the operation and the recreation priority land use of the area; the balance between the attainment of ecological diversity (small cutting units) and economies of scale (large cutting units) and provisions for, and the protection of, regeneration." (p. 120)

Prescriptions
"*1. Timber utilization will be allowed in the Recreation Zone of the Reserve following consultation with the NPNCA and subject to the condition detailed in Section C13.2 of this plan.*

3. CALM will undertake a comprehensive inventory of resources and values within the Recreation Zone. This will include:

[…]

- *site vegetation surveys and comparison made between inventory plots to determine details of age structure.*

- *dieback photography and interpretation. Disease distribution and impact maps are required. In dieback free areas, plans are also required which predict possible introduction routes and impact should the disease be accidentally introduced.*

[…]
4. Logging and regeneration plan for the next 3 years will consider forest outside the Reserve. After that the Recreation Zone may be considered.

All strategies must provide sufficient lead time between planning and operations. CALM will define the silvicultural criteria for timber utilization and regeneration." (p. 120)

[…]
"*6. CALM will compile a balanced cutting and regeneration program for the Recreation Zone which integrates cutting and regeneration in the Reserve with that outside it and uses silviculture to upgrade fire degraded or dieback damaged jarrah stands. This program will also optimise the sequence of timber cutting with existing roads suitable for log hauling and public safety.*" (p. 120-121)

"*7. CALM will ensure that any logging and regeneration plans for the Recreation Zone include the following goals:*

- *conformity with the dominant recreational land uses.*
- *minimum spread of Phytophthora cinnamomi.*
- *minimum environmental impact.*
- *maximum silvicultural and ecological benefits, and increased ecological diversity.*

8. CALM will develop a strategic, prescribed burning program within and outside the Reserve to protect regenerated jarrah forest until it is old enough to become fire tolerant (Re Section C7.1)

[…]

12. Any logging and regeneration operations will be carried out according to conditions stated in the following 3 publications:
- *The Code of Logging Practice*
- *The Manual of Hardwood Logging Specifications*

[…]" (p. 121)

MANUAL OF LOGGING … 3RD ED. – 1990

Manual of Logging Specifications … 3rd Ed. 1990

Section 1 : Planning
Specification 1.1 : Logging Plans
1. Responsibilities
"*In all cases, planners must produce fully integrated plans and consult with Regional staff, District staff, Specialist Branch staff and where relevant Timber Industry Representatives during plan preparation.*" (p. 1)

4. Monitoring and Records
"*Logging cannot commence until an approved logging plan has been issued and CLM 109 has been signed by Regional Manager (ref Part 6 of this Specification).*

District staff must maintain up-to-date field records of areas cut over and silviculturally treated. This information must be ready when inventory officers visit Districts within one month of the close of the logging season (refer to revamped HOCS – issued from SOHQ on 14/8/90 and CLM 160 – Coupe silviculture report – Jarrah – refer Attachment 1.1.2)." (p. 3)

8. Field Plans and Checklists
"*In most operations it is necessary for the Forest Officer in Charge of the operation to prepare a checklist of work required in the field before and during logging, and to prepare a sketch diagram of the coupe (commonly referred to as a 'blown-up HOCS sheet'). The sketch diagram is drawn sufficiently large to show the following information:*

** individually numbered sub-coupes and/or faller's blocks.*
[…]
** all areas reserved from cutting.*
[…]" (p. 4)

"*These sketch diagrams or plans are used to record the progress of cutting and extraction, and silvicultural treatment.* […]" (p. 5)

Section 3 : Silviculture

Specification 3.1 : Current Specification

NOTE: REFER TO ENTRY UNDER 1989 EDITION (SIMILAR WORDING)

Section 4 : Coupe Management

Specification 4.2 Falling (Including Tree Marking Techniques)

2.Tree Marking

NOTE: REFER TO ENTRY UNDER 1987 EDITION (SIMILAR WORDING)

***EXCEPT* FOR THE FOLLOWING-**

"*Tree marking will normally be carried out by Forest Officers. Occasionally, however, the Forest Officer in Charge may allow cutting to take place without tree marking. This may occur in 'first thinning' of young, even-aged regrowth stands, and in 'clear cutting' areas. In these cases the FOIC must ensure that:*

i) silvicultural objectives are not compromised and
ii) protection of retained crop trees meets standards as per Specification 5.4." (p. 37)

Specification 4.5 : Logging Operation Inspections and Certifications

NOTE: REFER TO ENTRY UNDER 1987 EDITION (SIMILAR WORDING)

Specification 5.4 : Protection of Crop Trees

NOTE: REFER TO ENTRY UNDER 1987 EDITION (SIMILAR WORDING)

CODE OF LOGGING … - 1990

Code of Logging Practice. 1990

Introduction

"*The 'Code of Logging Practice' is a concise set of rules governing the conduct of timber harvesting (logging) operations on state forest and other Crown lands managed by the Department of Conservation and Land Management, and on private property where CALM is in control of the logging operation.*

The Code, which applies to both hardwood and softwood logging operations, is part of a hierarchy of rules relevant to logging operations controlled by CALM :

- *CALM Act (1984) and other relevant Acts*
- *Regulations under the CALM Act and other relevant Acts*
  (Note : Forest Resource Management Regulations under the CALM Act are currently being prepared. Until they are endorsed by Parliament regulations under the Forests Act (1918) apply)
- *Code of Logging Practice*
- *Manuals of Logging Specifications and other guidelines relevant to logging*
- *Log Supply Contracts between CALM and Logging Contractors, and Forest Produce harvesting or collection licences.*" (p. [i])

Section 2 : General
NOTE: REFER TO ENTRY UNDER 1988 EDITION (SIMILAR WORDING)

Section 3 : Felling, Trimming and Crosscutting
NOTE: REFER TO ENTRY UNDER 1988 EDITION (SIMILAR WORDING)

Section 4 : Extraction
NOTE: REFER TO ENTRY UNDER 1988 EDITION (SIMILAR WORDING)

STRATEGIC PLAN – 1989-1993

Strategic Plan For the Period 1989-1993. 1988

Functions Under the Legislation
"*The Conservation and Land Management Act specifies a series of functions for the three controlling bodies and the Department. In brief these function are:*" (p. 4)

"*The Department of Conservation and Land Management (CALM)*

- *manages State forests, timber reserves, national parks, nature reserves, marine parks, marine nature reserves and other designated lands and the associated forest produce, fauna and flora;*

- *assists the Commission, Authority and Council in their functions;*

[…]" (p. 6)

General Principles/Philosophy
"*The Department is committed to the principle that it is managing public land and natural resources, and conserving indigenous wildlife on behalf of the public of Western Australia. Consequently, particular importance is placed on informing the public of the Department's activities and wherever possible involving the public.*

The regional system of management as adopted by the Department ensures that its officers develop a detailed knowledge of the area of their operations, are available to interact with local communities and resolve problems associated with local conservation and land management operations. […]" (p. 10)

5. Mission
"*Western Australia has a beautiful and diverse natural environment which provides material, aesthetic and spiritual benefits. The natural environment is an essential component of the quality of life for West Australians. The statement of mission for the Department of Conservation and Land Management is therefore:-*

> *TO CONSERVE WESTERN AUSTRALIA'S WILDLIFE AND MANAGE LANDS AND WATERS ENTRUSTED TO THE DEPARTMENT FOR THE BENEFIT OF PRESENT AND FUTURE GENERATIONS.*" (p. 11)

6. Primary Objectives
"*Five primary objectives have been established:-*

- *MANAGEMENT*
  To protect, restore and enhance the value of resources entrusted to the Department so as to meet, as far as possible, the diverse expectations of the community.

[…]

- *PRODUCTION*
  To provide and regulate the supply of those renewable resources that Government decides should be used, on a sustained yield basis for the satisfaction of long term social and economic needs, and in a manner that minimises impact on other values." (p. 12)

"**7. Broad and Sub Strategies**
"*To achieve the Primary Objectives the Department will:-*
[…]
7.8 Prepare and implement strategies to promote and encourage development of the forest production requirements of the State.

This will involve:

[…]

7.8.2 The development of cost effective procedures for growing, processing and marketing timber at the level sustainable under sound forest management.

[…]

7.8.5 Re-forestation of cleared lands with hardwood forests to supplement production from native forests and to assist in soil and water conservation." (p. 17)

"***7.9 Manage approved commercial operations on renewable natural resources according to the following principles.***

(i) resources are managed to ensure their long term conservation;" (p. 17)

10. The Organisation
10.3 Planning
"*Detailed planning of conservation and land management activities is a key function in the Department.*

Under the Conservation and Land Management Act, there is a responsibility to prepare management plans for all land and water vested in either the Lands and Forest Commission or the National Parks and Nature Conservation Authority. Such plans must be available to the public for comment for a period of at least two months. They apply for a maximum period of ten years.

Two levels of this planning are undertaken. These are regional and area management plans.

Regional management plans are to be prepared for each CALM administrative region. They will cover all categories of land and water entrusted to the Department. Each plan will described the management objectives to be achieved over the life of the plan and the strategies for implementation which are to be adopted.

Area management plans will apply to specific areas such as a national park, marine park, nature reserve, marine nature reserve. State forest, or other reserve. These are more detailed than regional management plans. Area management plans will be prepared only where there are requirements that cannot be adequately considered by a regional management plan. Each area management plan will also describe management objectives and strategies for implementation." (p. 31)

"*Other major plans prepared by the Department are issue plans that are either a follow up to an approved management plan, or consist of interim guidelines for necessary operations where there is not yet an approved management plan. Issue plans cover all relevant topics, such as site plans, fire plans, dieback plans, recreation*

plans, resource allocation plans and wildlife management programs. Issue plans are generally prepared by district or regional staff in conjunction with research and other specialist branches within the Department. […]" (p. 32)

In addition, the Department prepares operational guidelines, manuals and prescriptions. These draw on the results of research and experience and are used to implement the works and activity programmes derived from the planning process." (p. 32)

10.4 Regionalisation
"*The Department is extensively regionalised in a way which provides the benefits of small autonomous organisations in close proximity to their area of operations while providing access to services that are best provided by a larger integrated organisation. Regions are responsible for the management of all departmental lands and waters and for conservation of flora and fauna within their boundaries. According to the intensity of activity regions are subdivided into districts.*" (p. 32)

"*The general responsibilities allocated to regions are to:*

- "[…]
- *supervise and regulate industry (e.g. wildflower pickers, apiarists, timber and mining operations) on departmental and some other land;*
- *preserve or restore the natural environment on departmental land and water;*
- *provide information and advice on land management and conservation to people in the region; promote conservation and good land and marine area management;*" (p. 33)

10.5 Specialist and Support Services
"*Functions of the Branches within each of these Division are as follows:*" (p. 35)

Forest Resources Division
- "*Timber Production Branch – controls and monitors the harvesting of timber and collection of royalties; advises on timber quality, wood technology and related matters.*

- *Silviculture Branch – develops silvicultural guidelines and practices, advises on their implementation, and manages nurseries and seed supplies.*

- *Inventory Branch – services management operations of the Department with resource information and plans for forest production, disease protection; develops relevant computer systems.*" (p. 35)

STRATEGIC PLAN (SOUTHERN REGION) – 1989

Strategic Plan : Southern Forest Region. 1989

4. Most Important 5 Year Goals
"*4.1 Implementation of the Timber Strategy.*

To ensure the successful implementation of the Timber Strategy, its 49 commitments will be reviewed quarterly and standards of implementation inspected in the field.

[…]" (p. 12)

5. Most Important One Year Goals
"*5.3 Hardwood Silviculture*

- *To integrate the activities of Silviculture Branch, Silviculture Research workers and operations staff in the SFR. Quarterly reviews of jarrah and karri silviculture research programmes, field operations and prescriptions will be conducted. (Deputy R/M and R/L Operations to arrange).*

- *Silviculture research programmes, field operations and prescriptions will be conducted.*

- *A jarrah regrowth definition and identification project will be initiated by 1/2/89.*" (p. 14)

Key Result Objectives
Jarrah Regeneration
"*Objective*
1. To satisfactorily and effectively regenerate all cut over jarrah and mixed jarrah forest." (p. 47)

Hardwood Tending
"*Objective*
Jarrah. Maintain the Jarrah Stand Improvement programme to Silviculture Branch specifications. Complete crop tree protection operations in all dieback free cut over jarrah forest. Complete JSI treatment for all areas cut over.

Measure of Performance
'Priority'
1. Jarrah stand improvement operations to cover at least 800 ha annually.
[…]" (p. 47)

Retained Crop Trees
"*Objectives*
[…]
2. Implement a standard procedure for checking that silvicultural prescriptions are being applied correctly in thinning operations." (p. 58)

Environmental Controls
"*Codes of Logging Practice*
Objective
1. Ensure all logging contracts contain a comprehensive 'Code of Logging Practice." (p. 58)

Crop Trees
"*Objective*
1. Ensure protection of retained crop trees in karri and jarrah regrowth forests.

'Priority'
1. Introduce a monitoring and penalty to reduce damage to crop trees in all regrowth logging areas. Incorporate in 'Code of Practice' for all new Contracts.

Objective
2. Trees resistant to insect attack to be retained as first priority and obviously weaker stems removed in jarrah forest." (p. 60)

SILVICULTURE SPECIFICATION - 1989

Silviculture Specification 7/89 : Treemarking and Silvicultural Treatment in Multiple Use Jarrah Forest

NOTE: THIS SPECIFICATION SUPERSEDES SILVICULTURE SPECIFICATION 1/87

Preamble
"*The CALM leaflet 'Treemarking and Silviculture in the Forest' (1987) provides the foundation for this specification and should be read concurrently.*

The aim of jarrah silvicultural practice is to maintain and develop forest structures which satisfy goals relating to water, timber production, landscape, wildlife conservation and other values. This specification primarily deals with practices relating to timber production and is modified by reference to detailed specifications concerning other values. (eg 5/89) Maintenance of Habitat for Hole Nesters in Timber Production Operations in the Jarrah Forest).

This specification is to be applied in areas of jarrah forest which are dieback free and where timber production is a major objective." (p. 1)

2. Objectives
2.1Stand Objective
"*To provide for sustaining production of high quality timbers and other forest values by developing and enhancing a grouped forest structure with silvicultural objectives appropriate to the stage of development of each group.*" (p. 1)

2.2Silvicultural Objectives
"*b. Where groups of trees are retained or established, they must be of a size where external competition and felling damage will have a limited effect on growth. The ideal minimum diameter of a group is 100 metres (4 times tree height).*
c. In any group only one silvicultural objective will be pursued at any one time.
d. Fragile, unproductive and environmentally-sensitive areas. No trees will be harvested from these areas." (p. 1)

3.Assessment Prior To Cutting
"*A broad appraisal of each coupe is required to forearm the forester with the objectives to be applied. This can be achieved by aerial photographic interpretation, site-type maps and field reconnaissance.* […]" (p. 2)

3.2 Areas To Be Left As Uncut Strips
"*Where cutting is confined to a portion of a coupe due to landscape, water or other requirements and must be separated by uncut strips, the site-types in 3.1* [….]" (p. 2)

3.3 Areas Available For Cutting
"*Through records of cutting history, API types and reconnaissance, assess the coupe for the types present. Site-type maps and aerial photographs will give an indication of the presence of areas likely to require shelterwood treatment.* […]" (p. 2)

3.5 Coupe Plan
"*Prepare a broad coupe plan showing:*
- *limitations on extent of cutting*
- *areas excluded from cutting*
- *preferred areas for uncut strips*
- *likely shelterwood areas*" (p. 2)

4.Treemarking
4.1General
"[…] *The process for making these decisions is outlined in 'Treemarking and Silviculture in the Jarrah Forest' (1987).*

Individual trees can then be marked to meet that objective." (p. 3)

4.2Marking for Thinning
Selection of Crop Trees
"*A thinning aims at increasing the growth of selected crop trees. A crop tree is one with the capacity to grow vigorously into high value products.*

The key characteristics to look for are:
- *an existing or potential for a well-developed crown*
- *a bole capable of producing a minimum high-quality product*

Appendix 1 details the criteria for crop tree selection." (p. 3)

Thinning Intensity
"*The desirable retained density of crop trees varies with their size. When crop trees are smaller the aim is to grow individual trees rapidly to sawlog sizes. Once crop trees are of sawlog size, the aim is to maximise the growth of sawlog volume per hectare – therefore a higher basal area is retained.*

Thinning regimes for different crop tree sizes are detailed in Table 1." (p. 3)

Technique
"*Mark to retain the desired density of crop trees (Table 1), and fauna habitat trees.* […]

The retained basal area must be regularly checked with a 2-factor prism." (p. 3)

Partially-stocked stands
"*Where the stocking of crop trees is less than specified in Table 1 but greater than 5m^2/ha, all crop trees must be retained*." (p. 3)

Marking For Gap Creation
Technique
"*- Where it is evident that insufficient crop trees exist to enable a thinning, check that the stocking of ground coppice/saplings is adequate, determine the boundaries of the gap and mark fauna habitat trees (in clumps) in gaps over 1 hectare in size*. […]" (p. 3)

Gap size
"*- Where the gap would exceed the maximum dimension (10ha), strips of uncut forest are required to confine the gap to that maximum*. […]" (p. 3)

Table 1 : Jarrah Thinning Intensity

"*Mean DBHOB of best 150 stems/ha at first thinning*	*Crop Tree Basal Area (m^2/ha)*	*Schedule*
Less than 20 cm	*N/A*	*release 200 jarrah stems/ha from overtopping and crown abrasion. The objective is to maintain healthy crown development on future jarrah crop trees without promoting a permanent low crown break.*
20-25cm	**10m^2/ha*	*this will usually be a non-commercial thinning. It will leave more than 150 stems/ha but ensures that the stand is not left under-stocked. A further thinning will be required before the crop trees reach 50cm dbhob.*

25-30cm	**10m^2/ha*	*This is likely to be both a commercial and non-commercial thinning. The remaining trees are capable of reaching 50cm dbhob without the stand becoming overstocked (50 years). More conservative thinning in the future will maximise sawlog volume/ha.*
40cm	*18m^2/ha*	*thin again when crop trees reach 50cm dbhob. Above comments apply.*
50cm	*20m^2/ha*	

[…]" (p. 4)

4.4 Marking For Shelterwoods
"*The shelterwood overstorey is retained to provide seed for regeneration and a continuity of forest values until ground coppice is capable of rapid growth following release. It is applied when there is inadequate stocking of crop trees for thinning and where there is insufficient ground coppice available for immediate release.*" (p. 5)

Technique
- Mark to retain 15m^2/ha of overstorey in a relatively even spacing. Preferred species is jarrah, with trees which will grow vigorously for the next 20 years. The treemarker must endeavour to retain a stand which will support a harvesting operation in the future.

[…]" (p. 5)

4.5 Marking In Stands With Small Groups
"*Frequently existing stand structure consists of gaps and groups of thinnable forest, each below the minimum desirable size (i.e. 100m diameter).* […]" (p. 5)

6.Follow-Up Silvicultural Treatment
"*These operations assist in developing the stand to meet the treemarking objectives. Unless a stand is fully marked to record the objective, interpretation for follow-up treatment will be difficult.*" (p. 5)

6.1 Timing
"[…] *Shelterwood disturbance must be done before tops burning.* […] *Where significant quantities of merchantable produce remain, do not treat until harvesting is completed.*" (p. 5)

6.2 Treatment of Gaps
"*The object is to encourage regeneration by the removal of competing culls. This can be done either by:*
- *immediately removing all culls after harvesting, or*
- *initially removing sufficient culls to allow regeneration to develop into saplings, and then in 20-25 years removing remaining culls and releasing saplings to grow into poles.*" (p. 6)

Gap size 0-2ha
"*Remove all unmarked trees and mature Banksia grandis, except potential crop trees which have not been damaged during harvesting.*" (p. 6)

Gap Size Over 2ha
"*As for gaps 0-2ha, except only remove the following unmarked culls:*
- *DBH >40cm, all cull trees*
- *DBH 20-40cm if within 15 metres of other trees, including crop or habitat trees or other remaining culls*
- *DBH 10-20cm if within 7 metres of other trees*

Consider trees <3metres apart as one tree.
See figure 1 for interpretation.

On all gaps remove all mature Banksia grandis by felling or pushing down and do not treat within 5 metres of fauna habitat trees.

[…]" (p. 6)

Technique
"*Where stump coppice is needed, fell saplings (DBH <15cm) close to ground level.*[…]" (p. 6)

6.3 Treatment of Thinning Groups
Fully-stocked Stands
"*Removing all unmarked trees, mature Banksia grandis and sheoak by notching with an approved herbicide (See Herbicide Manual, Technical Instructions), except those trees which appear to share a common root system with adjacent crop trees. These are to be felled.* […] *Do not treat culls within 5 metres of fauna habitat trees.*" (p. 6)

Partially-stocked Stands
"*Treat as for fully-stocked stands, but only individually release crop trees by removing competing trees for a distance of 4 metres and all vigorously-growing culls over 50cm DBH.*

Do not individually release around retained trees which are not of crop tree standard." (p. 6)

6.4 Shelterwood Treatment
Competition Removal and Soil Disturbance
"*Remove competing understorey in swathes at least 3 metres wide and not more than 8 metres apart. Preferably use a tracked machine with a rake blade. Also remove mature Banksia grandis and unmarked sheoak. Do not establish swathes within 5 metres of retained trees. This work must be done in dry soil conditions. Instal erosion barriers at the appropriate intervals. (See Hardwood Logging Specifications)*" (p. 6)

Natural Seedfall
"*Examine the seed crop in late summer, and where there is viable and plentiful crop aim to burn in autumn. (See Section 7.1)*" (p. 8)

Artificial Seeding
"*Where there is a poor seed crop or poor success by natural seedfall, it is necessary to broadcast seed. Use a cultivator to lightly scarify the soil along the prepared swathes. Simultaneously seed and fertilise using:*
20, 000 viable seeds per ha and
450kg No. 1 superphosphate.
Apply seed and fertiliser to disturbed soil during July. (or in late autumn if hygiene restricts access)"
(p. 8)

Establishment Survey
"*For both natural seedfall and artificial seeding undertake a regeneration survey in the following February.*"
(p. 8)

7. Burning and Protection
7.1 Tops Burning
Gaps
"*Tops burning is a fuel reduction measure, except where used to re-establish poorly-formed sapling stems as coppice from the base of the stump.* […] *Where burning is necessary, it must take place within 2 years of cutting to ensure that regeneration can be burned to ground level rather than damaged.*" (p. 8)

Shelterwood
"*Burn during autumn after the seed-bed has been prepared.* […]" (p. 8)

Mixed Objectives In One Stand
"*Most cutting coupes will contain a mosaic of objectives each with different burning aims. Where there are mixtures of thinning and gaps, burning is done over the whole area at the standard for thinning.*" (p. 8)

7.2 Protection
Gaps
"*It is essential that once released to grow regeneration is not damaged by fire.*[…]" (p. 8)

Shelterwoods
"[…] *If they lie within an area which is not being burnt it will be necessary to mount special prescribed burning operations. See Technical Report 4 for a discussion of the options and trade-offs for burning in these stands.*" (p. 8)

8. Records
"*The aim of silvicultural records is to accurately describe the condition of the forest when the operation is completed.*" (p. 9)

SILVICULTURE SPECIFICATION - 1989

Silviculture Specification 4/89 : Regeneration in Forest Affected by Phytophthora cinnamomi.

2. Objective
"*To regenerate, protect and sustain the multiple values of the jarrah/marri forest on dieback affected areas.*" (p. 1)

3. Silvicultural Strategies
"3.1 *To protect existing natural regeneration and retained growing stock from damaging agencies and enhance its growth so that a forest cover is restored.*
***3.2** To establish regeneration in understocked areas.*
***3.3** Maintain fauna habitat (refer to Specification 5/89)*" (p. 1)

4. Suitable Growing Stock for Retention
"*Healthy trees are of high value on areas with a high impact from dieback. They continue to provide the forests' values, albeit at a much reduced level, and play a role in the regeneration process through seeding and site amelioration.* […]" (p. 1)

5. Stands Requiring Regeneration
"*Regeneration is required where there is an insufficient crop tree stocking to provide the desired forest values. Dieback - affected areas with a basal area of less than 5m^2/ha or gaps of greater than 50 metres in diameter are to regenerated.*" (p. 2)

6. Establishment of Regeneration
***"6.1** Mark to retain crop trees (Specification 3/89) and harvest produce. Remove tops and debris 5 metres from retained trees.*" (p. 2)

6.2 Burning
"*Separate the area from surrounding forest with an adequate firebreak. Allow logging tops to dry for at least one summer and burn in autumn to create ashbeds and stimulate seed fall.*" (p. 2)

6.3 Seeding
"*During July/August scarify the soil surface, seed and fertilise. Prepare and treat in 2-3 metre swathes, with swathes not being more than 5 metres apart. Do not treat within 5 metres of retained trees. Best results are obtained if seed is sown on freshly disturbed ground*." (p. 2)

6.4 Establishment Survey
"*The minimum acceptable stocking is 750 s.p.ha*." (p. 2)

6.5 Infill
"*Excluding harsh sites (eg shallow caprock), where the establishment survey reveals 0.5 ha of understocked regeneration, infill by planting with marri (and blackbutt) to bring the stocking up to 750 s.p.ha*." (p. 2)

7. Regeneration Release
"*Where sufficient natural regeneration exists but lacks dynamic growth, in spite of apparently being well established and free from overstorey competition, a fertiliser treatment may be undertaken to boost growth. It is aimed at accelerating the restoration of a forest cover*." (p. 3)

8. Protection
"*Once advanced growth is established and dynamically growing it needs to be protected from all forms of disturbance, including fire. Prescribed burning can be conducted once regrowth reaches 6 metres in height.*

Harvesting operations are to be excluded from sapling stands." (p. 3)

MANUAL OF HARDWOOD … 2nd Ed. – 1989

Manual of Hardwood Logging Specifications … 2nd ed. 1989

Section 1 : Planning
Specification 1.1 Logging Plans
1. Responsibilities
"*The preparation and distribution of logging plans is the responsibility of the Regional Inventory Branch Offices. These plans are prepared for each Supply Area and include:*
i) a one or two year logging plan (short-term)
ii) a four or five year logging plan (medium term)
and
iii) a long term (eg. 15 years) logging plan (long term).

These plans are produced after consultation with District staff, Regional staff and specialist branch staff, and timber industry representatives where necessary. The plans must be integrated with all other operational plans including plans for roading, silviculture, mining, fire control and visual resource management." (p. 1)

6. Monitoring and Records
"*Logging must not commence until plans are issued. If during a year additional areas of forest are to be cut, additional or amended plans must be issued by the relevant Inventory Office. Districts supervising logging must keep accurate records of areas cutover and quantities of log products removed and forward such information to the relevant Inventory office as required.* […]" (p. 2)

Section 3. Silviculture
Specification 3.1 : Current Specifications
"*3. The decision as to which silvicultural specification to use must be given careful consideration prior to the commencement of treemarking and harvesting. The decision made must be noted on the Hardwood Harvesting Prescription Form (CLM093).* […]" (p. 26)

Section 4 : Coupe Management
Specification 4.2 Falling (Including Tree Marking Techniques)
2.Tree Marking

NOTE: REFER TO ENTRY UNDER 1987 EDITION (SIMILAR WORDING)
***EXCEPT* FOR THE FOLLOWING-**

"*Tree marking will normally be carried out by Forest Officers. Occasionally, however, the Forest Officer in Charge may allow cutting to take place without tree marking. This may occur in 'first thinning' of young, even-aged regrowth stands, and in 'clear cutting' areas. In these cases the FOIC must ensure that:*

i) silvicultural objectives are not compromised and
ii) protection of retained crop trees meets standards as per Specification 5.4." (p. 37)

Specification 4.5 : Logging Operation Inspections and Certifications

NOTE: REFER TO ENTRY UNDER 1987 EDITION (SIMILAR WORDING)

Section 5 : Environmental Protection
Specification 5.4 : Protection of Crop Trees

NOTE: REFER TO ENTRY UNDER 1987 EDITION (SIMILAR WORDING)

POLICY STATEMENT – 1988

Implementing the Timber Strategy. 1988

Forest Management
Jarrah Silviculture Prescriptions
"*A new and improved system of managing the jarrah forest to ensure regeneration, increased productivity and protection from disease has been devised and is being implemented*." (p. 5)

CORPORATE PLAN OBJECTIVES - 1988

CALM Annual Report 1st July 1987 to 30th June 1988. 1988

NOTE: REFER TO ENTRY UNDER ANNUAL REPORT FOR 1986/87 AND 1985/86, ENTRY IS SIMILAR EXCEPTING THAT THE MISSION STATEMENT HAS CHANGED (THE SCOPE HAS BECOME THE STATEMENT OF MISSION)

"*TO CONSERVE WESTERN AUSTRALIA'S WILDLIFE AND MANAGE LANDS AND WATERS ENTRUSED TO THE DEPARTMENT FOR THE BENEFIT OF PRESENT AND FUTURE GENERATIONS.*" (p. 6)

NOTE: THE ENTRY UNDER TIMBER PRODUCTION HAS CHANGED TO INCLUDE AN ADDITIONAL OBJECTIVE (SEE THE FINAL OBJECTIVE)

"*Prepare and implement strategies to promote and encourage development of the forest production requirements of the State.*

This will involve:
[…]
- *The development of cost effective procedures for growing, processing and marketing timber at the level sustainable under sound forest management.*

[…]

- *Re-forestation of cleared lands with hardwood forests to supplement production from native forests and to assist in soil and water conservation.*" (p. 9)

STRATEGIC PLAN – ND [?1988]

Central Forest Region Strategic Plan. [?1988]

Industry Control – Timber (Function)
Hardwood
Objective
"*1. Use hardwood logging as a silvicultural tool to improve the forest.*" (p. 52)

Strategy
"*i) Carry out all hardwood logging operations in accordance with the Code of Hardwood Logging practice and the Manual of Specifications for the control of Hardwood Logging Operations.*
[…]
iii) Ensure retained crop trees are protected." (p. 52)

Measure of Performance
"*1. Silvicultural benefits are achieved.*
[…]
3.Forest is regenerated." (p. 52)

Harvey District's 5 Most Important Goals Over the Next 5 Years
"*Silviculture*
Jarrah: Silviculturally treat all jarrah forest during logging, to ensure adequate regeneration […]" (p. 122)

CODE OF LOGGING PRACTICE – 1988

Code of Logging Practice. 1988

Section 2 : General
NOTE: REFER TO ENTRY UNDER 1987 EDITION (SIMILAR WORDING)

Section 3 : Felling, Trimming and Crosscutting
NOTE: REFER TO ENTRY UNDER 1987 EDITION (SIMILAR WORDING)
***EXCEPT* THAT 3.8 NOT INCLUDED IN THIS EDITION**

Section 4 : Extraction
NOTE: FOR 4.1 REFER TO ENTRY UNDER 1987 EDITION (SIMILAR WORDING)

"*4.3 A Contractor is required to confine his extraction activity to certain defined coupes, subcoupes and/or faller's blocks within the cutting areas. These defined areas must be extracted to the satisfaction of the F.O.I.C. before further areas will be made available for extraction.* […]" (p. 13)

NOTE: FOR 4.8 REFER TO ENTRY UNDER 1987 EDITION (SIMILAR WORDING)

CONSERVATION POLICY - 1987

Strategies for Conservation and Recreation on CALM Lands in Western Australia. 1987

The Objectives and Principles in the State Conservation Strategy (SCS)
"*The SCS for W.A. sets out five key objectives for conservation. These are:*

> *to maintain essential ecological processes and life-support systems;*
> [...]
> *to ensure the sustainable utilisation of species and ecosystems;*
> *to maintain and enhance environmental qualities*
> [...]" (p. 4)

"*CALM is committed to the objectives and principles listed in the SCS and uses them as the basis for all conservation planning and operations.*" (p. 4)

The Legislative Base
"*CALM operates under two legislative acts: the CALM Act and the Wildlife Conservation Act.*

These Acts place a number of statutory requirements on the way in which CALM manages land and wildlife. The major requirements are:

(1) Management must be in accord with a published management plan and all management plans must be made available for public review and comment in the draft phase.

(2) All lands are vested in two controlling bodies (not the Department). The controlling bodies (National Parks and Nature Conservation Authority and Lands and Forest Commission) are comprised mainly of members of the public representative of conservation and land management interests.

(3) The Department must perform the following functions:

> *manage land vested in the NPNCA and LFC;*
> *provide the NPNCA and LFC with assistance;*
> [...]" (p. 4)

The Corporate Plan : The CALM Mission and Key Objectives
General Principles and Philosophy
"*CALM is committed to the principle that it manages public land and natural resources and conserves native wildlife on behalf of the public of W.A. Emphasis is placed, then, on informing the public of the Department's activities and, wherever possible, involving the public in planning and management.*" (p. 5)

Statement of Mission
"*In recognising that Western Australia has a beautiful and diverse natural environment which provides material, aesthetic and spiritual benefits and that the natural environment is an essential component of the quality of life for Western Australians, a statement of mission adopted for the Department of CALM is:*

> *TO PROVIDE FOR THE USE OF THE NATURAL ENVIRONMENT WITHOUT DETRACTING FROM POSSIBLE FUTURE USE.*" (p. 5)

Charter
"*The scope of the Department's responsibilities is represented by its charter which is:*

TO CONSERVE WESTERN AUSTRALIA'S WILDLIFE AND MANAGE PUBLIC LANDS AND WATERS ENTRUSTED TO THE DEPARTMENT FOR THE BENEFIT OF PRESENT AND FUTURE GENERATIONS.

Primary Objectives
Five primary objectives have been established:

Management
To protect, restore and enhance the value of resources entrusted to the Department so as to meet, as far as possible, the diverse expectations of the community.

Conservation
To conserve the indigenous plant and animal species and environmental processes in natural habitats throughout the State.

Production
To provide and regulate the supply of renewable resources on a sustained yield basis for the satisfaction of long-term social and economic needs, and in a manner that minimises impact on other values." (p. 5)

"*Subsequent sections of the Department's corporate plan elaborate on these objectives, particularly those relating to conservation. The strategies used to meet these objectives are:*

ESTABLISH AND MAINTAIN A SYSTEM OF SECURE RESERVES WHICH PROTECT VIABLE REPRESENTATIVE SAMPLES OF ALL THE STATE'S NATURAL ECOSYSTEMS AND SPECIES BOTH TERRESTRIAL AND AQUATIC, AS WELL AS AREAS SUITABLE FOR RECREATION AND THE PRODUCTION OF RENEWABLE NATURAL RESOURCES." (p. 6)

"*PREPARE AND IMPLEMENT MANAGEMENT PLANS FOR LANDS AND WATERS ENTRUSTED TO THE DEPARTMENT.*

This will involve:

The establishment of priorities for management plan preparation according to set criteria.
[…]
PREPARE AND IMPLEMENT TIMBER PRODUCTION STRATEGIES WHICH MEET THE OBJECTIVES OF THE STATE.

This will involve:

Continuous review of supply and demand data for wood products.

The development of cost effective procedures for growing, processing and marketing timber at the level sustainable under sound forest management.
[...]
MANAGE EXPLOITATION OF RENEWABLE NATURAL RESOURCES ACCORDING TO THE FOLLOWING PRINCIPLES:
resources are managed to ensure their long-term conservation;
[...]" (p. 7)

POLICY STATEMENT – 1987

Policy Statement No. 19 : Fire Management Policy. 1987

Strategies
"*4.2Use of Fire*

Prescribed fires will be used to achieve a range of management objectives, including … forest regeneration […].

According to management objectives, appropriate prescriptions will be developed, and staff will be trained in their application.

Monitoring of the effects of fires will be undertaken wherever effective systems have been developed and resources are available." (p. 5)

CORPORATE PLAN OBJECTIVES - 1987

CALM Annual Report 1st July 1986 to 30th June 1987. 1987

NOTE: REFER TO ENTRY UNDER ANNUAL REPORT FOR 1985/1986, ENTRY IS SIMILAR EXCEPTING FOR THE FOLLOWING ADDITION UNDER THE OBJECTIVE FOR TIMBER PRODUCTION –

Corporate Objectives
[…]
"*To achieve the primary objectives the Department will:*
[…]
Prepare and implement timber production strategies which meet the objectives of the State.

This will involve:
[…]
- *The development of cost effective procedures for growing, processing and marketing timber at the level sustainable under sound forest management.*

[…]" (p. 12)

TIMBER STRATEGY - 1987

Timber Production in Western Australia : a strategy to take W.A.'s south-west Forests into the 21st Century. 1987

Objectives
"*The objective of this strategy is to provide a plan for an efficient timber industry which is sustainable indefinitely.* […]" (p. 2)

Principles
"*(3) forest areas harvested for timber production will be regenerated, and previously regenerated forests will be silviculturally managed to optimise the management objective;*" (p. 2)

Future Forest Management Proposals
"*It is proposed to further upgrade forest management during the planning period by:*

(1) thinning 4 000 ha of jarrah regrowth stands per annum;
[…]" (p. 35)

MANAGEMENT PLANS - 1987

Northern Forest Region Regional Management Plan 1987-1997. 1987
Central Forest Region Regional Management Plan 1987-1997. 1987
Southern Forest Region Regional Management Plan 1987-1997. 1987

Objectives and Principles
"*In addition, the following principles set down in the State's timber strategy apply also to the preparation of this regional management plan:*
[...]

All areas of forest managed for timber production are also to be managed to provide for other values of the forest and all areas harvested are to be regenerated." (p. xiii in *Northern Forest … Plan*)

Hardwood Timber
"[…] *Silviculture is aimed at encouraging regeneration or increasing growth rates of selected crop trees. High quality stands receive follow-up stand improvement treatment after logging, including the removal of logging residue from the trunks of retained trees and the removal by cutting and poisoning of suppressed trees, and competing species.*" (p. 47)

Northern Forest Region Regional Management Plan 1987-1997

Regional Strategies
"*In addition to implementing Departmental policies and guidelines … during the period of this plan CALM staff in the region will:*

(i) implement the strategy described in 'Timber production in Western Australia' CALM (1987);

(ii) maximise growth on retained trees or regeneration;

[...]
(iv) implement the 'Code of hardwood logging practice' and 'Manual of specifications for control of hardwood logging operations in the Northern Jarrah Forest' (CALM, 1986);
[…]" (p. 48)

Central Forest Region Regional Management Plan 1987-1997

Regional Strategies
"*In addition to implementing Departmental policies and guidelines … during the period of this plan CALM staff in the region will:*

(i) implement the timber strategy described in 'Timber production in Western Australia' CALM (1987);

(ii) achieve full occupation of the site after logging and maximise growth on retained trees or regeneration;
[...]

(iii) maintain the 'Code of Hardwood Logging Practice' which defines silvicultural, disease and environmental criteria for logging, within the context of CALM management policies and objectives;
[...]" (p. 49)

Southern Forest Region Regional Management Plan 1987-1997

Regional Strategies
"*In addition to implementing Departmental policies and guidelines … during the period of this plan CALM staff in the region will:*

(i) implement the strategies in 'Timber Production in Western Australia. A strategy to take W.A.'s South-West Forests into the 21st Century' (1987) …;" (p. 46)

"*(vi) progress towards totally integrated logging operations for all log products including minor forest produce;*

(vii) ensure that all logging and related operations conform to the 'Code of Logging Practice';
[...]
(x) control logging under logging plans." (p. 47)

Shannon Park and D'Entrecasteaux National Park Management Plan 1987-1999. 1987

10.0 Conservation Opportunities
"*Protection of the natural values of the Parks is a fundamental concern of this plan. Thus, management and sustained use must not cause irreversible environmental damage or impairment of scenic beauty.*" (p. 43)

1.0 Management Objectives For National Parks
"*The following management objectives for national parks are derived from the Conservation and Land Management Act (1984) and departmental polices for management. The objectives are to:*

[…]
4.Regulate use to be consistent with the maintenance and protection of natural resource values and to minimise conflict between uses.
[…]" (p. 47)

6.0 Protection
6.1 Fire
Objectives
"*The Parks are to be managed primarily to conserve their natural ecosystems and landscapes, whilst ensuring the Park visitors have the opportunity to enjoy the Parks without detrimentally affecting them. In setting the specific fire management objectives to achieve the management objectives for the Parks, the protection of life and property within and near the Parks must be of high importance.*

Consistent with this principle, the following objectives will apply in order of priority:

[…]
2.To protect community and environmental values in or near the Parks including … forest regeneration …."
(p. 75)

SILVICULTURE SPECIFICATION – 1987

Silviculture Specification 1/87 : Jarrah Thinning and Regeneration

NOTE: REPLACES SPECIFICATION 1/86

"*These specifications are to be read in conjunction with 'Treemarking and Silviculture in the Jarrah Forest' 1987. They are applicable to areas that are classed as dieback free.*" (p. 1)

2. Marking of Crop Trees

"[…] *The requirement is that 10 sq.m/ha of acceptable crop trees are retained. In addition to these crop trees, provision is made to retain a further 5 sq.m/ha of potentially merchantable trees of high value – these are jarrah/marri trees which are within 5cm dbhob of becoming an S.E.C. pole or sawlog, and that meet crop tree specifications.* […]" (p. 2)

"[…] *Where significant amounts (5 sq.m/ha or more) of marri and sheoak are being considered for retention the alternative option of regenerating rather than thinning must be considered carefully.*" (p. 2)

4.Follow Up Silvicultural Treatment

"*Following commercial utilisation, areas selected for intensive treatment will have other surplus trees removed non-commercially to reduce competition to the crop trees. This will be done by notching and poisoning on most areas with felling and stump poisoning only in selected special areas.*

In patches of forest where there are 10 sq.m/ha or more of jarrah crop trees, all surplus trees (including banksia) are removed. […]

Where there are less than 10 sq.m/ha of jarrah crop trees, crop trees are released individually from surrounding competition by removing all surplus stems within 4 metres of each crop tree. […]

5.Jarrah Thinning Intensity

Mean DBHOB of best 150 stems/ha at first thinning	*Schedule*
Less than 20cm	*release 200 jarrah stems/ha from overtopping and crown abrasion. The objective is to maintain healthy crown development on future jarrah crop trees without promoting a permanent low crown break.* […]
*20-25 cm**	*thin to 10 sq.m/ha O.B. – this will usually be both a commercial and non-commercial thinning. It will leave more than 150 stems/ha but ensures that the stand is not left under-stocked. A further thinning will be required before the crop trees reach 50cm dbhob.*
*25-30cm**	*thin to 10 sq.m/ha O.B. – this is likely to be both a commercial and non-commercial thinning. The remaining trees are capable of reaching 50cm dbhob without the stand becoming overstocked (50 years). More conservative future thinning will maximise sawlog volume/ha.*

40 cm	*thin to 18 sq.m/ha O.B. – thin again when crop trees reach 50 cm dbhob. Above comments apply.*
50 cm+	*thin to 20 sq.m/ha O.B.*

[…]" (p. 3)

B. Regeneration
2. Follow Up Silvicultural Treatment
2.1 Shelterwoods
"*Maximise soil disturbance to remove the scrub root stock and create an improved seed bed for seedlings to establish or develop without a competition of the scrub. Remove banksia and sheoak understorey where necessary.*

Top dispose and burn to create ashbeds (without excessive damage to retained stems) in a seed year. (Alternatively sow with jarrah seed after the burn)." (p. 4)

2.2 Gaps
"[…]
Complete fire protection of the developing regrowth is required until it can withstand a mild burn (< 70 kw/m), when it reaches a height of 5-6m (at about age 10, depending on site)." (p. 5)

MANUAL OF HARDWOOD … - 1987

Manual of Hardwood Logging Specifications … 1987

3.Silviculture
Specification 3.1 Jarrah Silviculture
"*Silviculture, particularly in the jarrah forest, must be given due consideration prior to the commencement of cutting. In particular, the 'Coupe Cutting Prescription' form (CLM 093) must be carefully completed prior to the commencement of tree marking.*" (p. 28)

3.3 Tree Marking
"*Because of the variability of the jarrah forest, a fixed tree marking prescription will not work for every stand.* […] *Tree markers must therefore have a sound understanding of the document 'Tree Marking and Silviculture in the Jarrah Forest' (Bradshaw, 1985; reviewed 1987) and any specifications issued to complement this document.*" (p. 31)

Section 4 : Coupe Control
Specification 4.2 Falling (Including Tree Marking Techniques)
9. **Tree Marking**
"*Trees to be removed from an area may be indicated to fallers by marking either those trees to be removed or those trees to be retained as crop trees. The Forest Officer in Charge will decide which method is to be used depending on the type of bush being cut and other practicalities. Once the decision is made, the tree marking method must not be changed within an individual coupe.*" (p. 44)

9.1 Tree marking for removal
"[…] *In areas where trees are marked for removal by either of the two methods described, no other trees may be felled.*" (p. 45)

Specification 4.5 Logging Operation Inspections and Certifications

"*1. The contractor's foreman or supervisor must check logging standards periodically on a faller's block by faller's block (or sub-coupe by sub-coupe) basis to ensure falling and extraction standards are maintained. CALM's Forest Representative will periodically accompany the contractor's foreman or supervisor on these inspections to monitor standards.*

Aspects of logging to be inspected include:
[…]
- *damage to retained (crop) trees by falling and/or skidding*
- *extraction pattern*
[…]
- *tops disposal*." (p. 42)

Section 5 : Environmental Protection
Specification 5.4 : Protection of Crop Trees

"*1.In coupes where crop trees are marked for retention, Industry personnel must make every effort during all phases of logging to protect the crop trees from physical damage. Physical damage is any damage resulting in one or more of the following:*

(a) The exposure of more than 100cm 2 of cambium on the bole of a crop tree.
(b) The falling, breaking, or uprooting of a crop tree, or
(c) The removal of more than 30% of the crown of a crop tree.

2.Periodical assessments of crop tree damage must be carried out by a Forest Officer using the 'Assessment of Crop Tree Damage' form. In carrying out these assessments, a Forest officer must assess a sample of at least 100 crop trees in a given faller's block or sub-coupe. […]" (p. 69)

"*4. Copies of all crop tree damage assessments must be handed immediately to the relevant District Manager. Copies must be forwarded to the Manager of the relevant logging operator, and the relevant Industry Bush Boss.*" (p. 87)

"*5. As well as avoiding physical damage, Industry must ensure, that all logging debris created by a logging operation is removed from the base of crop trees. This task is commonly known as 'tops disposal', and is designed to protect crop trees from fire damage. The debris to be removed include all woody material greater than 75mm diameter. This material must be moved at least lm away from the bole of a crop tree. Tops disposal must be completed before a faller's block or sub-coupe is certified complete.* […]" (p. 88)

CODE OF HARDWOOD – 1987

Code of Hardwood Logging Practice. 1987

"*Where specifications for the performance of the rules and instructions in this Code are required they are to be found in the Manual of Specifications covering the forest area in which logging operations are taking place.*" (p. i)

Section 2 : General

"*2.1 The Instructions contained in this Code shall be observed by all persons participating in any hardwood forest logging operation on land managed by the Department of Conservation and Land Management.* […]

2.2 An Operator shall observe all Acts of the State of Western Australia, and in particular, the Bush Fires Act 1954, the Conservation and Land Management Act 1984, the Inspection of Machinery Act 1921, the Machinery Safety Act 1974, the Road Traffic Act 1975, the Timber Industry Regulation Act 1926,

the Workers Compensation Act 1912, the Wildlife Conservation Act 1950-79, the Agriculture and Related Resources Protection Act 1976-83, the Country Areas Water Supply Act 1947-76, and the Water Authority Act 1986, including all amendments to those Acts for the time being in force and any Act passed in substitution or in lieu thereof and all Regulations for the time being in force thereunder as well as this Code of Logging Practice." (p. 4)

"2.*7 An Operator shall exercise strict supervision and control over operations of all workers employed by him, with a view to:*

2.7.1 Preventing any breach of the Conservation and Land Management Act and Regulations, the TIR Act and Regulations and this Code of Practice.

2.7.2 Preventing damage to other standing timber during felling extraction and hauling operations in accordance with current silvicultural prescriptions.

2.8 All operations carried out by, or on behalf of, an Operator in hardwood forest areas shall be carried out as directed by a Forest Officer. Any monetary penalties for breaches of this Code or for damage to or waste of timber in breach of the instructions of this Code will be deducted from any money due to the Operator, or failing that from the Operator's deposit." (p. 5)

Section 3 : Felling, Trimming and Crosscutting

"*3.1 All felling, trimming and crosscutting shall be carried out in such place, order, time and manner as the Forest Officer in Charge shall from time to time approve.*" (p. 8)

"*3.5 Felling by machines such as feller-bunchers or harvesters will be permitted only after specific approval for the use of each type of machine has been given by the Executive Director through the Forest Officer in Charge.*" (p. 8)

"*3.7 If possible, areas of forest suitable for operation by approved machines will be made available. A maximum of two sub-coupes per machine or group or machines will be demarcated for operation at any one time. Further sub-coupes will not be worked until one of the previously allocated sub-coupes has been utilised to the satisfaction of a Forest Officer.*

3.8 Extraction, erosion control and cleaning up must work progressively through fallers blocks and allocated coupes." (p. 9)

3.9 Marking of Trees for Removal

"*(a) Where trees are marked for removal an Operator shall fell and utilise only such trees as have been marked or otherwise indicated for the purpose by a Forest Officer.* […]

(b) An Operator shall not fell, damage or utilise any unmarked trees.

(c) If an Operator wishes to cut unmarked trees to assist his operations, eg, widening vehicle tracks, extending landings, he shall refer the matter to the Forest Officer in Charge and such trees will not be cut until marked by a Forest Officer." (p. 9)

3.10.1 Marking of Trees for Retention

"*(a) Trees to be retained as crop trees will be marked or otherwise indicated by a Forest Officer. All other trees in the coupe are to be felled if in the opinion of the Forest Officer in Charge they contain log produce designated as such under the conditions of the Operation.*" (p. 9)

"*(b) An Operator shall not fell, damage or utilise any tree marked for retention by a Forest Officer.*

(c) *If an Operator wishes to cut marked (retained) trees to assist his operations, eg, widening vehicle tracks, extending landings, he shall refer the matter to the Forest Officer in Charge and such trees will not be cut until released by a Forest Officer.*" (p. 10)

"*3.11* *An Operator shall incur penalties at rates determined by the Executive Director for any wood contained in any trees felled by him in breach of Instructions 3.9 and 3.10. Such trees shall remain the property of the Department.*" (p. 10)

"*3.14* *All felling, trimming and crosscutting is to be carried out with a minimum of damage to retained standing trees.*

Where standing trees are damaged by him an Operator shall be liable for such damage at rates determined by the Executive Director. Any penalties will be charged under Instruction 2.8 of this Code. Such damaged trees shall remain the property of the Department." (p. 10)

"*3.17* *An Operator shall be liable to pay the Department for all wood not cut in accordance with Instruction 3.12, 3.12 or 3.16 at rates determined by the Executive Director.*

[…]

3.19 *'Hangups' shall be dislodged and cut-off tops shall not be left leaning against standing trees.*

3.20 *The tops and branches of any trees felled by the operator which fall close to retained crop trees shall be cleared away from the crop trees into open spaces to the satisfaction of the Forest Officer in Charge.*" (p. 11)

Section 4 : Extraction

"*4.1* *All extraction shall be carried out in such places, order, time and manner as the Forest Officer in Charge shall from time to time approve.*

4.2 *The Forest Officer in Charge may determine the priority of extraction of produce from time to time. An Operator shall comply with the Forest Officer's expressed priority of extraction. This priority may be expressed in type of log, point of removal, dieback hygiene requirements and deadline for delivery of all four together.*" (p. 12)

"*4.4* *All extraction is to be carried out with a minimum of damage to be retained standing trees. Where standing trees are damaged by him an Operator shall be liable for such damage at rates determined by Executive Director. Any penalties will be charged under Instruction 2.8 of this Code. Such damaged trees shall remain the property of the Department.*" (p. 12)

"*4.7* *An Operator shall not carry on extraction at such times or places, or by methods or equipment which a Forest Officer has prohibited until such prohibition has been revoked by the Forest Officer.*" (p. 13)

Section 6 : Loading and Hauling

"*6.6* *Loading and hauling of logs and timber shall be carried out with a minimum of damage to standing trees. Where standing trees are damaged by him an Operator shall be liable for such damage at rates determined by the Executive Director. Any penalties will be charged under Instruction 2.8 of this Code.* […]" (p. 16)

OPERATIONS MANUAL - 1987

Southern Forest Region Operations Manual. 1987

Measurement of Forest Fuel Quantity
Location of Sample Lines within Burn Area
"*The fuel sampling techniques described below allow for reliable estimation of fuel quantity on large areas. Three factors which must be considered when planning the sampling intensity and assessment procedure, determine the number of location of sampling sites required. The first consideration is the importance of the area in respect to the value of the timber and conservation assets, the presence of vulnerable regeneration and the proximity to private property. The second is that sampling intensity increases with diversity of the area sampled, whilst the third consideration is the ease of access.*

The location of sampling lines must be carefully planned as it is important to assess the full range of major forest or vegetation associations and fuel types in order to reduce costs and damage from the prescribed burning operations.

The following sets out the steps to follow in locating the sample lines.

(a) *From past burning plans trace the areas of same age burns onto the 1:25000 (where practical) map of the proposed area. Label with year and season of last burn.*
(b) *Outline the major forest or vegetation association types within the areas of same burning age.*
(c) *Isolate the canopy cover extremes of each forest type, and randomly select sites for two sample lines within these extremes.*" (p. 5)

Hardwood Burning Prescription Preparation
"*The following notes have been issue to obtain uniformity in the preparation of the Hardwood Prescription and Burning Report. These notes accompany the handout describing the assessment of forest fuel quantity.*" (p. 14)

Location
"*1. The hardwood burning prescription form must be completed as follows: (See Appendix 1)*

Prior Inspection
"*2. The PLAN of the area must be included in the Burning Prescription.*" (p. 14)

4. Suggested Conditions for Burning
"*In setting the conditions necessary to achieve a successful burn result, it is important to keep in mind the factors that dictate the number, the timing, the fire danger ratings, and the strip spacing of each of the lightings required.*

These factors include:
- *the season of burn*
- *the forest or vegetation type, condition and vegetation/tree size,*
- *the total <u>available</u> fuel quantities*
- *the acceptable scorch limits,*
- *the range of fire danger index required to burn the full range of fuels.*" (p. 15)

4.1 Season
"*Allocation of the burn season depends on the moisture content of the fuels, the crown height of the potential crop trees and other local requirements. In general, Autumn burns are cleaner and so of high protection value than Spring burns. Certain forest areas, e.g., flats and eastern wandoo types, will not burn in early spring. However, Autumn burns are associated with high scorch heights due to the dryness of outer bark, heavy*

ground fuels and duff litter. Also the Autumn burning season can be cut short by winter rains and at best is an unpredictable burning season. On the other hand, Spring is a more reliable season, and burning at this time leads to less scorch damage." (p. 16)

4.2 Total Available Fuel Quantity
"*Fire behaviour studies indicate that scorch heights vary with fire intensity which in turn is related to the amount of available fuel and the fire rate of spread.*

These relationships have been tabulated for both karri (including karri-marri) and jarrah forest associations.

To calculate the available fuel quantity, refer to appropriate trash and scrub fuel tables (Forest Fire Behaviour Tables) and obtain the available fuel weight for these components. Obtain the available litter weight by multiplying the total litter weight by the Available Fuel Factor (AFF). (For Jarrah litter one can assume AFF to be 1.0; for Karri litter AFF = 0.5)

Add the trash, scrub and litter available values to derive the total available weight." (p. 16)

4.3 Acceptable Scorch Height Limits
"*The forest type, condition and height of canopy will indicate the level of scorch which is considered acceptable. Stands susceptible to scorch, such as young saplings, require a lower scorch standard than pole stands, which in turn can stand less fire than mature forests.*" (p. 16)

Table 1 : Maximum Scorch Acceptable for Various Tree Sizes

Stand Type	*Max. Scorch Height (metres)*	
	Spring	*Autumn*
J Coppice	*3m*	*3m*
J, M or K Saplings	*4*	*4*
J, M or K Poles (10-18m tall)	*5*	*5*
J, M or K Poles (20+ m tall)	*6*	*7*
" Mature	*7 to 9*	*7 to 12*

Note: These scorch limits may need to be modified if stands contain logging tops or massive fuel accumulations." (p. 17)

7. Pre-Burning Work Required
"*Record on the prescription form details of the following jobs that must be completed before lighting takes place.*" (p. 19)

Jarrah Regeneration Burning
Scope
"*This prescription provides guidelines for the burning of jarrah, marri forest stands following trade operations.*" (p. 56)

Objective
"*2.1 To provide development of lignotuberous growing stock.*
1.2 To remove the maximum amount of logging debris consistent with 2.1 & 2.3.
1.3 To provide protection for the growing stock through fuel reduction." (p. 56)

3. Planning
"*3.1 The cutting prescription dictated by the stand structure will largely determine the type of fire appropriate for the regeneration burn.*

[…]

4. Burn Prescription
"*4.1 All burns conducted must be to a prescription which clearly states the objectives and F.D.I.'s to be used.*
1.2 The attached table gives guidelines for the different cutting systems." (p. 56)

REFER TO ORIGINAL DOCUMENT FOR TABLE 2.9 JARRAH REGEN BURN GUIDELINES

Top Disposal in Jarrah Regrowth Stands
Scope
"*Tops disposal shall be applied to areas of forest where protection of retained or crop trees is required following logging operations.*" (p. 121)

Objective
"*To protect retained trees from fire damage during tops burning and subsequent fuel reduction burns.*" (p. 121)

Prescription
"*3.1 Selection of Trees to be Tops Disposed*
a) Each area to be tops disposed will be treated on the merits of that stand.
b) The marking of potential crop trees shall be carried out by the OIC of the coupe prior to the logging operation i.e. retention marking.
[…]" (p. 121)

3.2 Tops Disposal
"*a) Using axes or chainsaws remove all debris >75mm in diameter from base of retained trees to a distance of at least 1 metre.*
b) Elevated branches immediately around the tree to be lopped flat." (p. 121)

ADMIN. INSTRUCTIONS - 1986

Administrative Instruction No. 23 : Interim Guidelines For Operations. 1986

Introduction
"*For substantial areas of land under the control of the Department of Conservation and Land Management it will be many years before approved Management Plans will be developed. In the meantime the CALM Act provides in Section 33 (3) (b) that certain operations can be carried out when there is no management plan.*" (p. 1)

"*For indigenous State forest the operations are defined as those actions that ensure the multiple use and sustained yield of that resource for the satisfaction of long term social and economic needs.*

In accordance with the Departmental Planning Policy (Policy 1, January 1986) the necessary operations must be carried out in a planned manner through the development and implementation of INTERIM GUIDELINES FOR OPERATIONS.

The Interim Guidelines will consist of:

(1) a brief description and brief guidelines for major potential activities;

(2) a map showing the locality and area of proposed management activities;

(3) an indication of who must give approval before particular operations can be carried out.

This paper shows how the Interim Guidelines are intended to work." (p. 1)

Aim
"*The aims of the Interim Guidelines are:*

(i) *to provide an adequate safeguard against natural and operational calamities on lands administered by CALM in the absence of an approved Management Plan;*

(ii) *to ensure that critical 'necessary operations' are identified and properly prescribed;*

(iii) *to ensure that the impacts of necessary operations are fully considered and effectively incorporated within existing management and control systems;*

(iv) *to provide a simple, efficient and attainable means of gaining approval for necessary operations.*" (p. 2)

Identification
"*The first step is to identify all the necessary operations within each of the areas concerned. Use can be made of a checklist showing all the possible necessary activities – see Appendix 1. Only those operations that are essential for safeguarding the area in question should be considered. These must be consistent with the objectives for the area concerned as described in the CALM Act.*" (p. 2)

Strategies and Prescriptions
"*The development of suitable strategies and prescriptions* ***will*** *necessitate consultation and collaboration between CALM Operations, Planning and Specialist groups.* […]" (p. 3)

Duration of Interim Guidelines
"*Most Interim Guidelines should have an approval duration of at least 3 years with a maximum of 5 years.* […] *However, the works programme that emanates from these Interim Guidelines must be reviewed and updated annually.*" (p. 4)

Approval
"*A system of approval for the Interim Guidelines and the methods of implementing these is to be adopted which recognises and utilises the established hierarchy of authority and control, i.e. District Manager to Regional Manager to Divisional Manager (or Branch Manager) to Directorate (Director National Parks or Director Nature Reserves or both, or entire Policy Directorate depending on the range of necessary activities). It is expected that once the pattern of the development of these Interim Guidelines have been universally accepted, that the final approval will be delegated to Divisional or Regional Managers.*" (p. 4)

CORPORATE PLAN OBJECTIVES - 1986

CALM Annual Report 1st July 1985 to 30th June 1986. 1986

Corporate Objectives
"*Under a corporate plan formulated in 1985/86 the statement of mission for the Department of Conservation and Land Management is:*

> *TO PROVIDE FOR THE USE OF THE NATURAL ENVIRONMENT WITHOUT DETRACTING FROM POSSIBLE FUTURE USE.*

The scope of the Department's responsibilities is represented by its charter which is:

TO CONSERVE WESTERN AUSTRALIA'S WILDLIFE AND MANAGE PUBLIC LANDS AND WATERS ENTRUSTED TO THE DEPARTMENT FOR THE BENEFIT OF PRESENT AND FUTURE GENERATIONS.

Primary objectives are:

Management

To protect, restore and enhance the value of resources entrusted to the Department so as to meet, as far as possible, the diverse expectations of the community." (p. 9)

"*Production*

To provide and regulate the supply of renewable resources on a sustained yield basis in a manner that minimises impact on other values.

[…]

To achieve the primary objectives the Department will:

Provide an effective administrative framework for the conservation of wildlife throughout the State and the management of lands, waters and natural resources entrusted to the Department.

This will involve:

- *The maintenance of a Policy Directorate to establish, review and refine Departmental aims, policies and priorities; to monitor the implementation of management plans; and to see that goals are achieved.*
- *The maintenance of an operations wing to implement policies and management plans and to set up efficient financial, administrative and management systems.*" (p. 9)

"*Establish and maintain a system of secure reserves which protect viable representative samples of all the State's natural ecosystems and species, both terrestrial and aquatic, as well as areas suitable for recreation and the production of renewable natural resources.*

This will involve:

[…]

- *Categorising lands and waters entrusted to the Department into priority use zones and applying the principle of multiple use consistent with the needs of (in order of priority) nature conservation, recreation and production.*" (p. 10)

- "*Protecting ecosystems, landscape and the cultural heritage on lands and waters entrusted to the Department from damage by fire, disease, grazing, feral animals and people.*

- *Developing prescriptions for control of disturbance and for rehabilitation of damaged forests, parks and reserves.*

[…]" (p. 11)

"*Prepare and implement management plans for lands and waters entrusted to the Department.*

This will involve:

- *The establishment of priorities for management plan preparation according to set criteria.*

- *Restricting procedures to necessary operations to maintain public safety and the status quo of area management where no management plan exists.*" (p. 13)

Manage exploitation of renewable natural resources according to the following principles:

- *resources are managed to ensure their long term conservation;*

[…]" (p. 13)

STRATEGIC PLAN - 1986

Strategic Plan : Southern Forest Region. 1986

Key Area : Jarrah Regeneration
Objective
"*1. To satisfactorily and effectively regenerate all cut over jarrah and mixed jarrah forest.*" (p. 16?)

Key Area : Hardwood Tending
Objective
"*3.**Jarrah.** Maintain the Jarrah Stand Improvement programme to Silviculture Branch Specifications. Complete tops disposal operations in all dieback free cut over jarrah forest.*" (p. 16?)

Measure of Performance
"*1. Jarrah stand improvement to cover at least 800 ha.*" (p. 16?)

Key Area : Crop Trees
Objective
"*1. Ensure protection of retained crop trees in karri and jarrah regrowth forests.*" (p. 25)

Measure of Performance
"*1. Introduce a penalty system for damage to crop trees in all regrowth logging areas.*" (p. 25)

Hardwood Establishment
Objective
"*3. To regenerate all cut over jarrah forest*" (p. 75)

Measure of Performance
"*1. Assess lignotuber stocking at the time of coupe demarcation.*

2. Carry out advance burns at least 12 months prior to logging and mild tops burns in spring following logging.

3. Re assess lignotuber stocking prior to logging commencing.

4. Clearfell areas with adequate lignotubers and ensure that gaps do not exceed 10ha.

5. Retention mark and selection cut, areas which have an inadequate stocking of lignotubers.

6. Protect significant (0.5ha +) areas of advanced growth and saplings
[…]." (p. 75)

Silviculture
Objective
"*3. To effectively regenerate all karri and jarrah areas back to the original species composition (as soon as possible) after logging.*

b) jarrah silviculture treemarking to be given highest priority in jarrah industry control operations." (p. 88)

Key Area : Hardwood Establishment
Objective
"*2. To regenerate all cut-over jarrah forest.*" (p. 59)
Measure of Performance
"*1. Regenerate all cut-over areas of jarrah forest within 12 months of completion of cutting.*
[…]" (p. 59)

Key Area : Silviculture
Objective
"*1. Protect crop trees and lignotubers.*" (p. 62?)

Measure of Performance
"*1. Reduce fuel loads to below 5 tonnes/ha on all areas prior to J logging.*
2. Damage during logging not to exceed 10% of retained crop trees.
3. Tops dispose prior to burning.
4. Burn tops in season following logging." (p. 62?)

Objective
"*2. To improve growth potential of jarrah forest after removal of sawlog and chip.*" (p. 63?)

Measure of Performance
"*1. Define appropriate silviculture practice to be followed in all cutting prescriptions prior to commencement of logging.*
2. Carry out stand improvement works within 12 months of tops disposal burn.
3. Encourage removal of unwanted stems by contractors to reduce cost of operations." (p. 63?)

MANUAL – 1986

Manual of Specifications for Control of Hardwood Logging Operations in the Northern … 1986

Section 1 : Planning
Specification 1.3 Coupe Cutting Prescriptions and Plans
"*2. For each coupe or set of similar coupes, a Coupe Cutting Prescription must be prepared on the prescribed form (Attachment 1.3.1). This document requires the District to decide on silvicultural objectives and marking techniques and contains a checklist of work required before cutting starts.*
3. A Coupe Plan or plans must accompany the Coupe Cutting Prescription. […]" (p. 19)

Specification 5.4 Protection of Crop Trees
"*1. In coupes where crop trees are marked for retention, Industry personnel must make every effort during all phases of logging to protect the crop trees from physical damage. Physical damage is any damage resulting in one or more of the following:*
(a) The exposure of more than 100 cm^2 of cambium on the bole of a crop tree.
(b) The falling, breaking, or uprooting of a crop tree, or
(c) The removal of more than 30% of the crown of a crop tree.

2. Periodical assessments of crop tree damage must be carried out by a Forest Officer using the 'Assessment of Crop Tree Damage' form (attachment 5.4.1). In carrying out these assessments, a Forest Officer must assess a random sample of:

(i) at least 100 crop trees in a given faller's block excluding those crop trees immediately adjacent to landings and major snig tracks and
(ii) at least 50 crop trees immediately adjacent to landings and major snig tracks.

If more than 5% of trees assessed in category (i) or 10% in category (ii) are damaged, then the Industry will be charged for all damaged trees in that faller's block at rates determined by the Executive Director. […]" (p. 72)

"3. As well as avoiding physical damage, Industry must ensure that all logging debris resulting from a logging operation is removed from the base of crop trees. This task is commonly known as 'tops disposal', and is *designed to protect crop trees from fire damage. The debris to be removed includes all woody material greater than 75mm diameter. This material must be moved at least 1m away from the bole of crop trees. Tops disposal must be completed before a faller's block is certified complete.* […]" (p. 73)

SPECIFICATIONS – 1986

Silviculture Specifications 1/86 Jarrah Silviculture Specifications. 1986

NOTE: REPLACED BY SILVICULTURE SPECIFICATION 1/87

Thinning
1. Criteria for Selection of Crop Trees
"*Select crop trees to retain using the following considerations:*

* *Crop tree selection is based on the following species priority:-*
1. *Jarrah*
2. *Marri*
3. *Sheoak*

* *Jarrah/Marri crop trees should be in the dominant or codominant level, with a healthy well structured crown. Trees with primary crowns are capable of expansion to take advantage of the space available. Secondary crowns show less capacity for expansion.*

\- *Trees with a deep, broad crown grow five times faster than trees with a narrow, shallow crown. Crown vigour is much more significant than bole length.*

eg. Original diameter	*30 cm*	*30 cm*
Bole length	*5 m*	*10 m*
Crown condition	*Deep, broad, dense*	*shallow narrow dense*
Diameter in 20 years	*50 cm*	*34 cm*
Volume on 20 years	*.64 cu.m*	*.5 cu.m*
Time to taken to reach sawlog size (50 cm)	*20 years*	*100 yrs*

[…]

\- *In general, larger diameter trees will increase in diameter faster than smaller ones.*

[…]

* *Even spacing is not a critical factor provided the crown of a selected crop tree has space to expand in at least two directions. The total space available (expressed as Basal area/hectare) is of more importance.*" (p. 1)

Retention of Crop Trees and Commercial Logging
"[…] *The requirement is that 10 sq.m/ha of acceptable crop trees are retained. In addition to these crop trees, provision is made to retain a further 5 sq.m/ha of potentially merchantable trees of high value – these are jarrah/marri trees which are within 5cm dbhob of becoming an S.E.C. pole or sawlog, and that meet crop tree specifications.* […]

[…] *Where significant amounts of marri and sheoak are being considered for retention the alternative option of regenerating rather than thinning must be considered.*" (p. 2)

3. Follow Up Silvicultural Treatment

"*Following commercial utilisation, areas selected for intensive treatment will have other surplus trees removed non-commercially to reduce competition to the crop trees. This will be done by notching and poisoning on most areas with felling and stump poisoning only in selected special areas.*

In patches of forest where there are 10m^2/ha or more of jarrah crop trees, all surplus trees (including banksia) are removed. […]

Where there are less than 10m^2/ha of jarrah crop trees, they are released individually from surrounding competition by removing all surplus stems within 4m of the crop tree. […]" (p. 3)

4. Jarrah Thinning Intensity

"*Mean DBHOB of best 150 spha at first thinning*	*Treatment*
<20cm	*- release 200 jarrah stems/ha from overtopping and crown abrasion. The objective is to maintain healthy crown development on future jarrah crop trees but without promoting a permanent low crown break.* […]
*20-25cm**	*thin to 10m^2/ha O.B. – this will usually be a non commercial thinning. It will leave more than 150 spha but ensures that the stand is not left under-stocked. A further thinning will be required before the crop trees reach 50 cm dbhob.*
*25-30cm**	*- thin to 10m^2/ha O.B. – this is likely to be both a commercial & non-commercial thinning. The remaining trees are capable of reaching 50 cm dbhob without the stand becoming overstocked. (50 years.) More conservative future thinnings will maximise sawlog volume /ha.*
40cm	*- thin to 18m^2/ha O.B. – thin again when crop trees reach 50cm dbhob. Above comments apply.*
50cm+	*- thin to 20m^2 / ha O.B.*

[…]" (p. 4)

GUIDELINES – 1986

Silvicultural Guidelines for Virgin Southern Jarrah Forest. 1986

Introduction

"*A silvicultural system is a planned series of silvicultural operations aimed at achieving management objectives for the forest. Where wood production is one of the objectives, the operations include: logging to provide the required wood resources; and the establishment, protection and tending of the regeneration and the developing second growth forest. Each operation should facilitate the next in continuous cycles of production, regeneration and stand development. Silvicultural systems must be formulated to take into account management objectives, the silvics of the species, the forest's present condition, its protection needs, and the practical application of the operations.*

Variation due to site and past treatment of the forest preclude a universal set of silvicultural prescriptions for the jarrah forest. Even within one broad site classification, variation in stand structure, regeneration status and protection needs are such that fixed prescriptions are seldom appropriate. While the principles are similar the application is not.

This paper is one of a series of guidelines being prepared. They are not intended to provide a comprehensive silvicultural system for the entire forest, but rather to outline silvicultural practices which are most critical to a particular forest and its stage of development. Sufficient of the rationale which has been the basis of the prescriptions is provided to allow forest managers to vary the treatment to suit particular stands while still meeting the overall objectives of silviculture and management." (p. 3)

"*These guidelines are specifically directed at those virgin jarrah forests of the Pemberton-Walpole area which have a management priority for wood production. However, the same principles of regeneration establishment and development apply to other land uses where wood production is compatible, but not a priority use. The principles outlined here will have application to other similar jarrah forests outside this area. The emphasis is on regeneration establishment, integrated fire protection of developing regeneration, and the release of regeneration in sufficiently large groups to allow for subsequent logging to be carried out without excessive damage to the future crop.*

While it is customary to name a silvicultural system according to one of the classically defined systems, this often leads to unnecessary strictures and a tendency for silvicultural practices to be adjusted to meet the strict definition of the system rather than to meet the particular requirements of the forest. In formulating rather than selecting an appropriate silvicultural system for this forest, a system has evolved which contains elements of several classical systems, including clearfelling, group selection, and uniform and grouped shelterwood." (p. 4)

1.Silvicultural Objectives

"*The minimum size of the patch is determined by the size of the area which would be required to allow subsequent felling of large adjacent trees without excessive damage to the regrowth. This is currently considered to be a minimum of 4 tree heights in diameter.* […]" (p. 5)

"*The application of these principles, together with other appropriate treatments, will ensure:*

- *adequate regeneration is obtained before final removal of the overstorey,*
- *satisfactory growth is maintained on developing trees,*
- *felling of mature trees can take place without excessive damage to growing stock,*

all within the context of a group cutting system which can be perpetuated.

If, on the other hand, an attempt is made to satisfy more than one of these objectives on one patch, or the patch to which a single objective is applied is too small (in effect the creation of an all-aged forest), then eventually:

- *over-mature or defective trees are retained because their felling could cause excessive damage to growing stock. These trees occupy space which could grow more useful and vigorous trees, and they compete with other growing stock resulting in reduced growth rates and the gradual degradation of the stand.*
- *or the removal of mature or defective trees excessively damages younger growing stock, with the loss of potential yield. A substantial part of the forest will always be occupied by regeneration which never reaches maturity before being smashed by the felling of larger trees.*" (p. 8)

"*These guidelines apply to virgin stands, or those which, having been lightly cut in recent times, have no significant development of second growth poles. Crown condition is generally poor, and there are few trees which could be classified as genuine growing stock. Only the first two objectives are therefore relevant: partial cutting to reduce the competition from the overstorey, and the removal of the overstorey to allow ground coppice to develop into saplings and poles.*" (p. 8)

3.Status of Advanced Growth
"*The status of advanced growth is the basis for selecting the most appropriate regeneration treatment. Although all stages of regeneration … may occur in any one area of forest, one stage tends to predominate in any particular patch. The stages vary throughout the forest and may be influenced by fire history, past logging and soil type.*

In virgin southern jarrah forest two types of stands can generally be recognized:
- *adequate advance growth is present in the small pole, sapling and ground coppice stages (1000 stems per hectare of ground coppice and saplings more or less evenly distributed would be considered adequate). This type most commonly occurs where the soil contains gravel.*
- *Inadequate advance growth of saplings and ground coppice is present (seedling coppice may occur in large numbers). This is generally where:*

  The scrub species are dominated by root stock species (e.g. ti-tree, Agonis parviceps, and emu bush, Podocarpus drouyniana) on deep sand and podsols.

  The scrub species are predominantly seed species (e.g. Petrophile spp and Ac. Browniana) on podsols.

  The scrub species are dominated by seed species typical of the karri forest (e.g. netic, Bossiaea laidlawiana and karri wattle, Ac. pentadenia) on red 'karri' soils." (p. 9)

"*There are exceptions to this general pattern, the reasons for which are not clear.*

A significant proportion of the southern jarrah forest has inadequate or undeveloped lignotubers, probably due to competition from an overstorey of mature trees common to the virgin forest, and additional competition from the high density of scrub on some sites." (p. 10)

4. The Effect of Cutting and Burning
"*The effect of cutting and burning varies according to the stage of the development of the advance growth.* […]" (p. 10)

5.Regeneration Treatment Required in Stands With Different Stages of Lignotuber Development
"*In order to determine the most appropriate silvicultural practice, it is necessary to identify those sites that will regenerate easily and those that will not.* […]" (p. 12)

6. Integration of Logging, Regeneration and Fire Protection
"*A silvicultural system requires the integration of logging, regeneration and fire protection. It is pointless to acquire regeneration which will later be damaged by logging or fire.*

The silvicultural treatment required for the two types – those that contain advanced regeneration and those that do not – are quite different, particularly with respect to fire management.

On one hand, types where logging is designed to release advanced regeneration require a top disposal burn to remove logging debris, but the burn is not constrained by the need to protect an overstorey. This is followed by a fire exclusion period of approximately 10 years.

On the other hand, types where regeneration has to be established require a top disposal burn which will not damage retained trees, followed by regular prescribed burning every five years for about 20 years.

These different types, however, occur as a mosaic within the one stand, occupying areas of a few hundred square metres to several hectares. […] *The conflicting needs of the various components of the stand must be taken into account.*

There are several alternative strategies, each with advantages and disadvantages, aimed at satisfying these conflicting needs." (p. 18)

(a) Strategy 1

"*This provides for gap creation to release existing regeneration (ground coppice) and uniform selection cutting to establish regeneration at the time of the initial cut. Protection regrowth is given priority by not burning the stand for 10 years after the initial cut.*

[…]

(i) *Advance burn the coupe two years before the proposed cutting. This will improve visibility of the lignotuber development and allow sufficient time for the lignotuber to re-shoot after the burn.*

[…]

(iii) *Demarcate areas with an adequate stocking of regeneration of ground coppice or larger (see Section 5 (a): Stands with Adequate Advance Growth of Saplings and Ground Coppice) and create gaps by logging. Carry out a uniform selection cut in the remainder (Section 5 (b) Stands with Inadequate Advance Growth).*

(iv) *Carry out cull treatments in the created gaps, disturb the soil in the uniform selection cut patches, and burn tops in a seed year.*" (p. 19)

"*(v)* *Exclude fire from the stand till regeneration in the gaps is large enough to withstand a prescribed burn (5-6 m in height, or about 10 years).*

(vi) *Following the fire exclusion period burn about every 5 years till regeneration in the uniform selection cut areas has developed to the ground coppice stage (about year 20).*

(vii) *Then cut, burn tops, and cull the uniform selection cut area in the same way as for previous gap cutting (Section 5 (a) : Stands with Adequate Advance growth of Saplings and Ground Coppice). It is important to cut this area before the regeneration begins to develop into large saplings and small poles. If left beyond this time the regeneration which will be damaged by logging will be more difficult to burn back to ground level. This may result in excessive coppice development and malformed stems in the future regrowth stand.*

Following cutting, exclude fire from the area till the new saplings are old enough to withstand a mild fire (about 10 years) before resuming normal prescribed burning." (p. 20)

"*(v)* *Exclude fire from the stand till regeneration in the gaps is large enough to withstand a prescribed burn (5-6 m in height, or about 10 years).*

(vi) *Following the fire exclusion period burn about every 5 years till regeneration in the uniform selection cut areas has developed to the ground coppice stage (about year 20).*

(vii) *Then cut, burn tops, and cull the uniform selection gap cutting (Section 5(a): Stands with Adequate Advance growth of Saplings and Ground Coppice). It is important to cut this area before the regeneration begins to develop into large saplings and small poles. If left beyond this time the regeneration which will be damaged by logging will be more difficult to turn back to ground level. This may result in excessive coppice development and malformed stems in the future regrowth stand.*

(viii) *Following cutting, exclude fire from the area till the new saplings are old enough to withstand a mild fire (about 10 years) before resuming normal prescribed burning.*" (p. 20)

(b) Strategy 2

"*This provides for initial gap creation to release existing regeneration (ground coppice) and a delay of uniform selection cutting required to establish regeneration till the first protection period is complete (Fig. 4).*

(i) *Advance burn, demarcate and cut to create gaps as described for Strategy 1. Do not remove any trees from areas containing inadequate or undeveloped lignotubers.*

(ii) *After logging, burn the whole area with the primary objective of burning the tops in the gaps. Poison or coppice culls in the gaps.*

(iii) *Exclude fire from the stand till the regeneration in the gaps is old enough to withstand a fire (5-6 m in height or about 10 years).*

(iv) *Following the first prescribed burn, cut the remaining areas on the basis of a uniform selection. Disturb the soil and burn tops in a seed year (see Section 5 (b)).*

(v) *Burn regularly till lignotubers have developed into ground coppice but have not yet become large saplings or small poles.*

(vi) *At this stage cut, burn tops and cull the uniform selection cut area in the same way as for previous gap cutting described in Section 5 (a): Stands with Adequate Advance Growth of Saplings and Ground Coppice.*" (p. 22)

"*(vii)* *Exclude fire from the stand till new regrowth can withstand a fire (a further 10 years).*

Then resume normal protective burning." (p. 24)

(c) Strategy 3

"*This provides for gap creation to release existing regeneration (ground coppice), and a uniform selection cut in other areas to establish regeneration. The initial fire exclusion period for the released regeneration is foregone in favour of frequent burning to stimulate the development of new regeneration in the selectively cut areas (Fig. 5).*

(i) *The first stages of the operation (advance burning, group and selective cutting, and tops burning) are the same as for Strategy 1 (I-iv).*

(ii) *Following the top disposal burn, the area is burnt after 5 years. Regular burning stimulates the development of lignotubers in the selectively cut areas. This involves the risk of damage to regeneration in the gaps. However, if the gaps are free of overstorey and the scrub is not dense, leaf litter accumulation in the gaps will be very low. In such circumstances it may be possible to burn the whole area at year 5, without excessive damage to the regrowth in the gaps. This strategy then becomes feasible.*

(iii) *Subsequent final cutting of the selective areas and the follow up protection period of 10 years is the same as for previous strategies.*" (p. 24)

(d) Strategy 4

"*This is a special case where some cutting may be required to provide a resource, but regeneration is not immediately desirable because of the need for continued protective burning in these areas. This could apply in*

burning buffers or in coupes where the proportion of the areas with adequate ground coppice is very low. In the latter case a large area could be under fire exclusion to protect a very small area of regrowth (Fig. 6).

(i) *Advance burn as for previous alternatives.*
(ii) *Demarcate areas with inadequate or undeveloped lignotubers and carry out a uniform selection cut as described in Section 5 (b). Disturb the soil and burn in a seed year.*
(iii) *Do not cut areas containing adequate ground coppice. In these patches it is necessary to maintain a full overstorey canopy to prevent this regrowth developing into saplings and poles.*
(iv) *Conduct regular prescribed burning to promote the development of lignotubers to the stage of dynamic ground coppice.*
[…]" (p. 26)

"*(vi)* […] *Following the tops disposal burn the area is again protected for 10 years, before resuming normal fuel reduction burning.*" (p. 28)

(e) Some Applications of Alternative Strategies
"*The choice of an appropriate strategy largely depends on management requirements. Table 2 lists relevant data for a number of parameters against each alternative. Each has its own characteristics.*

Strategy 4, for example, delays the fire exclusion period for 20 years, but provides a low yield at year 0 and delays regeneration release for 20 years. […]

Strategy 3, on the other hand, delays the fire exclusion period for the same time (20 years), but it does so at the expense of proper protection of developing regrowth. For that reason it is not a preferred alternative unless it can be shown that lignotuber development is seriously impaired by a no-burn period in the first 10 years.

On the basis of this analysis of the advantages and disadvantages of the systems, Strategy 2 is the best choice from a silvicultural point of view. It may, however, produce some management problems by reducing the immediately available resource and in the process exacerbate protection problems. Management requirements are therefore important factors to consider.

Silvicultural requirements will have a marked effect on the timing of the availability of wood yield from particular stands and on strategic fire protection. Effective planning will depend on extensive surveys of lignotuber development well ahead of proposed logging. " (p. 29)

" *It is also clear that variable silvicultural requirements involve a commitment to thorough scheduling and conduct of operations. This is made more difficult because of the long-term nature of the commitment.* […]" (p. 30)

POLICY STATEMENT - 1985

Forests Department Annual Report 1 July 1984 to 21 March 1985. 1985

NOTE: REFER TO ENTRY UNDER 1982 EDITION, SIMILAR WORDING FOR ANNUAL REPORTS FOR 1983, 1984, 1985

LEGISLATION - 1984

Conservation and Land Management. No. 126 of 1984

"AN ACT to make better provision for the use, protection and management of certain public lands and waters and the flora and fauna thereof, to establish authorities to be responsible therefor, and for incidental or connected purposes

[Assented to 8 January 1985]" (p. 1881)

Part II. - Land To Which this Act Applies
Division 1. - Categories of Land
"*5. Where in this Act reference is made to 'land to which this Act applies', the reference is to land, or land and waters, comprising -*

(a) State forest;
(b) timber reserves;
(c) national parks;
(d) nature reserves;
(e) marine parks;
(f) marine nature reserves; and
(g) any other land reserved under the Land Act 1933 and vested by order under that Act in the Commission or the Authority." (p. 7)

"*6. (1) State forest comprises all lands that-*

(a) immediately before the commencement of this Act were dedicated as a State forest under section 20 of the Forests Act 1918;

or

(b) after such commencement-
(i) are reserved under section 8; or
(ii) are acquired and set apart under section 15,
for the purpose of a State forest.

(2) Timber reserves comprise all lands that-

(a) immediately before the commencement of this Act were timber reserves under section 25 of the Forests Act 1918; or" (p. 1886)

"*(b) after such commencement-*
(i) are reserved under section 10; or
(ii) are acquired and set apart under section 15,
for the purpose of a timber reserve." (p. 1887)

Part IV. - Department of Conservation and Land Management
Division 1. - Establishment of Department
"*33.(1) The functions of the Department are, subject to the direction and control of the Minister-*

(a) to manage land-

(i) to which this Act applies; or

(ii) which becomes subject to the management of the Department under subsection (2),

and the associated forest produce, fauna and flora;

(b) to provide the Commission, the Authority and the Council with such assistance as they may reasonably require to perform their functions;" (p. 1905)

"*(d) to be responsible for the conservation and protection of flora and fauna throughout the State, and in particular to be the instrument by which the administration of the Wildlife Conservation Act 1950 is carried out by the Executive Director pursuant to section 7 of that Act;*

(e) to carry out or cause to be carried out such study or research of or into-

(i) the management of land to which this Act applies; and

(ii) the conservation and protection of flora and fauna, as the Minister may approve;

(f) to provide advice to, or undertake work for or jointly with, and to supply services or facilities to, any department, public or private body or other person if that Minister is of the opinion that the provision of that advice or the undertaking of that work is in the public interest;

(g) upon request by the Minister to whom the administration of the Land Act 1933 is committed, to advise him on the reservation, alienation, and disposal of Crown land in rural areas under that Act." (p. 1906)

"*33(3) The management of land referred to in subsection (1) (a) (i) and the associated forest produce, flora and fauna shall be carried out-*

(a) where there is a management plan for the land, in accordance with that plan; or" (p. 1906)
"*(b) where there is for the time being no such plan-*
(i) in the case of national parks and nature reserves, in such a manner that only necessary operations are undertaken; or
(ii) in any other case, in accordance with the provisions of section 56 applicable to the land.
(4) In subsection (3) (b), 'necessary operations' means those that are necessary for the preservation or protection of persons, property, land, flora or fauna, or for the preparation of a management plan.

(5) Nothing in subsection (1) shall be read as limiting the functions of the Commission and the Authority under sections 19 and 22 respectively.

34. Subject to this Act and the Public Service Act 1978, the Executive Director has power to do all things that are necessary or convenient to be done for, or in connection with, the performance of the functions of the Department." (p. 1907)

Part V. – Management of Land
Division 1. – Management Plans
"*54. (1) A controlling body shall be responsible-*

(a) for the preparation of proposed management plans; and

(b) the review of expiring plans and preparation of further management plans,

for all land which is vested in it whether solely or jointly with an associated body.

(2) This Part applies to the preparation of a plan under subsection (1) (b) in the same way as it applies to the preparation of an initial management plan." (p. 1914)

"*(3) Proposed management plans for any land shall be prepared-*

(a) by the controlling body for that land through the agency of the Department; and

(b) within such period after the commencement of this Act as is reasonably practicable having regard to the resources of the Department available for the purposes." (p. 1915)

"*55. (1) A management plan for any land shall contain –*

(a) a statement of the policies or guidelines proposed to be followed; and

(b) a summary of the operations proposed to be undertaken,

in respect of that land during a specified period which shall not exceed 10 years.

(2) A management plan shall state the date on which it will expire, unless it is sooner revoked, but notwithstanding anything in this section or in the plan, a plan which would otherwise expire shall, unless it is revoked, remain in force until a new plan is approved." (p. 1915)

"*56. (1) 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, and in particular management plans shall be designed –*

(a) in the case of indigenous State forest or timber reserves, to ensure the multiple use and sustained yield of that resource for the satisfaction of long-term social and economic needs;
[…]" (p. 1916)

"*(2) In subsection (1) (a) 'multiple use' means as many different uses as are possible and compatible among themselves.*" (p. 1916)

POLICY STATEMENT - 1984

Forests Department Annual Report 1984. 1984

NOTE: REFER TO ENTRY UNDER 1982 EDITION, SIMILAR WORDING FOR ANNUAL REPORTS FOR 1983, 1984, 1985

RECREATION PLAN – [1984]

Forest Recreation Framework Plan. [1984]

9.3 Planning and Management Strategies Applicable to all Management Units
"*2. Site Maintenance*
Strategy
[…]
- *site maintenance programmes will include the periodic inspection and maintenance of:*

[…]
tree crops
[…]" (p. 48)

POLICY STATEMENT - 1983

Forests Department Annual Report 1983. 1983

NOTE: REFER TO ENTRY UNDER 1982 EDITION, SIMILAR WORDING FOR ANNUAL REPORTS FOR 1983, 1984, 1985

GENERAL WORKING PLAN- 1982

General Working Plan No. 87. Part I. 1982

The Concept of Multiple Use
"*With limited forest area and increasing demand for each forest value, management must cater for as many uses as possible in any particular location. The Department achieves this through multiple use management. In its simplest form, multiple use of land means the use of a tract of land for several different purposes.* […]

The approach adopted by the Forests Department involves the selection of a primary or priority use for an area together with compatible secondary uses. This requires priorities for use to be ranked. […]" p. 15)

Silviculture – Jarrah Forest
"*Because of the many variables involved there is no uniform prescription for treatment of the jarrah forest. Treatment varies according to land use priority, stand health, stand structure and site quality.*" (p. 12)

"*Advance growth existing on the forest floor is the main source of subsequent jarrah crops. Where there is no advance growth, seed trees are left during felling operations and the debris left after logging is burnt to stimulate seed fall and create ash beds to encourage seedling establishment.*" (p. 12)

MANAGEMENT PLAN – 1982

Hardwood Management Plan (Central Region). 1982

Section 1 : Introduction
1.1 Objectives and Policy
"*1.1 Objectives and Policy*
Hardwood timber specifications in the Central Region must:
[…]
(4) be in accordance with the silvicultural prescription prescribed for the particular forest stand. Each stand will be treated after considering; species, site, land use priority, dieback status, stand structure and site quality.
[…]
(6) Consider the regeneration, protection and the maintenance of the stand in a healthy and vigorous condition.
[…]" (p. 1)

1.2 Scope
"*(1) This Hardwood Management Plan attempts to cover all hardwood operations in the Central Region. Sawmill logging cannot be considered in isolation. Silvicultural, hygiene and protection objectives cannot be neglected unless all operations are considered and co-ordinated.* […]" (p. 1)

2.2.2 Land Use Management Priorities (L.U.M.P.)
"*To enable a silvicultural system to be prescribed management priority must be considered.*

(1) Catchment Protection
(2) Water Production
(3) Protection
(4) Production
(5) Recreation
(6) Conservation" (p. 3)

2.2.3 Forest Structure
"*Depending on past events, stands fall into two broad categories:-*

(1) Densely stocked even-aged pole stands; and
(2) Other stands, normally comprising mixtures of size and age classes." (p. 3)

2.4.2 Uniform System
"*Crop Trees retained under this system are to be free from damage and with healthy crowns and stocked as per table 2.4.5.*" (p. 4)

2.4.5 Stocking Levels of Crop Trees and Regeneration
"*It is of utmost importance than an adequate stocking of potentially merchantable stems should remain standing following logging operations in all but graveyard forest.* […]" (p. 5)

2.4.6 Seed Trees
"*Where stocking is considered to be inadequate then a minimum of 10 seed trees per hectare will be retained. Seed trees must have healthy vigorous crowns and must be at least pile size.* […]" (p. 5)

3. Sawmill Logging Operations
3.1.1 Five Year Logging Plan
"*(1) This plan is to be prepared by IPS in close consultation with Divisions. When preparing the logging plan the following must be considered.*

- *Policy as per the General Working Plan*
- *Management Priorities*

[…]" (p. 6)

3.2.2 Preparation of Coupe Plans
"*(2) The cutting coupe boundaries will also be determined by:-*
[…]
- *Silviculture type*

[…]" (p. 10)

5. Regeneration and Rehabilitation
5.1 Species Preference
"*(1) In the jarrah forest jarrah will be favoured above all other species.* […]" (p. 20)

5.2 Tops Disposal
"*(1) Involves the removal of logging debris to a distance of at least one metre from the base of retained crop trees and the lopping of elevated branches in the debris.*

(2) Tops disposal will only be carried out in:
- *Protectable and dieback resistant stands.*
- *Where tenure of the forest can be assures until at least next trade cut.*
- *In moderate to good quality stands (B+ or better).*

[…]" (p. 20)

5.3 Regeneration
"*(1) Regeneration burn. In areas where the residual crop is inadequate a regeneration type burn will be carried out following logging. This should be intense enough to create ash beds and to promote seed fall. This must co-incide with good seed crop on the crop trees,…*" (p. 21)

6. Records and H.O.C.S
"*6.1 <u>Need for Records</u> The structure and quality of each forest stand is dependent on what happened in the past. It is important to know the history of the stand before clear understanding of the forest land and its future can take place eg.*

(1) Improvement work carried out on a large scale in the jarrah forest during the depression years of the 1930's and its effects might be evident in the stand under consideration.

(2) Number, intensity, type and time of past trade cutting operations will determine the yield and type of regeneration that is present in the stand.
[…]" (p. 22)

POLICY STATEMENT - 1982

<u>Forests Department Annual Report 1982. 1982</u>

NOTE: SIMILAR WORDING FOR ANNUAL REPORTS FOR 1983, 1984, 1985

3. Objectives
"*The Government forest policy involves the following management objectives.*
[…]
Timber Production: To regulate the removal of produce from the native forests to a level that can be sustained by the forest growth in the long term.
[…]
Forest Protection: To maintain and add to the areas of permanently reserved forests; to protect these forests from fire, insects and other harmful agencies and to maintain and improve the health and vigour of the forest area.
[…] " (p. 7)

NORTHERN REGION OBJECTIVES AND GOALS- 1982

<u>Northern Region : Objectives and Goals 1982/83. 1982</u>

1.1 Departmental Objective : Conservation
"*Our overall aim is to achieve the Departmental objective, which is*
'the conservation, though planned use and management, of forest land and resources for the greatest long term social and economic benefit'." (p. 1)

"*1.5.2 <u>Timber</u>*
<u>Objective</u>: to ensure that timber is grown and harvested, in accordance with land management objectives, Departmental commitments and so as to maximise utilization without adverse effect on the environment.

<u>1982 Goals</u>
<u>Hardwood forests</u>
(i) Implement the full provisions of 'J81' on all hardwood operations.
[…]

(iv) Reintroduce jarrah thinning based on priorities developed from SQ, stand structure, Diebackfree and Mining maps/plans.

(v) Improve systems for handling minor produce salvage, based on forest improvement and hygiene.

Responsibility : R/L Hardwood forests
Priority : 1." (p. 3)

"*1.7 Forestry Practice*
1.7.1 Planning and Control
Objective: to ensure that forestry operations in the region at every level are in accordance with approved forward plans and programmes; and to ensure that control systems are an integral part of every plan.

1982/3 Goals
[…]
(i) To have an operational H.O.C.S. subsystem.
[…]" (p. 7)

GUIDELINES - 1981

Jarrah 81 : Guidelines for Planning and Control of Logging and Silvicultural Operations in the Northern Jarrah Forest, West of Quarantine. 1981

4. Silvicultural Practice
4.5.1 Stand A
"* *Water Production MPA*
* *Jarrah overstorey still largely unaffected by dieback*
* *Pole stand*" (p. 23)
"*(iii)* […]*Crop trees must be protected from falling and snigging damage.*[…]" (p. 23)
"*(v) Carry out tops disposal on crop trees.*
(vi) After one summer's drying, burn tops and banksia." (p. 23)

4.5.2 Stand B
"* *Water Production MPA*
* *Jarrah overstorey still largely unaffected by dieback*
* *Not an even aged pole stand*" (p. 24)
"*(i) Note presence and stockings of poles or advance growth. Where areas are understocked (ie. less than 500 sph of J or M), seed trees to be retained.*
(ii) Seek and mark for retention and protection crop trees less than 60 cm dbh at a spacing of approximately 250 sph (6 m x6 m spacing)
(iii) [...] *Crop trees to be protected from falling and snigging damage.*[…]" (p. 24)
"*(iv) Carry out tops disposal on crop trees.*
[…]
(vi) Burn tops and banksia in the autumn, under dry soil conditions.
[...]
(viii) Protect from fire until regeneration is tough enough to withstand its effects." (p. 24)

4.5.3 Stand C
"* *Water Production MPA*
* *Extensive mortality in jarrah overstorey*" (p. 24)

"*(iii) Carry out tops disposal on retained trees.*" (p. 24)
"*(v) Burn in the autumn under dry soil conditions to promote natural regeneration.*

[...]
(vii) Protect from future burning until regeneration can withstand fire." (p. 25)

4.5.4 Stand D
"** Recreation MPA*
** Even-aged pole stand*
** Jarrah overstorey largely unaffected by dieback.*" (p. 25)

4.5.5 Stand E
"** Recreation MPA*
** Not an even aged pole stand*
** Jarrah overstorey largely unaffected by dieback*

(i) Mark for retention crop trees and/or see [sic] *trees as in Stand B, but also retain the occasional large old tree (over 60 cm dbh) to add to the character and diversity of the forest produce.*
[...]
(iii) Carry out tops disposal and push banksia.
(iv) Burn in the autumn when soil is dry, but use low FD1 to prevent scorching retained forest.
[...]
(vi) Protect regeneration until no longer fire sensitive." (p. 25)

4.5.6 Stand F
"** Recreation MPA*
** Extensive mortality in jarrah overstorey*
** Average to good site quality*
(i) Apply as for Stand C (i) to (vi)" (p. 25)

"*(iii) Protect from fire until fire-resistance achieved.*" (p. 26)

4.5.7 Stand G
"** Recreation MPA*
** Extensive mortality in jarrah overstorey*
** Poor site quality*

(i) Apply as for Stand C (i) to (vi).
(ii) In the winter after burning, plant E. wandoo on selected sites (eg. ashbeds, stump holes, etc.) where a future tree might grow. An establishment of 50 - 100 trees per hectare will be acceptable.
(iii) Protect from fire until regeneration is no longer fire sensitive." (p. 26)

Part 5. Implementation
5.1 Responsibility
"*Classification of the forest and implementation of both hygiene and silvicultural prescriptions are the responsibility of Senior Divisional staff who will direct treemarkers and Industry staff.*" (p. 27)

5.2 Procedure
"*The basic steps are:-*
(i) Inspection of logging coupes
(ii) Classification and encoding stands within coupes
(iii) Marking coupe sheets
(iv) Treemarking to prescription
(v) Logging and Regeneration treatments
(vi) Return of coupe sheets so that work programme can be compared with work carried out
(vii) Update of protection and burning plans to ensure protection of regeneration." (p. 27)

FORESTERS' MANUAL – 1981

Fire Control : Foresters' Manual. 1981[in *Foresters' Manual.* 1979]

9 Fire Protection
"*9.001 The problem of fire control is intimately connected with the questions of reforestation and afforestation, and the ultimate success of the Department's efforts in these projects is largely dependent on a strong measure of public sympathy and co-operation in attacking the fire problem.*

Of equal importance is the proper use of controlled fires to regenerate and protect the forest and its associated flora and fauna, and to guard adjoining communities from wildfire." (p. 1)
Updated 10/81

Rotational Prescribed Burning
Master Plans
"*9.042Area O.I.C.'s must draw up prescribed burning master plans. These plans will show:*

> *Hardwood areas which will be burnt as buffer areas.*
>
> *Hardwood areas for prescribed burning on a rotational basis for protection of timber, flora, fauna or recreational values. Rotation length should depend on the average rate of fine fuel accumulation for each forest type, unless defined management objectives dictate otherwise for a particular area.* […]" (p. 23)
>
> "*The prescribed conditions for burning an individual area will be decided by the primary land use objective for that area. Where timber values and preservation of flora and fauna are paramount, the following limits will apply:*" (p. 23)

Standard for Prescribed Burning
"*9.043 (a) Management Priority Areas and other areas where primary land use requires mild prescribed burning.*

Jarrah Forest:
Burning cover in the range 60 to 80% with minimal crown scorch to crop or potential crop trees.
[…]
Flats :
Burning under mild conditions only to give a mosaic pattern with 40 to 60% cover.

Poor Quality Forest :
Burning cover in the range 40 to 60% carried out under mild conditions.

(b)Wherever possible, planning must aim to use aerial ignition techniques and be designed for aircraft ignition.

(c) Where more intense fires are specified for management objectives, the desired fire intensity and level of acceptable crown damage must be defined in the prescription." (p. 23)
Updated 10/81

MANAGEMENT PLAN – ND - 198-?

Land Management Plan for State Forest in the Mount William Area. ND - 198-?

3.2. Hardwood Logging
3.2.1 Objective of Management
"*To undertake hardwood logging in a manner which will treat and regenerate to forest in accordance with the allocated land uses.*" (p. 14)

3.2.2 Prescription
"*The general prescription below will be applied in Water Production and Recreation MPAs with exceptions for influence zones as outlined in Section 3.2.3. This logging prescription will not be applied in the Samson Conservation MPA.*" (p. 14-15)

"*3.2.2.1 Identify logging areas in terms of dieback risk categories (dieback infected, non-protectable, protectable and resistant) by the use of aerial photography and detailed field mapping of the disease.*

3.2.2.2 Schedule the logging operations to treat dieback risk categories in the following order of priority – dieback, non-protectable, protectable or resistant. The impact of the disease on some non-protectable sites will be more severe than in others. Logging priorities in this risk category will be first directed to those sites where the disease is expected to have severe impact.

3.2.2.3 Vary the treatment according to dieback risk category.

(a) Dieback and non-protectable forest to be fully utilised – all saleable material to be removed.

(b) *Protectable and resistant forest to be treated according to the uniform system of silviculture. Subject to adequate stocking, full utilisation of distribution poles greater than 9.5m in length, sawlogs to be removed during treemarking. All trees greater than 60cm d.b.h.* to be removed. Below this diameter limit only future crop trees are to be retained. Where regrowth is inadequate, sufficient seed trees will be retained.*" (p. 15)

"*(c) In all risk categories, favour the retention and regeneration of marri, blackbutt and bullich within the stand.*" (p. 16)

"*3.2.2.6 Remove logging debris from the base of future crop trees in resistant and protectable forest which is not programmed for mining for at least ten years.*" (p. 16)

3.3 Stand Improvement (Forest Improvement and Rehabilitation Scheme)
3.3.1 Objective of Management
"*To treat forest areas between mined areas in order to enhance land management objectives.*" (p. 19)

3.3.2 Treatment Zones Recognised
"*Areas vary in susceptibility to, and subsequent impact of, dieback disease, and hence require different treatments. Zones recognised and requiring field demarcation are:*

(a) Stream zone (characterised by ti-tree, marri, bullich, blackbutt).
(b) Dieback infected zone.
(c) Protectable and Non-Protectable zone.
(d) Resistant zone." (p. 19)

3.2.3 Prescription
"*The general prescription is outlined below and will apply in Recreation and Water Production MPAs except within nominated influence zones.*" (p. 19)

3.3.3.2 Dieback Infected Zone
"*These areas are characterised by a very light overstorey and sparse ground cover. Some areas are shallow to cap rock. The major requirement is to ensure soil erosion is prevented and, where necessary, this is most practically achieved by application of ground cover.*

(a) Salvage all saleable jarrah produce from the area. Carry out erosion control measures on haul roads, snig tracks and landings.

(b) Push (or fell) dead and dying trees into small heaps to provide ash beds after burning. These heaps are to be placed in scattered pockets on deeper soils but should not occupy more than 75% or not less than 50% of each dieback infected area. This treatment will provide for both water production and the production of good quality timber.

(c) Eradicate all living banksia.

(d) Retain all living marri except those unable to withstand the regeneration burn because of bole damage." (p. 20)

"*(e) Burn area in autumn to form ash beds.*

(f) Plant dieback resistant eucalypt seedlings at a stocking of 625 ha (average tree spacing of 4 metres x 4 metres) on and around the ashbeds such that tree clumps will develop on 50-70% of the area.

(g) fertilise seedlings at 3 weeks and 9 weeks after planting.

(h) Broadcast acacia seed together with appropriate fertiliser over the entire area at a rate of 1 kgm/ha." (p. 21)

3.3.3.3 Protectable and Non-Protectable Zone
"*(a) Remove all saleable distribution poles and sawlogs under dry soil conditions. Carry out erosion control measures on haul roads, snig tracks and landings.*

(b) Eradicate all banksia stems and thin jarrah, marri, bullich and blackbutt crop trees to a stocking of 250 stems/ha (average tree spacing of 6 metres x 6 metres). Favour the retention of dieback resistant species where high impact from the disease is likely, and jarrah where partial resistance is indicated.

(c) Remove all debris from around the boles of crop trees.

(d) Ignite area under weather conditions which will produce high ground temperatures (dry soil and slow moving fire) in order to promote acacia regeneration.

(e) *Physically close all tracks not required for management access or forest protection.*" (p. 21)

"*(f) In areas where pre-burn inspection has indicated an absence of acacia in the understorey, carry out broadcast seeding (with fertiliser) up to a maximum rate of 1 kgm acacia seed/ha.*" (p. 22)

3.3.3.4 Resistant Zone
"*This area is to be treated the same as protectable and non-protectable zones with the exception that seeding with acacias and associated fertiliser treatment is not required.*" (p. 22)

3.3.5 Rationale for Treatment
3.3.5.1 Reduction of Tree Cover
"*Designed to promote healthy tree growth and favour development of a leguminous understorey.*" (p. 23)

3.3.5.2 Removal of Banksia
"*Designed to make the existing forest less susceptible to dieback infection.*" (p. 24)

3.3.5.3 Introduction of Acacia
"*Designed to increase forest resistance to disease and reduce potential for erosion. Opening up the canopy to increase tree growth and enhance the potential for dieback infection and spread, and acacia introduction is expected to offset this.*" (p. 24)

3.3.5.4 Fertiliser Application
"*Designed to increased growth on tree species and ground cover in confer some resistance to susceptible species and to enhance timber production.*" (p. 24)

FORESTERS' MANUAL – 1980

Foresters' Manual : Fire Protection. Rev. 1980

9. Fire Protection
"*1.The problem of fire control is intimately connected with the questions of reforestation and afforestation and the ultimate success of the Department's efforts in these project is largely dependent on a strong measure of public sympathy and co-operation in attacking the fire problem.*

2. Of equal importance is the proper use of controlled fires to regenerate and protect the forest and its associated flora and fauna and to guard adjoining communities from wildfire." (p. 1)

Hazard Reduction
Prescribed Burning
"*There are six types of prescribed burning that are standard practice:* […]
54.5 Slash burning, for regeneration or hazard reduction, following logging operations.[…]

Areas To Be Protected
55. Except for those areas where specific approval for burning has been obtained from Head Office, complete protection will be afforded to:[…]
55.4Regenerated jarrah areas where crop saplings are less than 6 metres tall.
55.5Areas required for research and investigation." (p. 16)
Issued 12/78

Standards for Prescribed Burning
"*The prescribed conditions for burning an individual area will be decided by the primary land use objective for that area. Where timber values and preservation of flora and fauna are paramount the following limits will apply:*

(a) […]
Jarrah Forest:
Burning cover in the range 60 to 80 percent with minimal crown scorch to crop or potential crop trees." (p. 17)

Issued 12/78

Hardwood Prescriptions
"*63.Prescriptions for hardwood burning will be based on 1:25,000 scale A.P.I. plans.*

Preparation of hardwood prescriptions should follow guidelines set out below:

63.1Use the A.P.l. plan for separating each job into similar forest types based on species, height, and density.
63.2 Examine cutting records to determine top disposal requirements, sapling age, likely height of regeneration and changes to canopy density since aerial photography.[…] *Where top disposal cleaning is necessary it is to be shown in prescription and works programme.*" (p. 19)
Issued 12/78

"*63.4 From the number of leaf falls and canopy density, fuel quantities are estimated from fuel accumulation tables.*

63.5 Inspect sufficient check points to confirm the predictions of fuel weight, and height of potential crop tree regeneration. Record scrub type, density and height. Techniques for assessing fuel quantity are available from fire research. Note topography.

See job specification 'Measurement of Forest Fuels'.

63.6 The prescription must nominate fire danger index and number of lightings for each job.

Number of lightings will be decided from range of forest types and fuel quantities in the area. […]" (p. 20)
Issued 12/78

Top Disposal
"*88. Burning of tops is carried out to reduce fine fuel hazard and to dispose of as much limb wood as possible.*[…]" (p. 28)
Issued 12/78

PLANNING POLICY - 1977

A Perspective For Multiple Use Planning in the Northern Jarrah Forest. 1977

"*The perspective is drawn primarily from the viewpoint of multiple use management in the northern jarrah region. Nonetheless, it establishes principles that can be applied to State Forests as a whole. It also establishes a framework for more broadly based regional land use plans.*" (p. 2)

Introduction
"*The Forests Department is required to provide a multiplicity of benefits from the northern jarrah forest according to the inherent capabilities of the environment, the existing statutory constraints and the recognised public demand. This objective is attainable because sufficient data are now available for a comprehensive and environmentally responsible regional plan.*" (p. 4)

"*This document sets the overall perspective for the development and subsequent implementation of detailed proposals. In doing this the region has been divided into six management zones based on geomorphology and climate. However, for detailed local planning it is envisaged that site vegetation zoning will be more appropriate and precise.*

The management strategies proposed supplement the Forests Department policy on multiple land use." (p. 4)

4.2 Lateritic Uplands, High Rainfall Zone (more than 1 150 mm/annum)
Current Land Use
"*a) Hardwood silviculture, based on high stocking rates, a high proportion of merchantable species and high growth rates.*
[…]

Management Strategy

"c) *The residual healthy stands of upland jarrah forest (which could represent less than 20 per cent of the area, after mining) will be managed for timber production and water. This involves the restriction of motorised access, and silviculture to maximise increment on the crop trees and to increase water yield*." (p. 27)

WORKING PLAN – 1977

General Working Plan No. 86 of 1977 Part I

4.2 The Concept of Multiple Use of Land Management

"*(c) The selection of a priority or dominant use for an area with the practice of secondary uses which in some circumstances may not significantly interfere with the primary aim, but in others may impose a restriction on output from each competing use. This necessitates a social ranking of use priorities which can usually be done satisfactorily with limited data and experienced value judgement. The Forests Department has adopted this approach for the future management of State Forests and timber reserves.*

Multiple use has temporal as well as spatial over-tones. In the long term the structure of use priorities may alter with socio-economic, technological and successional changes. Such changes could be brought about by a number of influences such as dieback spread, mining, increased water supply requirements or altered demand for wood." (p. 31)

"***Conservation of the Physical Environment***: *To minimise the deleterious effects of land use and management on the soil, air and water components of the forest environment*." (p. 4)

5.2 Wood Production

5.2.6.1 Sawlog Production Policy

"*4. Continue investigations into harvesting techniques designed to avoid environmental damage.* […]" (p. 70)

5.2.6.2 Sawlog Production Strategy

"*8. Prevent damage to soil values, and further artificial spread of dieback, by reducing winter logging operations and developing summer stockpiling techniques.*" (p. 72)

5.2.6.3 Residue Production Policy

"*2. Harvesting of residues will be according to priorities set to achieve maximum State benefit and minimum environmental damage.*" (p. 73)

5.2.6.8 Forest Management Strategy

"1. *Taking into account growth and natural succession characteristics of forest stands, apply silvicultural techniques such as cultivation, fertilisation, thinning and removal of competing vegetation, which will stimulate growth on the remaining crop trees.*[…]" (p. 74-75)

5.9 Protecting the forest from destructive agents

5.9.3.6 Background to policy formation

"*Throughout the hardwood forest prescribed burning during spring or autumn is applied on a rotational basis, except where management requirements for regeneration or research favour fire exclusion. In plantations where management is more intense and trees more sensitive to fire damage, prescribed burning in winter is generally used on buffer strips designed to restrict movement of wildfires.*" (p. 122)

POLICY STATEMENT- 1976

Forests Department 1976 'Focus on Forest Policy', *Forest Focus*, No. 17, pp. 1-15.

"*The present regeneration process of the jarrah and karri forests will be continued. Because jarrah forest grows more slowly, particular attention will be given to the karri/marri forests.*" (p. 6)

"The principle objective in native forest management for timber production will be to adjust log removals to a level that can be sustained by forest growth." (p. 6)

Forest Policy
"*The Forests Department will manage the state-owned forests and timber reserves in Western Australia according to a policy that will ensure provision for the optimum social and material needs of the people. At the same time the policy will provide for the environmental well-being of the forests themselves.*

The policy involves the following objectives:
[...]
To regulate the removal of produce from the native forests to a level that can be sustained by the forest growth.

[…]" (p. 15)

FOREST POLICY – ND [?1975]

Forest Policy : Western Australia. [?1975]

Introduction
"*It has therefore become necessary to restate forest policies to take into account the major changes that have taken place since rigid control of the timber industries was first introduced in 1918.*

The objectives of forest management at that time were to protect the forest estate through control of the industry and to protect the forest itself from fire and other destructive agencies.

In more recent times there has been a greater emphasis placed on multiple-use of the forest but with a strong tendency still to produce timber for industry. However, multiple-use demands have imposed limits on the timber resources of the native forests. Emphasis has therefore been given to pine planting to provide a source of timber to supplement and in some instances replace those native forests that will be required for purposes other than timber production.

This statement will outline the current situation regarding those permanently dedicated State Forests and Timber Reserves which come within the stewardship of the Forests Department and formally establish management objectives according to the requirements that now exist. It will take into account a multiple-use concept of those forests managed by the Forests Department." (p. 2)

2.4 Forest Protection
"*As well as safeguarding the integrity of the forest estate, the principal avenues of the protection which must be afforded the dedicated State Forests are those of cutting control, fire protection and control of forest pests and diseases. Authority to undertake these protective functions is provided in the Forests Act.*" (p. 7)

2.9 Wood Chipping
"*The reasons for approval being given for the wood chip operations are many. They are both economic and social but from the forest management point of view, the opportunity is now given to bring about a renewed state of health and vigour to the forests. Past use of the forest has provided logs that have been used entirely by*

the sawmilling industry. It has hitherto not allowed complete utilisation of what are overmature forests, crowded by stagnant trees that preclude regeneration of a new forest crop which could, if allowed to grow, be managed and protected to produce most valuable and aesthetically – attractive forests. Such forests would be capable of not only generating their own economy but also providing the non-productive benefits that now exist.

The management objective of the area now defined as the wood chip is to improve utilisation through use of residues not currently processed in an established sawmilling industry, to use the operation as a silvicultural tool and at the same time, continue to provide the current social values of the forest." (p. 11)

3. Future Management Objectives

3.1 Policy

"*The future policy will emphasise the multiple-use management of State Forests and Timber Reserves. It will continue to provide for the renewable resources of publicly-owned forests to be utilised in the combination that will best meet the needs of the West Australian people. The aim will be to make the most judicious use of the land for some or all of the resources or related service over areas sufficiently large to provide latitude for periodic adjustments in use to conform with changing public needs and the development of the forest itself.*" (p. 12)

3.1.1 Multiple-Use Priorities

"*Multiple-use management implies the realisation of the best combination of forest benefits according to the particular attributes of each area considered. Compatible benefits may be derived simultaneously from the same area, but separate areas must be used where there is conflict in management for non-compatible benefits.*

In order to overcome the problems imposed by limited forest area, it is proposed to establish a system of management priorities so that the greatest possible number of compatible uses can be practised throughout most of the forest, whilst carefully selected representative areas of native forest will be managed specifically to retain them in an undisturbed condition for scientific reference purposes." (p. 12)

"*The major forest values currently recognised for multiple-use management are:*

> *Timber Production*
> *Water Supplies*
> *Amenity and Recreation*
> *Flora and Fauna*
> *Special Scientific Values*" (p. 13)

3.1.2 Multiple-Use Requirements

"*Future requirements to meet the need for multiple-use forest management posed by increasing public demand are:*

> *Classification and designation of State Forest into areas to be managed according to a scale of multiple-use priorities, together with increased security for these management objectives.*
>
> […]" (p. 13)

3.2 Management of the Native Forests

"*The present regeneration processes of the jarrah and karri forests will be continued. The process is long in the case of jarrah and therefore particular attention will be given to the karri/marri forests. Although the latter forest type occupies only 7 per cent of the total State Forest, it provides 37 per cent of the total timber growth under current management. Prompt and effective regeneration of the seed tree system now used will be continued to re-establish areas cut over by the karri/marri sawmilling and the marri wood chipping industries. Environmental values will be taken into account and constantly monitored.*" (p. 14)

FORESTERS' MANUAL – 1973

Foresters' Manual : Fire Control. 1973

Introduction

"1. *The problem of fire control is intimately connected with the questions of reforestation and afforestation and the ultimate success of the Department's efforts in these projects is largely dependent on a strong measure of public sympathy and co-operation in attacking the fire problem.*

2. Of equal importance is the proper use of controlled fires to regenerate and protect the forest and its associated flora and fauna and to guard adjoining communities from wildfire." (p. 3)

Top Disposal

"*100. Burning of tops is carried out to reduce fine fuel hazard and to dispose of as much limb wood as possible. It may also be essential for regeneration* […]

100.1 Jarrah tops burning must reduce fine fuel and heavy wood effectively. Tops must be held unburnt for at least two summers after cutting so that large wood has dried. […]" (p. 16)

FORESTERS' MANUAL - 1972

Foresters' Manual : Reforestation and Silvicultural Operations : Jarrah and Karri. 1972

"*Management of indigenous hardwood forest aims at producing the highest possible yield of useable wood, consistent with the maintenance of a protective forest cover for water catchments and a general forest environment.*

The marking axe and the spray gun used in treemarking, for trade cutting and and stand improvement works, are the tools for the manipulation of the forest crop policy. Stands must be regenerated adequately after the trade cut and maintained thereafter in a vigorous and healthy condition to ensure maximum increment." (p. 3)

Jarrah Forest Operations
Assessment
Standing Trees

"The following tree classification will be used:-

Standing Trees

A. Over 90 in G.B.H.

(i) Trees retained as growing stock (or will be retained where bush not previously treemarked).

(ii) Trees held for special reasons. In treemarked bush this includes trees held-

(a) To prevent damage to immature growth.

(h) To allow a top log to reach millable size.

(c) For seed supplies where advance growth is lacking." (p. 6)

"*B. Trees between 72 in. and 90 in. G.B.H.*

(i) Growing stock for the future.

(ii) Trees that could be removed - too defective for future growing stock." (p. 6)

"*C. Trees between 60 in. and 72 in. G.B.H.*

(i) Dealt with in same manner as B.

(ii) Dealt with in same manner as B.

(iii) Dealt with in same manner at B.

D. Under 60 in. G.B.H. Piles and Poles (tree classes)

When above 60 in. G.B.H. engineers' piles and poles will be classified according to their girth class, but the letter 'E' will be added in the class columns, e.g., BI (E)." (p. 6)

Current Cutting Practice

"*58. The system of silviculture, including both cutting and regeneration, in use in the jarrah forest is the Australian group selection system.*

In the past the cutting cycle was 30 years, resulting in a relatively light cut. Grossly overmature trees were removed resulting in the creation of relatively small gaps for regeneration. Some thinning also took place among overdense veterans.

59. The present trend is towards a longer cycle and a far heavier cut, creating much larger gaps for the development of regeneration." (p. 15)

"*60. Two constraints are placed on the quantity of timber to be taken from a coupe. The first comprises management considerations and the prescribed yield to be harvested from the area. The second concerns regeneration. The treemarker must ensure that any gaps created by trade-cutting are adequately stocked with advance growth. Where regeneration is lacking, no gap may be created.*

61. A minimum adequate stocking is 200 stems per acre, or a spacing of approximately 15 feet. Both jarrah and marri regeneration are acceptable.

62. As a general guide, the bulk of the trade-cut will comprise mature and overmature trees. These are identified by evidence of moderate to extensive dying backing of the outer branches in the crown. Piles and vigorous, immature veterans will only be removed as a thinning in patches that are too heavily stocked. An exception occurs when a pile-getting operation seeks bridging timbers and large transmission poles. The clear felling of groups of immature trees over 40 feet in length may be prescribed in such an operation, but the constraint of inadequate regeneration will still apply." (p. 15)

Cutting Prescriptions

"*63.A cutting prescription for each cutting section will be prepared by the D.F.O. and most be approved by the Superintendent.*

64. Cutting in virgin forest: Gaps may be created by clear-felling where regeneration is adequate. Elsewhere the treemarker will mark individual stems for removal, either as a thinning or because the tree is unthrifty and is likely to deteriorate before the next cut. The intensity of the cut will be dependent on management prescription.

65.*The second cut-high quality forest*:
Type A.-High quality forest is defined here as being B+ or better height class. All overstorey trees of more than 72 inches g.b.h .[58cm dbh] *will be removed. The only constraint prescribed here is that where such removal creates gaps, the gaps must carry an adequate stocking of regeneration.*

Type B.-In some cases commitments to permit holders can involve cutting over a section which is under-stocked with trees of all sizes including regeneration. In this case a minimum of eight seed trees per acre shall be left. […]"

"*66.The second cut-low quality forest: Low quality forest is defined here as being B height class or lower. Such forests are mainly located on the eastern side of the jarrah forest belt and frequently include mixtures with wandoo. Coppice is an important source of regeneration in this region, hence the constraints made by existing regeneration are relaxed. The removal of all merchantable timber of 72 inches g.b.h. will be prescribed.*" (p. 15)

Treemarking
"*68. It must be stressed that treemarking plays a vital part in determining the future condition and productivity Of. the forest. D.F.O.'s will ensure that careful instruction and close supervision is given to all treemarkers. Consistent attention to the maintenance of standards is imperative and all questions in this regard will be referred to the Inspector or Superintendent.*" (p. 16)

Top Disposal
"*70. On completion of the trade operation, the Department carries out a programme to ensure that the burning of logging debris will do little or no harm to growing stock. Inflammable material is moved to a distance of at least three feet from the base of retained trees and elevated branches are lopped flat. Although mainly axe work is required, chain saws can be used to advantage on large limbs. it is the overseer's responsibility to see that no areas or trees are missed, that the standard set is maintained, and that unnecessary work is avoided. The overseer will indicate where the chainsaw is to be used. In low quality forest the top disposal operation may be excluded at the discretion of the Inspector.*

71. The burning of tops is carried out during mild weather or at night to reduce the possibility of damage to the retained trees. However, in order to dispose of as much limb wood as possible it should be left until it has dried out thoroughly.

The length of time between trade cutting and top disposal will be determined by the drying period, and the integration of other silvicultural operations. In this respect see the later sections of this pamphlet on stand improvement." (p. 16)

Regeneration
"*72.General: The existence of a pool of advance growth on the ground has been relied upon as a source of regeneration during the whole history of jarrah forest management. The term 'advance growth' refers to bushy jarrah plants up to three feet in height with numerous shoots, none of which show any apical dominance. A characteristic of the plant at this stage is a large, subterranean, woody lignotuber and a massive tap-root. The quantity of advance growth on the ground was regarded as generally adequate as a source of regeneration under the relatively light trade-cut achieved under treemarking as practised in high quality forest until recently. Hence, little attention was regeneration pool prior to areas being cut over*." (p. 16)

"*Under the present practice of heavier trade cuts, it is imperative that attention be paid to the adequacy of the advance-growth pool when treemarking. Failure to do this will result in the creation of gaps in the forest and an overall condition of understocking. The constraints placed on cutting by a lack of advance growth are described in the section headed "Current Cutting Practice". Where heavy trade-cuts are anticipated as a regular future operation, an assessment of the regeneration potential of the area must be made at least 25 years prior to the cut.* […]" (p. 17)

"*73. **Seeding Characteristics**: Although a few trees may be flowering in the forest every year, the majority exhibit a social flowering habit every five to seven years. Flower buds begin to develop in January. Flowers open the following November to February and capsules contain ripe seed about a year later. Natural seedfall takes place in the hot, dry summer months, but prescribed burning in spring is likely to result in the rapid shedding of a high proportion of the seed.*

*The seed is relatively large (60,000 per lb.) and dispersal is confined to a distance equal to the height of the mother tree. After falling, the seed remains dormant until the onset of the winter rains and lower temperatures in mid to late May, when rapid germination takes place. **Autumn prescribed burning completely destroys any seed lying on the ground.***

Seeding results in the loss of a complete season's shoot growth; the crowns of heavily seeding trees become very sparse and a massive loss in wood increment is associated with the seeding cycle.

Veteran jarrah, particularly those with receding crowns, are very poor seed producers and are of little value in this respect. The period of maximum production in pile- sized trees seed production occurs in the pile stage when seed production is ten times greater than in an ageing veteran stand. The maximum recorded fall is 340,000 viable seeds/acre from a pile stand in a seed year." (p. 17)

"*74. **Seedling Development**: The rate of development of the seedling is closely tied up with the density of the overstorey. Measured seedlings in a very dense pole stand have an average height of three inches at five years and consist of a single stem. Seedlings of the same age which have developed on disturbed soil on a landing may be over one foot high with more than a dozen stems. A similar range occurs for survival figures, losses exceeding 90 per cent. can occur over the first five years in dense stands while they may be negligible in disturbed soil in openings. The exact relationship in quantitative terms between seedling development rate and the density of the overstorey has yet to be determined.*

The further development of the plant consists of an enlarging lignotuber and an increase in the number and length of the stems. Best development appears to take place when regular controlled burning destroys the stems every three to five years after which new shoots emerge from the lignotuber. A lack of burning results in woody, moribund shoots and the consequent poor development of the plant." (p. 17)

"75. *Sapling (dynamic shoot) Release: The bushy advance growth plants, provided they have reached a certain size, respond to the trade-cut and top disposal burn by producing one or two shoots which are far more vigorous than the others. These shoots develop into saplings and are commonly called 'dynamic shoots'. The exact nature of the stimulus required for the formation of dynamic shoots is imperfectly understood. However, it is achieved by trade cutting operations which must reduce competition in the stand considerably, a factor which undoubtedly contributes to this stimulus.*

The minimum sized advance-growth which is capable of producing a dynamic shoot is one with a lignotuber approximating the size of a clenched fist. An advance-growth plant at this stage will have at least six shoots, and the sum of the lengths of all the shoots will exceed 15 feet.

The period required for the seedling to develop this size will vary with the density of the stand. On high quality sites in stands of average density, a minimum period of 15 years has been suggested, extending to 50 years on low quality sites. At the other extreme, jarrah seedlings planted on cleared, ploughed ground will generally produce a dynamic shoot in one to five years, and the bushy, advance-growth stage is frequently by-passed." (p. 17)

"*76.* **Prescribed Burning and Regeneration***: The young jarrah seedling is easily killed by even mild fires during the first four to five years after germination.The lignotuber forms in the axils of the cotyledons of the young seedling. Its subsequent development takes place downwards along the stem and it eventually becomes a largely subterranean organ. The four to five year period of susceptibility to fire represents the period required for the lignotuber to reach this position. Thereafter it can only be killed by prolonged, intense heat and normal prescribed burns will not affect its survival.*

77. A further period of susceptibility to fire occurs when the dynamic shoot is produced from bushy advance-growth. This shoot remains susceptible to fire until thick bark develops on the lower portion of the stem; a period of between five and 10 years. If a dynamic shoot is killed by fire, the plant will revert to its original bushy form and a second dynamic shoot will subsequently develop.Stands which are being regenerated should therefore not be burnt for the four to five years following germination and seedling establishment. Nor should they be burnt in the dynamic shoot stage until the saplings have developed thick bark up to the predicted scorch height of the fire. In most instances, it is preferable to defer control burning in sapling stands for 10 to 12 years after regeneration. D.F.O.'s must pay particular attention to this in drawing up annual burning programmes. Stands to be withheld from cyclic burning for regeneration must be clearly indicated on divisional burning proposals." (p. 18)

Stand Improvement
"*82.* **Historical***: Improvement work was carried out on a large scale in the northern jarrah forest during the depression years of the 1930's. This work was termed a regeneration cleaning and was performed in young regrowth stands. It involved the freeing of crop trees, the ringbarking of useless overstorey, mainly marri, and the falling near ground level (mullinising) of small trees which had been too severely damaged by fire to have any crop-tree potential. Vigorous coppice regeneration resulted from this latter operation on a high proportion of the 300,000 acres treated*." (p. 18)

"*88.* […] *(c) Sufficient crops trees must be present. The present stand selection prescription is based on a minimum of 40 crops trees per acre.*
(d) Any fire damage in the stand must not be severe." (p. 19)

Appendix 'A' Selection of Jarrah Stands for Pole Thinning

"[…] *The critical level of regrowth stocking below which thinning is not considered to be warranted is 35 per cent. by area. To exceed this minimum level requires the presence of at least 40 regrowth stems per acre which meet crop-tree requirements as laid down in the thinning prescription, and which need freeing from competition of surrounding trees*." (p. 21)

Method
Initial Selection of Areas for Sampling
"*Areas to be investigated must have been cut-over during or prior to the 1930-1940 decade; this ensures that only crops in excess of approximately 30 years of age will be tackled.* […]" (p. 21)

Appendix B : Prescription for Pole Thinning
Definitions
"*(a) Crop Trees. Crop trees are between 18 inches and 40 inches g.b.h. with a reasonably straight bole of at least 20 feet length and free from visible defect.* […] *The crowns of crop trees will generally be at or above the general canopy level of the stand and will be in a healthy condition.* […]" (p. 23)

Selection of Crop Trees
"*Crop trees are selected and marked on the basis of a basal area of approximately 65 ft^2/acre remaining after thinning. As a general guide, crop trees should be selected at an approximate spacing of 20 feet; this will give in the region of 110 crop trees per acre in a fully stocked stand.*

A stem will not be selected as a 'crop tree if- …
(b it will be damaged in a cull-tree falling operation.[…]" (p. 23)

The Freeing of Crop Trees
"*The non-merchantable thinning operation is basically one of freeing individual crop trees from competition.*[…]" (p. 23)

FORESTERS' MANUAL – 1972

<u>Foresters' Manual : Control of Trade Operations. 1972</u>

Registration of Timber Workers and Brands
"*1. The purpose of the registration of bush workers is the proper control of men directly engaged in the cutting and removal of timber from the forest, natural or planted, and the prevention of waste and damage in all associated operations. Consequently, it is necessary that every man who is engaged in the extraction of forest produce shall be a registered timber worker*." (p. 3)

Permits and Licenses
"*31. The granting of sawmilling permits and licenses for general trade cutting is governed by the provisions of the general working plan for the hardwood forests, which regulates the annual cut. Areas of State forests and reserves which will serve as future sawmilling permits and licenses have been listed in these working plans and cutting rights over such areas will be submitted to public auction or tender or granted in accordance with the plan.*" (p. 7)

Quarterly TradeCutting Operations
"*67a. Within 30 days of the close of each quarter officers in charge of Divisions will submit completed form F.D. 517 (Progress plans check by Working Plans Office).*

The detailed information required for the areas cut over, is as follows:-

[…]

(ii) Land Tenure – whether State Forest Timber Reserve, other Crown Land or Private Property.
(iii) Classification of area as maiden or old bush.
(iv) Species – the areas cut over by species.
(v) Class of log, MNT, Dieback, salvage etc." (p. 11)

Pile and Pole Licenses
"*90. Owing to serious shortage of intermediate age classes in all areas of State forest and the need to conserve such growing stock to protect the future of the sawmilling industry, the Department for many years past has endeavoured to confine pile and pole getting to private property and land for alienation.*" (p. 14)

"*2. Poles and piles less than 45 feet in length should be obtained from the areas listed in sequence of priority under para. 91 sections 1 and 2. However, where it is necessary to obtain them under para. 91, section 3, removal under treemarking must ensure that:*

(a) An adequate level of growing stock is retained, especially in gaps.
(b) No cutting back in length will be permitted.
(c) Contractors will be expected to find orders for the full range of lengths becoming available.
(*d*) *No recutting will be permitted until the next major trade operation is scheduled.*" (p. 14)

"*3. A pile and pole license … must be obtained in all cases before piles or poles are cut. Licenses will be issued only to persons holding definite orders for the supply of piles or poles for use within the State who may be required to produce their orders or satisfactory evidence thereof. The term and area for which the license is issued must be clearly shown on the form. In no case should a license be issued for more than three months.*

"*94. Pile and pole licenses will in all cases set out the minimum maximum crown and maximum crown diameter of the poles and/or piles authorised to be obtained.* […]" (p. 14)

Tally of Piles and Poles in the Bush
"*104. Piles and poles cut under license must not be carted from the area where they have been obtained until they have been either inspected or tallied and correctly branded.*" (p. 15)

WORKING PLAN – 1971

General Hardwood Working Plan No. 85 : Part I. 1971

"*This General Working Plan No. 85 is prepared under Section 31 of the Forest Act 1918-1969 which provides amongst other things, that the Conservator shall from time to time, prepare Working Plans for each State Forest and Timber Reserves. The practical value of the General Working Plan is that it sets out the policy of the Forests Department for managing the State's Crown timber resources, thereby informing the Government and the Forests Department's professional staff of the details of this policy.*

The last General Working Plan No. 79 was approved by the Governor in Executive Council in 1956. The provisions of this plan were revised Departmentally in 1960 and again in 1966, but formal ratification was not sought because of the changes which could be foreseen in the structure and economic conditions of the industry and which have subsequently become more evident." (p. 1)

0.2 Major Changes Since 1956

"*A number of major factors affecting the timber industry have emerged since 1956 and current planning must take them into account. The most important are:*

2. *Final definition of the total area available for dedication for forestry purposes which can now be Stated as an absolute purposes which can now be stated as an absolute maximum of 4, 975, 405 acres provided that all outstanding dedications are completed.*

3. *Completion of a comprehensive inventory of the forest resource indicating that the total longterm hardwood sawlog yield from Crown land is unlikely to exceed 600, 000 loads per year compared with former estimates of 800, 000 loads per year and actual current demand for Crown timber of approximately 750,000 loads per year. Improved inventory data, and to a lesser extent, the identification of dieback areas have been the reasons for this change in estimate of longterm yield.*" (p. 1)

"*6.* *The delineation of 1.79 million acres of high quality jarrah and karri forest as units for intensive management with a view to maximising both volume and values of timber production. These high quality sites are of the greater significance for future timber production, and the need to exclude mining operations from them must be stressed, when areas of lesser forest value could be considered as more readily available for mining.*

7. *Development and application of economic techniques for silvicultural treatment of hardwood stands with a view to concentrating management upon and increasing yields from specially selected areas of high quality forest.*

8. *Modification of logging procedures to conform with:*
(a) *The silvicultural requirements for optimum regeneration in the karri forest.*
(b) *The needs of logging hygiene in areas affected by or susceptible to jarrah dieback.*

[…]

10. *The approaching end of the initial cut in virgin forest on several sawmilling permits whose permissible intakes, based on originally incomplete assessment data, and the closer utilisation in the boom period of 1950-1960, have proved optimistic.*

Associated with this problem, the reduced per acre yields, and the increased proportion of small logs becoming available from areas now being cut for the second or third time, must also be taken into account." (p. 2)

0.3 Conditions For Future Planning

"*1. These factors set a climate for planning under which two distinct contingencies must be covered:*

(1) *<u>Continuation of the present downturn in the timber industry.</u> In this case any rationalisation must be effected so as to reorganise permit boundaries and intakes to the lower level of longterm yield, but without detriment to meeting the anticipated increase in longterm needs of the industry in the most effective way.*" (p. 2)

"*(2) <u>Early recovery from the present downturn in the industry, followed by a progressive increase</u>*

in demand for sawn timber. In this case overcutting of the longterm hardwood yield for about 20 years must be provided for, followed by a reduction in hardwood production for an equivalent period as plantation conifers become available in sufficient quantity to bridge the gap.

For this reason Working Plan 85 will remain in force until 31st December 1976, however it will be revised earlier depending on the importance and urgency of any new factors that might arise in the meantime.

2. *Sleeper mills formerly operating on forest land to be alienated will have to cease operating on Crown land because they cannot be supplied from areas of permanent forest without seriously affecting the resources and planned future life of mills already established and many decades on State Forest.*

3. *Mills established on private property resources and now reaching the 'cut out' stage, cannot be accommodated on the remaining areas of permanent forest, because timber supplies from these areas are already fully committed to the established sawmilling industry.*

4. *Amalgamation of intakes and re-organisation of permit boundaries is required to rationalise the level of production and hauling arrangements between major permit areas, especially in the forests centred north of Collie and south of Manjimup.*

5. *A temporary rationalisation of intake is required to overcome present conditions of oversupply caused by unbalanced orders, even though it is predicted that there will be an increase in total demand for sawn timber within the next decade.*

6. *There is a real and urgent need for additional funds for forestry purposes to provide for expanded programmes of plantation establishment, hardwood stand improvement and dieback rehabilitation, in order to increase yields and thereby attain a state of nett self-sufficiency in sawlog timber by the year 2030.*

7. *The need to press for additional Commonwealth assistance to both hardwood and softwood forestry is recognised and can be amply justified in that it is the only way to avert the need for increasing quantities of timber imports to meet future demands.*" (p. 3)

3. Silvicultural Considerations
The Jarrah Forest
"*Conversion from a light selective cut to a heavy concentrated cut will favour the development of even-aged regeneration, will restrict the amount of road construction and maintenance required and will have the further longterm advantage of contracting the range of log sizes available under future logging operations.* […]" (p. 8)

4. Intensive Management Units
"*The initial survey has indicated that of the 3.3 million acres of jarrah forest, approximately 1.62 million acres are of sufficient quality and site productivity to warrant intensive multiple-use management, primarily for future timber production. The remaining area is considered more suited to extensive management for such vital purposes as catchment protection, salinity control, flora and fauna conservation and public recreation, as well as timber production.* […]" (p. 8-9)

"*Intensive management in the jarrah forest envisages, within the constraints of cost benefit evaluation and available finance:*

(a) *Maximum forest hygiene to prevent encroachment of Dieback.*

(b) *Optimum forest stocking to make best use of site productivity by encouraging regrowth, permitting regeneration of enrichment planting in under-stocked areas.*

(c) Silvicultural thinning to concentrate growth upon a limited number of desirable stems by eradicating competition from unwanted and undesirable stems. Research results already indicate that individual stems derive substantial benefit from judicious thinning.

There is little doubt that having assured protection from Dieback and an adequate level of stocking, further application of thinning techniques involving the controlled use of arboricides, results in a substantial increase in both volume and value yields from the forest.

Some improvement work will release growing stock from competition with unmarketable stems: the total volume of jarrah and karri currently considered unmarketable representing 22 per cent of total standing volume; the total volume of marri currently considered not generally marketable, comprising a further 33 per cent of total standing volume." (p. 9)

3.3 Mixed Species Forest
"*For most practical purposes the jarrah-karri forests are managed according to the requirements of the dominant species. The jarrah-wandoo forests are mainly significant from the viewpoint of catchment protection along the eastern extremities of State Forest.* […]" (p. 12)

3.4 Start Of Recutting
"*Virgin forest represents the capital accumulated by site productivity up to the end of biological rotation of the species. In most cases this is a much longer period than that required to produce sawlogs of commercial size. Under a selection system of forest management the first cut removes part of this capital so as to reduce the growing stock to a more productive level with a shorter rotation, while still growing logs of commercial size. Under a selection system of forest management the first cut removes part of this capital so as to reduce the growing stock to a more productive level with a shorter rotation, while still growing logs of commercial size. The second (or any subsequent cut) under a selection system removes part of all of the remaining accumulated capital to further adjust the growing stock towards the desired level for optimum productivity.*" (p. 13)

2. Length Of The Cutting Cycle
"*The length of the cutting cycle depends on the intensity of the cut, the growth rate of the forest, market and economic factors, the kind of product desired, and the intensity of management.* […]" (p. 13)

3. Future Optimum Log Sizes
"*With a constant volume of growing stock, longer cutting cycles produce a smaller cut of larger sized logs and vice versa. However inherent growth stresses in small rapidly-grown eucalypts create problems in seasoning stability of the sawn product as well as lower recoveries on account of smaller log sizes. At present it is considered that the minimum log size required to overcome these problems and still to provide a log of acceptable recovery in a reasonable time is 72" g.b.h. for jarrah and 12- g.b.h. for karri, which should be attained in 150 years and 90 years respectively given reasonable management. These targets will be adopted as the basis for management in this plan.*" (p. 14)

4. Implications Resulting From Recutting
"*(a) The inevitable result of recutting will be an initial reduction in per acre yield accompanied by an increase in the proportion of small logs becoming available.*
(b) Initially there will be an increase in the range of log sizes, becoming available from the process of converting partly cut irregular stands into fully stocked stands of even-sized regrowth.
(c) This situation will persist until regrowth stands obtain minimum commercial size and produce a log supply consistent in both size and quality." (p. 14)

"*(e) Where original sawmilling permits were sold on the basis of incomplete data with the result that there is now insufficient large-sized material to sustain their annual intake, a reduction in intake will be required to phase the remaining large-sized material over the period required for the replacement.*" (p. 15)

4. Economic Considerations
4.2 Future Trends In Demand
"[…] *In order to attain the objective of nett self-sufficiency in timber by the turn of the century, it therefore becomes essential*
[…]
(c) To intensify management of the hardwood forests, concentrated upon the karri forest and upon the high quality jarrah forest to further expand production in the longer term.
(d) To utilise current available hardwood resources in the most effective and efficient manner." (p. 16)

5.3 Determination Of The Longterm Allowable Cut
Concept Of The Allowable Yield
"*In a forest which lacks a balanced distribution of size or age classes, but which contains a very substantial proportion of unmarketable volume and incompletely regenerated areas, the classical concept of sustained yield is not truly relevant. In Western Australia the situation is further complicated by*

(a) Uncertainty as to the ultimate total area available for permanent forestry.
(b) The need for further improvements in hardwood growth rate data.
(c) Variations in standards of log acceptability due to changing market conditions.

For practical purposes, therefore, the concept of longterm allowable yield will be adopted. The long-term allowable yield will be regarded as the level of yield considered desirable to convert the forest into a condition of maximum productivity as soon as possible, while still providing reasonable continuity of log supplies in terms of both time and volume. This level of yield will be subject to review as improved data comes to hand and also as dictated by short term market conditions, but without prejudice to the basic principle that any cutting in excess of the estimated long term yield must be compensated by a corresponding reduction within a maximum period of the ensuing two decades." (p. 33)

6. Objectives Of Management
6.1 The Major Objective
"*A major objective of this plan is to regulate the cut from Crown lands so as to provide for anticipated demands in the next 20 years and to ensure the greatest degree of continuity in terms of economic production and employment in the timber industry within the framework of estimated longterm yield.*" (p. 35)

6.2 Secondary Objectives For Regulation Of The Cut
"*The major objective can only be achieved through a number of stages which may be termed 'secondary objectives'. These are:*

2. *To maintain the allowable cut of 750, 000 loads per year from Crown land for the period of the plan within the capacity of established Crown land sawmills known to have adequate longterm resources.*
3. *To regulate the allowable cut by adjusting permit intakes or permit areas in accordance with mill efficiency and the location of the mill in relation to resource.*
4. *To hold in reserve without encroachment in any way by any other operator any areas or intake so yielded as the first step towards a future reorganisation of permit boundaries.*
5. *To ensure the greatest possible degree of continuity on a local basis within the limits of permissible intake and mill efficiency whilst creating flexibility for the future development of efficient centres of utilisation of economic size.*
6. *To achieve maximum forest utilisation so as to obtain the greatest major economic and silvicultural benefit from utilisation operations.*" (p. 35)

7. Prescriptions For Implementation Of The Working Plan Objectives
"*The following detailed prescriptions will be implemented to achieve Working Plan objectives depending upon which of the planning contingencies stated in Section 0.3.1 materialises.*" (p. 35)

7.1 Regulation Of Cut
"*1. Transfer of minor amounts of residual cutting thought to remain on any permit or licence area to a new owner of the mill originally operating on that permit or licence area will not be permitted.*

Short term permits or licences for cutting on Crown land will not be renewed on completion of operations where resources are known to have been exhausted.

2. The reopening or relocation of any Crown land mill known to have inadequate resources will require special approval." (p. 35)

"*3. No cutting by any other operator will be permitted on areas yielded by any permit holder as part of an approved programme of rationalisation.*
[…]
5.Former private property mills will not be allowed to encroach upon areas of Crown land required as longterm reserves for established Crown land mills.

6. Supplies of salvage logs will be continued at an absolute maximum of 30, 000 loads per year at current quotas with a reduction as supplies of this class of material become exhausted. Metropolitan mills running short of supplies cannot be given access to alternative sources of sawlogs from Crown land.
[…]
9. Acquisition of cutting rights as required for any new developments under this plan will be subject to the provisions of the Forests Act.
[…]" (p. 36)

7.2 Forest Conservation and Multiple Use Management
"*In all operations proper attention will be paid to:*

1. Preservation of selected forest reserves on areas where no major trade operation has taken place." (p. 36)

7.3 Control Of Trade Operations
"*1. Major trade operations will be controlled by the issue of approved annual coupes under five-year logging plans to be drawn up in accordance with the requirements of the forest hygiene programme and revised annually.*

2. Every effort will be made to encourage permit holders or licensees to utilise small logs and other marketable sections. Where permit holders choose to reject this material, alternative arrangements will be made for its disposal in the interests of maximum utilisation and of the silvicultural requirements of the forest." (p. 37)

7.4 Silvicultural Prescriptions
"*1. The uniform system will be continued in the karri forest and concentrated cutting will be continued in the jarrah forests where control of Phytophthora Root-rot is of vital importance.*
[…]
3.Selected areas of prime jarrah forest will be set aside as intensive management units for complete protection from Phytophthora Root-rot and for intensive treatment including pole thinning, to improve site productivity." (p. 37)

8.2 Control Of Prescriptions Under the Plan
"*Progress in implementing the provisions of the working plan will be recorded as follows:*

<u>Documentation</u>
1. Amendments to Sawmilling Permits F.D. 70/A and Forest Produce Sawmilling Licenses F.D. 58/1953." (p. 38)

Trade Operations
"*2. F.D. 40A Application for the annual cutting coupe.*
F.D. 423 Quarterly assessment of cut-over bush.
F.D. 512 Bi-annual summary of areas cut-over.
F.D. 381 Monthly record of individual intakes and production." (p. 39)

1. Records Of Areas Cut-over
"*Plans T.O. 1, 2 and 3, 40 or 80 scale maps showing areas cut-over and revised half-yearly.*
Decades of cutting plans 80 scale maps summarising the above information by decades. Detailed progress plans will be maintained to show progress of silvicultural treatment." (p. 39)

4. Tenure Of Forest Land
"*District Plans, 40 chain tenure maps updated annually.*
State Forest Register.
Register of gazettal of deductions or alienations from each State Forest." (p. 39)

General Hardwood Working Plan No. 85. 1971: Part II : Detailed Prescriptions By Divisions. 1971

O.1 Introduction
"*The detailed prescriptions by Divisions which appear in Part II of this Working Plan are designed to implement the policy contained in Part I of this General Working Plan No. 85. These prescriptions will remain in force until 31st December, 1976, unless an early revision of the Plan becomes necessary in the light of new factors that might arise in the meantime. (See Part I Para. 0.3.1.2)*

0.2 General Prescriptions
"*1. General prescriptions for the implementation of Working Plan No. 85 are contained in Part I, Sections 7.1 to 7.5. All officers concerned are required to familiarise themselves with these prescriptions and to follow them closely.*

2. However the most important of these prescriptions are repeated below for emphasis." (p. 1)

> **(c) Five Year Logging Plan**
> "*All trade operations will be controlled by the issue of annual coupes under five year logging plans to be drawn up in accordance with the requirements of the forest hygiene programme, and revised annually.*
> *(See Part I Para. 7.3.1).*" (p. 1)
>
> **(e) Regulation Of the Cut**
> "*Particular attention will be paid to the detailed conditions contained in permits and licenses issued in accordance with the overall prescriptions for regulation of the cut contained in Part I, Section 7.*" (p. 2)

0.3 Operations To Be Controlled Under Special Working Plans
"*Because of the complexity of technical detail involved, it is impracticable to deal adequately with the operations listed below by general prescription. Detailed working plans will, however, be revised or finalised during the Plan period.*

1. Hardwood logging operations.

2. Mining timber operations in Collie and adjacent Divisions.

3. Firewood operations for charcoal production in Mundaring and adjacent Divisions.

4. *Forest improvement operations in the Intensive Management Units in all Divisions*." (p. 2)

CODE OF LOGGING … ND – [197-?]

'Code of Regrowth Logging Practice' for all Logging Operations … ND [197-?]

Section 2 : General

"*2.1 The Instructions contained in this Code shall be observed by all persons carrying out any regrowth logging operation.* […]"(p. 3)

"*2.3 A contractor shall observe all Acts of the State of Western Australia, and in particular, the Bush Fires Act, 1954, the Forests Act, 1918-1976 … including all amendments to those Acts for the time being in force and any Act passed in substitution or in lieu thereof and all Regulations for the time being in force thereunder as well as this Code of Regrowth Logging Practice*." (p. 3)

"*2.5 A contractor shall exercise strict supervision and control over the operations of all workers employed by him with a view to:*

2.5.1 Preventing any breach of the Forests Act and Regulations and this Code of Practice.

2.5.2 *Avoiding damage to other standing timber during felling extraction and hauling operations.*" (p. 3)

"*2.10 All operations carried out by, or on behalf of, a contractor in Regrowth areas shall be carried out as directed by a Forest Officer. A contractor shall be liable to pay the Forests Department full compensation for any damage or waste of timber resulting from his failure to comply with such directions.*" (p. 4)

Section 3 : Felling, Trimming, Crosscutting, etc.

"*3.1 All felling shall be carried out in such place, order, time and manner as a Forest Officer shall from time to time direct.*" (p. 6)

"*3.3 A contractor shall from time to time as required by the Conservator, confine his operations to certain defined coupes. Such defined coupes shall be cut out to the satisfaction of a Forest Officer before a further coupe is made available for cutting.*

3.4 A contractor shall fell and utilise only such trees as have been marked or indicated for the purpose by a Forest Officer.

3.5 Marking of Trees for Felling

- *(a) Trees to be felled will be marked or otherwise indicated by Forests Department staff. Only such indicated trees are to be felled.*
- *(b) In the event of a contractor wishing to cut unmarked trees to assist his operations, e.g., widening vehicle tracks, extending landings, he shall refer the matter to a Forest Officer and such trees will not be cut until marked by that Officer.*" (p. 6)

"*3.12 All felling, trimming and crosscutting shall be carried out with minimum of damage to standing trees. Where standing trees are damaged by him a contractor shall be liable for such damage at rates determined by the Conservator. Damaged trees shall remain the property of the Department.*

3.13 'Hangups' shall be dislodged and cut-off shall not be left leaning against standing trees. The tops and branches of all trees felled shall be dispersed to the satisfaction of a Forest Officer. All tops, slash and other debris shall be cleared from roads, firebreaks, creeks, landings and logging tracks as directed by a Forest Officer." (p. 7)

Section 4 : Extraction

"*4.1 All extraction shall be carried out in such place, order, time and manner as a Forest Officer shall from time to time approve.*" (p. 8)

"*4.4 All extraction is to be carried out with a minimum of damage to standing trees. Where standing trees are damaged by him the contractor shall be liable for such damage at rates determined by the Conservator. Such damaged trees shall remain the property of the Department.*" (p. 8)

"*4.8 A contractor shall not carry on extraction at such times or places, or by methods or equipment which a Forest Officer has prohibited until such prohibition has been revoked by a Forest Officer.*" (p. 8)

Section 5 : Loading and Hauling

"*5.1 All loading and hauling shall be carried out in such place, order, time and manner as a Forest Officer shall from time to time approve.*

5.2 […] *A contractor shall comply with the Forest Officer's expressed priority of loading.* […]" (p. 10)

"*5.6 Loading and hauling of logs and timber shall be carried out with a minimum of damage to standing trees. Where standing trees are damaged by him a contractor shall be liable for such damage at rates determined by the Conservator. Such damaged trees shall remain the property of the Department.*" (p. 10)

"*5.9 A contractor shall not carry on loading and hauling at such times or places, or by methods or equipment which a Forest Officer has prohibited until such prohibition has been revoked by the Forest Officer*." (p. 11)

FORESTERS' MANUAL – 1964

<u>The Foresters' Manual : Fire Control. 1964</u>

The Importance of Fire Control

"*1. The problem of fire control is intimately bound up with the questions of reforestation and afforestation and the ultimate success of the Department's efforts in these projects is largely dependent on a strong measure of public sympathy and co-operation in attacking the fire problem.*

2.Of almost equal importance is the proper use of controlled fires in silvicultural and protective operations." (p. 7)

<u>The Foresters' Manual : Reforestation and Silvicultural Operations : Jarrah and Karri. 1964</u>

"*1.The axe and the spray gun used in treemarking for trade cutting and stand improvement are tools for the manipulation of the forest crop with the aim of applying the highest measure of wood increment to selected crop trees and to ensure that not only is regeneration assured, but that the new crop is as far as possible the progeny of the best trees in the stand.*" (p. 9)

Methods of regeneration

"*2. In Western Australia the two main species, Jarrah (Eucalyptus marginata) and Karri (Eucalyptus diversicolor), regenerate easily under ideal conditions. However, as conditions are frequently not ideal, particularly in the karri forest, it is important for all officers to be familiar with the problems involved and to study the effect on regeneration of factors such as burning, treemarking, seed source and weed competition. The aim is that regeneration shall develop naturally in the openings created by trade cutting. Jarrah regeneration is obtained mainly from lignotuberous advance growth which is commonly present in dormant condition throughout the prime Jarrah forest (see under 'Jarrah Regeneration').* […]." (p. 9)

General Working Plan
"*5. The dedication of effective forest and accurate separation of forest types and volumes has been furthered by stereoscopic interpretation of aerial photographs which have now been secured for the whole of State Forest. Practically all forest worthy of dedication is now included in State Forest.*

6.For convenience of reference and compilation, Working Plan Areas have, where possible, been grouped in recent revisions of the General Working Plan into Planning Sections on the basis of common forest character or a common economic factor. A prescription for each Planning Section specifies permissible log intake for each established sawmill and provides for slight adjustments to permissible intakes and permit boundaries." (p. 9)

Aims and Policy
"*7. The Conservator, through the treemarker, controls all felling operations and in so doing ensures that the forest is worked systematically to ensure sound utilisation, effective regeneration and the retention of vigorous growing stock.*" (p. 10)

Cutting Section
"*8. Logging operations are each year confined to approved cutting sections. These areas are defined well in advance per medium of forward planning for at least five years by the Divisional Forest Officer, etc., in consultation with mill management, to ensure effective road planning and allocation of the cut for silvicultural improvement of stands which have suffered severe fire or other damage, and also to balance summer and winter operations.*" (p. 10)

Forest Composition
"*9. Jarrah and karri forest is comprised of groups, being more or less even aged within groups but frequently uneven aged between groups. Most of the virgin forest is physically mature or overmature and understocking is generally serious in the smaller age classes. In view of the considerably variation which occurs in the stand composition and, in some cases, degree of fire damage, the treemarker's approach must be flexible enough to treat each area to best advantage.*" (p. 10)

Treemarking – Historical
"*10. Early attempts to control the industry and preserve growing stock were by girth restriction (e.g.: Jarrah, 90 inches; Karri, 108 inches). However, as this could at best have marked silvicultural disadvantages, treemarking was introduced in the early 1920s. The present system of marking trees for removal, with specification of direction of fall, was commenced in jarrah forest in 1928 and in karri forest in 1944.*" (p. 10)

Regeneration – Natural
"*11. The trade cut is virtually a regeneration felling, the new crop normally deriving from advance growth (Jarrah) or seedling (Karri), following a regeneration burn prescribed to take advantage of the first good seed year after logging (see below). Treemarking, in controlling trade cutting, is, apart from protection measures and seed check, the first step in the regeneration sequence and plays an essential and most important part in determining the post-cutting condition of the stand.*" (p. 10)

Current Practice
"*12. Broadly, the aim in marking virgin forest is to release to the trade the static portion of the crop and to retain for the future the dynamic, or vigorously producing portion.* […]" (p. 10)

Cutting Cycle
"*14. A cutting cycle of 30 years has long been accepted in management planning. In practice, however, because of variations in stand quality and composition, the cutting cycle must be flexible and will obviously be longer where the site is poor and shorter where the yield is high.*" (p. 10)

Sequence of operations

"*15. The following sequence of operations comprises current practice:-*

(a) Fire protection of cutting section and provision of access (advance burn in Jarrah forest).
(b) Prescription for treemarking and regeneration.
(c) Treemarking
(d) Trade cutting (including 'cull felling' where prescribed).
(e) Assessment.
(f) Top disposal (including 'cull felling' where prescribed).
(g) Regeneration burning.
(h) Regeneration appraisal.
(i) Compartment subdivision and record (Compartment Register).
(j) Fire protection as prescribed." (p. 10-11)

Advance Burn

"*16.The advance burn, which is standard practice in jarrah forest, has been discontinued in karri forest where its advantages are outweighed by detrimental effects such as-*

(a) the difficulty of securing a uniform burn without scorching of canopy and damage to buds and blossom or release of seed which should ideally remain on the tree until after logging;
(b) adverse effect on the regeneration burn which becomes discontinuous and may destroy seedlings developing from the advance burn;
(c) dense establishment of fire weeds which inhibit development of karri." (p. 11)

Protection of Cutting Section

"*19. It is essential for the treemarker to receive the D.F.O.'s guidance in respect of atypical areas, particularly where the prescription forest is severely damaged, grossly overmature, or carrying an exceptionally high proportion of marri. These areas will be withheld from cutting until treemarking and regeneration treatment is prescribed.* […]" (p. 11)

"*21. Prescriptions for regeneration will be-made by the Regeneration D.F.O. in consultation with the Silvicultural Officer.*[…]." (p. 11)

Treemarking

"*23.The aim in treemarking virgin forest is to-*

*(a)**Remove static volume** (mature, overmature and defective stems). Merchantable suppressed or defective stems below 90 inch G.B.H. (Jarrah) and 108 inch G.B.H. (Karri) are also marked.*

As a rule trees in this class are retained only if their felling would jeopardise valuable growing stock. Vigorous immature trees must on no account be marked for cutting, excepting, rarely, to permit removal of overmature trees.

*(b) **Retain dynamic volume**, i.e., vigorous stems in all sizes. In general over 50 per cent. of merchantable volume is reserved in trees over 60 inch G.B.H. It is seldom necessary to retain jarrah trees over 12 ft. G.B.H.; however prime karri trees up to 18 ft. G.B.H. may occasionally be held to silvicultural advantage.*

(*c)Avoid damage to growing stock.*

(d)Create openings adequately served with seed trees and/or advance growth for generation of the new crop. (See also under 'Regeneration.')

(e)Remove cull trees (see under 'Improvement cutting.')

Seed Resource
24. Dynamic trees in the top canopy are not only the most productive component of the crop, but are also the best seed resource in terms of both quantity and quality. Eucalypt dominants produce more than 80 per cent. of the total seed supply." (p. 12)

Standards of Treemarking
"*25. It must be stressed that treemarking plays a vital part in determining the future condition and productivity of the forest. D.F.O.s are to ensure that careful instruction and close supervision is given to all treemarkers, especially those in training. Consistent attention to the maintenance of standards is imperative and all questions in this regard should be referred to the Senior D.F.O., or Inspector.*" (p. 12)

"*26. Trees will be marked by branding in an axe cut at the foot of the tree in such a position that the tree must be felled directly over the brand, i.e., over a radial line extended from the centre of the tree through the centre of the toemark.* […]" (p. 12)

Trade Cutting and Permit Control
Control of Bush Operations
"*28. The treemarker, as the Conservator's representative in the field, is responsible for ensuring effective control of trade operations in respect of orderly working, satisfactory utilisation and protection of growing stock.* […]" (p. 12)

Fallers' Coupes
"*29. Fallers' coupes or blocks must be blazed by the bush boss, or other company nominee. No treemarking shall be commenced until the blocks are marked out to the satisfaction of the Forester in Charge.*" (p. 12)

Inspection of Coupes
31. The treemarker must inspect coupes frequently to ensure that they are satisfactorily cut out before fallers are authorised to commence cutting on new blocks." (p. 13)

Assessment
Temporary Assessment Lines
"*35. All treemarkers are required to assess a portion of the area cut over at the close of each quarter and to forward the results to the D.F.O., who summarises them and forwards them to Head Office on Form F.D. 423 with a copy to the Working Plans Office.* […]" (p. 13)

"*The objects of these assessments are –*
(a) To inform the D.F.O. and the treemarker himself of the volume he is removing and the volume he is retaining per acre.
(b) To inform Head Office and the Working Plans Offices for management and working plans calculations.
(c) To assist the D.F.O. in preparing five-year logging programmes." (p. 13)

"*The assessment lines must be selected so as to be truly representative of the area cut over during the quarter and the D.F.O. must satisfy himself that this is, in fact, the case. Eight acres of assessment line will normally be run in each quarterly coupe and the direction of the line should be chosen so as to cross the prevailing topography.*" (p. 13)

Booking Procedure
"*39.The volumes of each tree encountered, or of each log removed, are recorded in Field Book type I/1954 and the classification of every tree as shown in paragraph 44 is also noted against each entry.* […]" (p. 14)

"*41. Loadages are totalled for each 10 chains and for the whole of the assessment line …*" (p. 14)

Prescription Required

"*43. Before completing his assessment, the treemarker should give a description of the forest remaining on the line and should write a prescription setting out his own ideas as to the future treatment of the forest. This is particularly important in areas where advance growth is inadequate or where only small sapling regrowth is inadequate or where only small sapling regrowth is present as special burning measures may be required to ensure satisfactory regeneration under these circumstances.*" (p. 14)

Tree Classification

"*44. The following tree classification will be used:-*

Standing Trees

A.Over 90 in. G.B.H. *(Karri over 108 in.)*

(i)Trees retained as growing stock (or will be retained where bush not previously treemarked). Sometimes only fair trees are retained because there is nothing better.

(ii) Trees held for special reasons. In treemarked bush this includes logs held-

(a) To prevent damage to immature growth.

(b) Trees held to allow a top log to reach millable size.

(iii) Marketable logs which should be taken to a mill in the district. This includes trees M.N.T. because of quality or because they would fall over a road.

(iv) Trees not at present exploitable. These may include some of the M.N.T's.

B. Trees between 72 in. and 90 in. G.B.H. *(Karri likewise)*

(i) Growing stock for the future.

(ii) Trees that could be removed – too defective for future growing stock.

(iii) Trees not at present exploitable because of defects.

C. Trees between 60 in. and 72 in. G.B.H. *(Karri likewise)*

(i) Dealt with in same manner as B.

(ii) Dealt with in same manner as B.

(iii) Dealt with in same manner as B.

D. Under 60 in. G.B.H. Piles and Poles *(tree classes).*

When above 60 in. G.B.H. engineers' piles and poles will be classified according to their girth class, but the letter 'E' will be added in the class columns, e.g., BI (E)." (p. 14)

Engineers' Piles and Poles

Poles *(all species) -*

Minimum length 20 ft.

Minimum crown diameter 6 in.

Maximum crown diameter 9 in.

Piles *(all species)-*

Minimum length 20 ft.

Minimum crown diameter 10 in.

Maximum crown diameter 16 in.

Record position, crown diameter and length of engineers' piles and poles. For others down to 24 in. G.B.H. record number only, but not on a separate line-see specimen page of field book.

Removed Trees

Jarrah-

Over 90 in. over bark-Rl.

Under 90 in. over bark-112.

Karri-

Over 108 in. over bark-Rl.

Under 108 in. over bark-R2.

The removed trees should be encircled thus in the case of an old cutting (R1), (R2) to differentiate from a further or new cutting which are marked thus, RI, R2." (p. 15)

"*46. Now that A.P.l. work is well in hand it is no longer necessary for the treemarker to provide detailed measurements of co-dominant trees, but he must ensure that the co-dominant height of the forest recorded in his Field Book is correct*." (p. 15)

Top Disposal
"*47. On completion of the trade operation the Department carries out a top disposal cleaning programme to ensure that the burning of logging debris will do little or no harm to growing stock. Inflammable material is moved to a distance of at least three feet from the base of reserved trees and elevated branches are lopped flat. Although mainly axe work is required, chain saws can be used to advantage on large limbs. It is the overseer's responsibility to see that no areas or trees are missed, that the standard set is maintained and that unnecessary work is avoided. The overseer will indicate where the chain saw is to be used. In low quality bush the Inspector will decide whether top disposal is warranted*." (p. 15)

Cull Trees
"*48. As mentioned under the heading 'Stand Improvement,' the elimination of cull trees may be coupled with the top disposal operation. In general culls will be ringbarked and/or treated with a hormone spray application.*" (p. 15)

The Top Disposal or Regeneration Burn
"*49. See under Jarrah … Regeneration*." (p. 15)

Jarrah Regeneration
"*50. Jarrah regenerates from seed. However, the seedling, instead of extending as a sapling, develops a woody lignotuber or reserve of food material with dormant buds from which a number of semi-prostrate stems a few feet high are produced. This lignotuber renders the jarrah "seedling" virutally [sic] indestructible for it rapidly produces new growth if the aerial portion is removed or damaged. It develops very slowly and may take 15 years or more to reach the stage where it is able, when stimulated by burning and/or removal of canopy in logging, to produce an erect dynamic sapling.*"

Problem areas
"*51. Although regeneration of jarrah is relatively simple where advance growth is present, it is important to note that such dormant growth is not always present. When this is the case care must be taken to programme the top disposal burn to coincide with the presence of sufficient seed in jarrah crowns. Seed years are not regular in the jarrah forest and a period of five or six years may elapse between general seed years, when roughly 25 per cent. of the stand can be expected to carry a heavy crop of seed. The scattered trees to be found in seed every year are usually insufficient for regeneration purposes. Top disposal burning should be deferred on areas lacking advance growth if jarrah seed is scarce*." (p. 16)

Flowering cycle
"*52. New flower buds appear in the axils of the leaves of the early summer growth and flower in the following November and December. The fruits mature to shed seed in the following summer or roughly two years after bud formation.*" (p. 16)

Seed fall
"*55. Natural seed fall occurs when mature fruits are opened by hot dry weather in mid-summer. Ripening of capsules may be spread over a period of months and some may remain on the tree over winter to release seed the following summer*." (p. 16)

Regeneration burn
"*56. Fire in the form of a light broadcast or regeneration burn is frequently used to trigger seed release onto ash bed*." (p. 16)

Seed dispersal
"*57. Dispersal of seed is usually confined to a radial distance not greater than the height of the tree*." (p. 16)

Germination
"*58. Germination follows the first winter rains in May and June. Under ideal conditions up to 0.5 million seedlings per acre may germinate. However, losses due to insects, fungi, frost and drought more than decimate the seedling population in the first year*." (p. 16)

Fire resistance.
"*59. During the first year seedlings are killed outright by mild burning. However, with the development of the lignotuber resistance increases to the extent that a three-year-old seedling will recover after a moderate burn*." (p. 16)

Fire protection
"*60. Protection of the new crop is necessary until it reaches the stage when it can withstand a light controlled burn. The D.P.O. is responsible for inspection after regeneration and for preparation where necessary of a prescription for protection. Owing to variations in stand height, density and condition, it is not possible to issue a general prescription. In general it is considered that in the northern and eastern jarrah forests, where stand heights are lower, complete protection will be required for 8-10 years until saplings are 20 feet high and the lower green crown about 12 feet above ground*." (p. 16)

"*61. In prime jarrah forest consideration may be given to resuming cyclic burning 4-8 years after the top disposal burn, the criterion being always whether burning will prejudice development of the new crop*." (p. 16)

Stand Improvement
"*97. Trade cutting removes the less productive component of merchantable volume. Vigour is the prime criterion in selection of growing stock for retention. Important though it is as a silvicultural operation, the controlled trade cut rarely leaves the stand with the potential for full production.* […]" (p. 20)

"*98. Assuming that regeneration is satisfactory, the main avenues for improvement are-*
(a) removal of useless overstory;
(b)removal of useless understory;
(c) removal of surplus crop trees;
(d) removal of scrub competition." (p. 20)

"*99. Removal of all or any of these competing strata can be expected to favour crop trees*." (p. 20)

Historical
"*100. Improvement work was carried out on a large scale in the northern jarrah forest during the depression years of the 1930's. This work was termed a regeneration cleaning and involved the freeing of crop trees, the ringbarking of useless overstory, mainly marri, and the falling near ground level (mullinising) of small trees which had been too severely damaged by fire to have any crop tree potential. Vigorous coppice regeneration resulted on a high proportion of the 300,000 acres treated*." (p. 20)

Coppice thinning
"*101. Subsequent trials to test the effect of thinning coppice to one or two stems per stump showed little advantage, if any, was to be gained*." (p. 20)

Sapling and pole thinning
"*102. Thinning in sapling and pole stands likewise achieved thinning little advantage, due largely to the development of competition from vigorous coppice which resulted wherever surplus trees were removed*." (p. 20)

Thinning potential,
"*103. Measurement from time to time of stems relatively free from competition has shown that substantial advantage could accrue from thinning if the problem of coppice competition could be defeated.*" (p. 20)

Hormone Sprays
"*104. It was not until the successful testing in the early 1960's of the hormone 245-T (Trichlorophenoxyacetic acid) for coppice prevention and eradication that stand improvement works could be planned in the certainty of achieving an effective increase in yield.*" (p. 21)

Development and protection phases
"*105. A further limiting factor in past years was the lack of funds for an intensive silvicultural programme, this in view of the need to first develop and protect the forest. It can be said that access is largely complete in the northern forests and that recent development in protection policy and techniques have set the stage for emphasis on stand improvement programmes.*" (p. 21)

Prescription for Stand Improvement
"*106. Prescriptions have been developed to cover jarrah stand improvement and the standard prescription is included as Appendix C. Deviations from this prescription are not to be adopted without good reason and the approval of the regional Inspector.*" (p. 21)

Working Plan
"*107. Stand improvement at the outset will apply only in prime jarrah forest (type JA, JB+). In each Division where this work is scheduled, the D.P.O. will draw up a working plan to define the sequence required, having in mind-*

(a) areas most in need of treatment;
(b) co-ordination with trade cutting;
(c) co-ordination with controlled burning." (p. 21)

Salvage Cutting
"*110.*[…] *These operators are being used mainly for the salvage of trees on dieback areas and of low grade logs from plantation clearings. They are used with silvicultural advantage in the forest and should work in advance over areas listed for stand improvement.*" (p. 21)

Crop Tree-Definition
"*112. Other basic features of the prescription are:-*

(a) Crop tree-definition: A tree which occurs in or above the general level of the canopy and has a healthy crown of reasonable vigour. […]" (p. 21)

"(b) Surplus trees saleable as poles will be removed whenever possible prior to the improvement operation or concurrently with it. Otherwise such trees will be reserved for removal at an early date.
Surplus trees will be reserved for sale if they have-
(1) minimum straight bole length of 7 feet; and
(2) minimum. G.B.H.o.b. of 36 inches.
(c) Ringbarking for removal of surplus trees will not apply-
(1) within 5 chains of main roads; or
(2) within at least 20 chains of private property on peripheral boundaries.
In these cases surplus trees will be felled." (p. 21-22)

Burning Nullifies Effect
"*114. It should be noted that it may take a considerable period of time before translocation through plant or root-stock is complete. Burning soon after treatment can completely nullify its effect. It is essential that no burning should take place within 12 months of treatment.*" (p. 22)

Cull Felling

"*116. **Cull tree-definition:** The cull tree has no potential, but has sufficient crown vigour to occupy millable, effective growing space.*" (p. 22)

"*117. In jarrah forest the aim is to remove the cull tree during the improvement programme or during top disposal cleaning.*" (p. 22)

"*119. Culls required for seeding or for testing seed availability in connection with regeneration burning are reserved from cutting.*" (p. 23)

Large Trees Not Culled

"*123. Cull trees above 24 ft. stump girth are not felled, this being the -reasonable size limit for one-man chain saws. These large culls, incidence one per 15 acres, are marked for ringbarking as part of the top disposal operation.*" (p. 23)

Appendix C : Prescription for Jarrah Pole Thinning

1. Marking for Thinnings

"*The marking for thinning will include:-*

(a) The retention of selected crop trees …
(b) The marking for retention of saleable trees for removal in the future …" (p. 30)

2. Definitions.

"(*a*) **Crop trees**- *Crop trees are trees with a reasonably straight bole which is at least 20 feet long and free from visible defect. These trees will normally be dominants or co-dominants with good crowns which are average or better as to width, depth, health and density.*

(b) **Saleable trees**- *Saleable trees are of two kinds:-*

(i) Suitable for transmission poles - Those trees which have a bole length of at least 30 feet and a crown diameter of at least 7 inches. These trees must also meet S.E.C. pole specifications in other respects.

(ii) Suitable for saw logs -Those trees which have a straight bole of at least 7 feet and a G.B.11. of at least 36 inches over-bark." (p. 30)

"*c) Do not mark for retention:-*

(i) Any crop trees within 20 feet of retained growing stock (A1 and B1 trees). […]
(ii) Any trees which would be smashed by falling marketable saw logs at the next cut.
(iii) Any crop tree with a large log or a heavy accumulation of logs within 5 feet of its base." (p. 31)

4-Thinning Procedure.

"*Two distinct procedures are to be followed for: (a) routine thinning; (b) roadside improvement work and private property boundaries.*

(a) **Routine thinning-***All trees, regardless of species, which have not been marked within 10 feet of a crop tree are to be removed as follows:-*

Stump diameter 6 in. or less---cut down by axe and poison the stump.
Stump diameter 6 in. to 14 in-frill-ring by axe and spray the ring with poison.
Stump diameter over 14 in-frill-ring by chain saw with sloping and overlapping cuts extending into the heartwood. Spray the ring with poison.

All falling and ringing must be carried out at no more than 6 in. above ground level because the poison acts on the root collar. All useless veterans, regardless of species, which carry 30 per cent. or more of their normal crown are to be rung and poisoned as above." (p. 31)

FORESTERS' MANUAL – 1961

The Foresters' Manual : Control of Trade Operations. 1961

Registration of Timber Workers and Brands
"*1. The purpose of the registration of bush workers is the proper control of men directly engaged in the cutting and removal of timber from the forest, natural or planted, and the prevention of waste and damage in all associated operations. Consequently, it is necessary that every man who is engaged in the extraction of forest produce shall be a registered timber worker.*" (p. 7)

Timber Workers' Brands
"*19. Every person engaged in felling or hewing of Crown timber, including pine, must provide himself with a distinctive branding hammer to be obtained from the Forests Department at the prescribed cost, plus the registration fee. Timber workers must accept the designs allotted by the Department.*

20. No branding hammer shall be used by a timber worker unless it is registered with the Department. Evidence of registration and particulars of the timber worker's brand will be given on the timber worker's registration certificate." (p. 8)

Permits
"*53. A permit holder of any class of permit must operate continuously and comply with all the conditions of his permit, unless exempted by the Conservator.*[…]" (p. 12)

Quarterly Trade Cutting Operations
"*74a. Within 30 days of the close of each quarter, officers in charge of Divisions will submit a return of Trade Operation on Form F.D. 390B.*

The detailed information required for the area cut over is as follows:-
(i) Permit or License No. and local mill name.
(ii) Land Tenure – whether State Forest, other Crown Land, P.P.T. R. or Private Property.
(iii) Maiden or old bush.
(iv) Species – the area cut over by species and the number of loads of Jarrah, Karri, Wandoo and other species obtained.
(v) The total number of loads cut.
(vi) The average loads per acre – by species where possible." (p. 15)

Registration of Sawmills
"*78. Every sawmill used in the timber industry must be registered under and in accordance with the regulations made under the Timber Industry Regulation Act.*" (p. 16)

Pile and Pole Licenses
"*110. Owing to serious shortage of intermediate age classes in all areas of State forest and the need to conserve such growing stock to protect the future of the sawmilling industry, the Department for many years past has endeavoured to confine pile and pole getting to private property and land for alienation. However karri poles are now available in quantity as thinnings and large numbers of jarrah poles should be available in the near future, also as thinnings.*

111. Licenses for the cutting of piles and poles may be issued only over-
(i) land which is in process of alienation or alienated land on which timber has been reserved to the

Crown;

(ii) areas being cleared for pine planting or other purposes;

(iii) land which is being held, pending the removal of timber before alienation;

(iv) subject to special head office approval, State forests and timber reserves as a sylvicultural thinning operation (in which case the trees available for cutting must be marked in advance).

112. Licenses for the cutting of piles over 50' and poles over 45' length on State forest, timber reserves or other Crown land may be issued from time to time by instructions from head office. All such piles and poles must be marked in advance of felling, and bush inspections to prevent waste must be carried out at intervals when cutting is in progress." (p. 19)

"*114. Pile and pole licenses will in all cases set out the minimum and maximum crown diameter of the poles and/or piles authorised to be obtained.*[…]"(p. 20)

WORKING PLAN – 1960

General Working Plan 1960 For The Regulation Of The Cut In The Jarrah, Karri and Wandoo …Working Plan No. 81. 1960

General Note

"*This Plan is concerned primarily with the regulation of the cut on State Forest and potential State Forest as provided for under Section 31 (3) (a) and (b) of the Act.*" (p. 1)

Introduction And Summary Of Principal Prescription, Object and Period Of the Plan

"*The object of the Plan, as stated at greater length in Part II, is to stabilise the Timber Industry; to ensure continuity of timber getting operations, and in so doing, ultimately to bring the cutting of the forests in units known as 'working circles' to a sustained yield basis.*

The Principal Prescriptions as set out in Part II cover:-

(1) The subdivision of all available forest under State control in the South West Zone of Western Australia into Planning Sections, and Working Plan areas to provide, as far as possible, sufficient forest in each section or area to ensure continuity of operations of existing mills or their equivalents and townships depending upon them." (p. 3)

Part I (a) Forest Area : Ownership and Subdivisions

"*In a Working Plan dealing with a forest area of the extent of over 5 million acres, it is necessary to sub-divide into units which may be discussed in relation to assessment, sylviculture, management and economics.*

The generally accepted ideals of working circles and logging sections cannot be followed in a young country where there is insufficient mapping and assessment of the area under consideration, and in this State previous plans adopted 'Working Plan areas' as units, about 70 of these areas being defined.

These units have a history and records under the previous Working Plans, and although they are not an ideal sub-division, it is considered desirable to adhere to them with, in some cases, their breakdown to sub-units, A.B.C. etc. They are no way to be regarded as Working Circles.

In plans prior to 1956, prescriptions for cutting dealt with each Working Plan area separately, but in the 1956 plan it was considered better to group the areas into 'Planning Sections' and this grouping is still desirable for this 1960 plan.

In designing these 'sections' the main criteria used were:-
[…]
(c) to provide units for which some general forest description was possible, although this latter requirement conflicted to some extent with the other factors. These Planning Sections, 22 in number, tend to an area of quarter to half-a-million acres each and are numbered and named, commencing from the North …
[…]" (p. 5)

"*In Part II 'Prescriptions', it will be found that the whole of the forest area is covered by 5 year proposals, with sustained yield proposals wherever practicable.*" (p. 6)

Part I (c) : Sylvicultural Considerations
"*Regeneration on most forest types in W.A. follows with comparative ease, any trade cutting of Jarrah and Karri conducted under treemarking and controlled top disposal operations, but it is generally considered that particularly with Jarrah some canopy must be maintained for reasons of both sylviculture and economics.*

Both Jarrah and Karri, therefore, are treemarked under a selection or a Group Selection System with a restriction upon the size of the openings, which may be permitted, in the canopy. There is, however, a growing school of thought favouring a uniform system in Karri which may influence planning in the future. On this subject experiments are in hand.

Under the present sylvicultural and economic restriction on falling and logging the forest naturally lends itself to cutting cycles of 30 to 40 years representing the approximate time taken for Jarrah trees of 72" girth to reach the economic log girth of 90" and under this system it is seldom that all trees over 90" can be removed without reducing unduly the cover needed for the young crop or without sacrificing trees of vigorous growth.

Thus the timber available for removal in any 30 to 40 year cutting cycle is a percentage only of the total stand.
[…]

Apart from these sylvicultural considerations, it is necessary in some areas which are deficient in the 72" to 90" girth classes to hold vigorous Jarrah trees over 90" G.B.H. and Karri trees over 144" girth for management purposes, in order to provide a cut for the second or third cutting cycle.

These considerations, together with economic factors, discussed in Part 1 (d) govern the general rule adopted of providing, wherever possible, major forest subdivisions on which a township depends, with sufficient forest to guarantee a life of 30 years on the first cut under treemarking. In some cases the whole area is held under permit, and in other cases, a Working Plan area or group of areas is reserved for a project under the prescriptions.

During 1956-60 extensive inventory work aided by Air photogrammetry was carried out by Working Plans staff with the result that much more accurate figures are now available for the volumes of timber in the main areas of forest and this data makes it possible to adjust many of the permit areas in the interests of sustained yield for major centres." (p. 10)

Part I (d) : Economic Considerations
"*Economic considerations today demand that with increasing State population, the whole of the State Forest must be brought under protection and to the increment bearing stage as soon as possible, and to this end any expansion of the industry must be placed in the virgin forests of the far South, rather than being permitted to cut more than the sustained yield from the already heavily cut Northern portions of the Forest.*

In considering the total cut per annum permissible from State Forests, the most important economic consideration is the fact that there will not, for further generations, be more than about 4 million acres of merchantable forest, whereas today there are 5 million, as listed in paragraph 1 (a), together with large areas of private property which once cut may be lost to timber production." (p. 11)

"*This consideration led to the policy which has been followed that State Forest should be conserved and cutting directed as far as possible to areas being cleared for agricultural settlement and to areas of Private Property with timber reserved to the Crown. Such conservation, however, is not longer applicable and sawmilling in virgin areas is an essential first step in bringing the forest under management.*

Thus, whatever cut per annum may be determined for State Forest, it is desirable to place as much of it as practicable in the virgin areas of the far South as soon as economic conditions permit." (p. 12)

Part I (e) : Discussion Of The Forest Capital and the Permissible Cut

"*In Forestry 'par excellence' the calculation of the yield and the determination of the cut are more or less synonymous terms, and the calculation implies a wealth of statistics on the volume standing in the forest and its rate of growth under proved systems of sylviculture and management, followed by mathematical and economic calculations of no mean order.*

In a young country with large areas of virgin forest inaccessible except on foot and with little knowledge of the ultimate growth statistics which follow from the practice of sylviculture, a full calculation of the permissible cut in the mathematical sense is not possible. It is still necessary, however, to 'determine' the cut using whatever information is available, and if necessary, overcutting in order to open up forest areas to provide finance for their protection and expansion and to remove overmature and damaged trees which are a diminishing asset.

A discussion followed by a decision, rather than a calculation, must still remain the basis of determining the permissible cut for Western Australia, and prescriptions must retain elasticity in view of the lack of precise data." (p. 13)

Part I (f) : Assessment Figures and Definitions

"*Throughout this Working Plan, assessment figures quoted vary considerably in their reliability since, although the whole area of the plan has had some assessment, pre-War practice was to assess only those trees which the assessor considered marketable in this district at the date of the assessment.*

During the post-war period, more reliable data arose from Permanent line and Temporary line assessment, but it was not until 1954 that full air photo interpretation and new field book was introduced which aimed at recording all trees of all species over 60" G.B.H. and classifying them as to their estimated percentage recovery and at the same time making an inventory of growing stock below 60" G.B.H.

This latter work has covered mainly the Southern portion of the State, and is based upon field assessment lines covering one-third to one-half per cent of the forest area on each Working Plan area. Although this figure appears low compared to olden day strip line methods giving 2 ½ % to 5% ground coverage, it is considered that the accuracy of assessment is superior to even 5% ground coverage, particularly in forest areas of varigated pattern such as the Karri region." (p. 16)

"*The marketable loadage is the gross marketable loadage over 60" G.B.H. exclusive of Marri, and this is further sub-divided into 'Available loadage' and 'Acceptable loadage'.*

These terms are defined as: -

'<u>Available loadage'</u> – The volume, exclusive of Marri, which the Forests Department is prepared to treemark during a cutting cycle under sylvicultural control, provided there is a prescription for such cutting.

<u>'Acceptable loadage'</u> is a percentage of the loadage which it is anticipated mills in the district will take under today's economic conditions. It can be assumed, of course, that while the acceptable loadage today is sometimes as low as 50% of the gross loadage, this percentage will increase with the years." (p. 17)

"*<u>Sustained Annual Yield.</u> (S.A.Y.)*

This term is used frequently and means the safe yield of acceptable mill logs of over 60" G..B.H. over the period of adjustment necessary to bring the forest to normality. This period is not of fixed length as it depends upon the time taken to remove non-growing stock. Thus on some areas the S.A.Y. may be as low as 10 cubic feet per ac. Per annum, whereas at some future date it could be as high as 50 cu.ft." (p. 17)

"*<u>Terms used in Sub-division</u>*
The term 'Planning Section' has been adopted as neither the old Working Plan areas nor their present grouping can be regarded as constituting working circles in the rigorous sense.

It will be found from the prescriptions, however, that many of the main Planning Sections are approaching the requirement for 'Working Circles' and at the 1965 revision following some adjustments the term 'Working Circle' in the sense of an area devoted to a sustained yield and under a separate Working Plan will be adopted for some of the areas of permanently dedicated forest now described as Planning Sections, but even after 1965 it is unlikely that some of the larger areas of Virgin Forest could properly be regarded as Working Circles." (p. 18)

Part II : Prescriptions For Future Management
Part 2 (a) : Objects Of Management And Period Of The Plan
"*The main object of the Working Plan remains, as it always has been, to stabilise the Timber Industry; including both sawmilling and other forms of utilisation to ensure continuity of operations, regular employment for the men engaged, and long life for the timber trade and the communities and industries dependent upon it; and by so doing, to bring the cutting of the forests to a sustained yield basis.*" (p. 19)

"*While the main object of management of the State Forests is to ensure that such areas are brought on to the basis of sustained yield, this desideratum cannot be accurately obtained until more precise data is available on the forest inventory and the rate of growth of species, and until the whole of the potential State Forest area is dedicated, under fire protection and in thrifty condition sylviculturally. This position could be reached by 1970.*

The approximate permissible cut can at any period be calculated only in the light of current knowledge of many factors, and frequent revisions of the Working Plan are necessary as further data comes to hand." (p. 19)

Part 2 (b) : Determination and Regulation Of The Cut and Issue of Cutting Rights
"*Apart from determining the cut, a regulation or distribution of the cut is necessary.*

This regulation of the cut includes, not only the determination of the gross cut, but also the actual distribution of the cutting. The retention of existing mill towns is an important factor. The necessity to cut and protect large virgin areas which are not bearing net increment has to be taken into account, together with the fact that over the past four decades the gross permissible cut on permits issued has never been realised due to losses of mills by fire, to labour shortages and to periods of trade recession." (p. 20)

"*The importance of the correct distribution of the cutting, as previously mentioned, must be stressed as although the gross cut can be substantially increased, it is evident that to ensure sustained yield on the cut over forest north of the Preston Valley, some centres must face a reduction of cut and the additional cutting must come from Virgin forests South of this line.*" (p. 21)

Part 2(c) : Detailed Prescriptions For Planning Section
(i) Summary of Part 2(c) Prescription
"*The cutting of the Jarrah, Karri and Wandoo forests of permanent land tenure as prescribed in this working Plan is now considered to be below the sustained yield potential of the State Forests.*" (p. 22)

"*All Planning Sections of permanent tenure are covered by prescriptions which permit of sustained yield within each section itself, or alternatively, the plan prescribes the action necessary to bring about adjustments within a 5 year period to accomplish this end. Areas are held in reserve pending greater refinement of assessment work, which will enable more precise calculations to be made by 1965.*" (p. 22)

"*Large planning sections of virgin forest nearing two million acres are now available for sawmilling, on a sustained yield basis, additional to the established centres, and while an early start on these areas is desirable in the interests of forest management, it is unlikely that the economics of the timber trade and the time factor for planning will permit of full development during the 5 year period of this plan. These areas will have the advantage of being planned on a sustained yield basis from the outset guided by the knowledge gained during the history of forestry and sawmilling in the cut-over portion of the forest.*" (p. 22)

Part 2 (d) (i) : Sylviculture and Protection

"*The regeneration and protection of State Forests is supervised by Officers-in-Charge of Divisions, governed by policy as laid down in the Foresters' Manual and periodic instructions. Work is superintended by Specialist officers.*

The basis of our Sylvicultural work is that the regeneration shall be the result of the fellings themselves and cuttings are controlled to this end as well as for considerations of management.

Close control of treemarking on permits under the 'selection' system ensures the retention of growing stock and its protection during falling operations. Advance burning before milling and top disposal operations after milling, ensure a new stocking of the openings by natural regeneration either from seed or from advanced growth.

Sylvicultural treatment required for special areas is the subject of instructions from the Conservator.

Top disposal and regeneration of all areas of forest cut over in the past are up-to-date, and, subject to the delaying of Top Disposal Burning in a few cases awaiting a seed year, the whole of the country cut over annually by sawmills receives this treatment. Cut over areas of approximately 2 million acres, apart from minor portions, are satisfactorily stocked with regrowth.

Current policy and explanations of sylvicultural work is summarised in the following papers.

'Second growth karri forest' by J.C. Meachem, 1954.

'Regeneration of jarrah' by A.C. Harris, 1955.

These papers are too lengthy for inclusion in this plan but are filed with the original Working Plan documents.

Fire protection is the responsibility of Divisional and District Officers assisted by the Fire Control Superintendent and his Staff. The permissible cut for future cutting cycles is intimately connected with the success or failure of fire protection and its extension into new areas. It is based upon controlled burning in Autumn, Winter and Spring months, and early suppression of fires in Summer. Its extension into areas at present unprotected is proceeding rapidly." (p. 25)

"*Temporary assessment lines run on each quarter's cutting by the treemarkers themselves assist to keep them aware of the loadages marked and trees retained by them and provide data for Divisional Office and Head Office checks against the quarterly and annual cutting records.*

Permanent growth study plots are established as required and serve the dual purpose of recording the loadage remaining per acre for future use and or providing the basis for growth studies for management purposes.

Quarterly Trade Operations summaries from Divisions also record areas cut over within and outside State Forest, and loads obtained by species together with records of sylvicultural work and protection." (p. 26)

FORESTERS' MANUAL – 1960

Foresters' Manual : Field Administration. 1960

Land Inspection

"*59. All applications received by the Lands Department for land within timber districts are referred to the Forests Department for report. In certain cases there is sufficient information available in head office from past inspection reports, special assessments, etc., to enable a reply to be sent to the Lands Department. In the majority of cases, however, it is necessary to obtain further information by field inspections. The primary object of such inspections is to ensure:*

(1) That good quality forest suitably situated shall be retained for dedication as State Forest;

(2) That the alienation of land shall not interfere with the economic management of State Forest as a result of the loss of necessary water supply, access routes, etc.; […]" (p. 20)

Field Notes

"*66. Field notes will be entered in the same way as for A.P.I. and quarterly assessment. As he paces or chains along the classification line, the inspection officer must enter, at 10 chain intervals-*

(a) marketable log timber over 90 inches girth;

(b) marketable log timber under 90 inches girth;

(c) timber removed; …

(All the above figures are to be given as loads per acre in the round, full volume measure.

(d) notes on piles, poles, regrowth, understorey, and ground vegetation;

(e) descriptive notes of soil types;

(f) other information under the headings in the field book – especially marri.

67. Attention is drawn to the necessity for qualifying such descriptions as 'poor', 'open', 'good', 'sparse', 'scattered', 'dense'. In themselves, these terms have very little meaning, and particulars concerning average heights, number of stems per acre, and similar information are essential. […]" (p. 21)

Forest Types

"*72. Forest type boundaries are to be noted in the field book so that area of each type can be calculated later and the appropriate assessed volume per acre applied to obtain a total loadage figure.*

The forest type is determined by the forest species with the greatest number of stems. If more than about 20 per cent of the stems consist of a second or third species, this is also listed. […]" (p. 22)

Stocking

"*74. Give details of the distribution of age classes, for example:-*

Open pole stand
Mainly large and over-mature trees.
All classes present.
All classes present but poles malformed because of fire damage
Open, malformed forest mainly below 60 in. G.B.H.
Appears to be mature.
Larger trees malformed apparently by fire. Saplings and poles are of better form due to absence of fire.

Note the presence or absence of advance regrowth or regeneration and also the species." (p. 22)

Fire Damage

"*75. Give notes to indicate the extent to which the forest has suffered from fire. For example:-*

Epicormic shoots up all stems.
Crowns severely damaged at intervals in the past.
Good crowns and no evidence of severe fires.
Give date when estimated last burnt." (p. 22)

Piles and Poles
"*76. Give number and species over 50 ft. If they are over 60 in. G.B.H. the volume will be assessed.*" (p. 22)

Recommendations
"*85. F.D. 89 calls for recommendations from the inspecting officer under four headings-*
(1) for immediate alienation;
(2) alienation subject to marketable timber being reserved for the Crown;
(3) reserved until marketable timber removed;
(4) for permanent dedication as State forest.

An officer making a recommendation under these headings must remember that present-day timber values are not the only guide and that considerable thought needs to be given to the area under consideration, as decisions made today may have far-reaching affects in the future.

Some of the many factors which need consideration are-
(1) the necessity for preserving lines of access for hauling and fire control;
(2) the question of fire lines and the State Forest boundaries;
… (4) the effect of an alienation upon fire hazards in the locality;
(5) where areas are distant from State Forest it must be kept in mind that timber reserves, even if the timber is of low present-day value, should be held for settlers' requirements in the future.

The remarks column of the report provides space in which to set out reasons for the recommendation made." (p. 24)

REGULATIONS - 1957

Forest Regulations. 1957.

Part IV. Regulations
General.
"*123. A timber worker or other person causing damage to growing trees or other forest produce, or not utilising trees felled or other forest produce obtained to the best advantage, or who in felling operations causes waste of timber by felling trees at too great a height above the ground level, shall be guilty of a forest offence.*" (p. 19)

WORKING PLAN – 1956

General Working Plan 1956, Jarrah, Karri & Wandoo (Original) and Planning Section Data : Working Plan no. 79 (1956-1960)

Introduction and Summary of Principal Prescription, Object and Period of the Plan
"*The object of the Plan, as stated at greater length in Part II, is to stabilise the Timber Industry; to ensure continuity of timber getting operations, and in so doing, ultimately to bring the cutting of the forests in units known as 'working circles' to a sustained yield basis.*" (p. 3)

Part 1 : Summary of Facts and Discussions
Part 1a : Forest Area, Ownership and Subdivisions
"*In a Working Plan dealing with an area of the extent of over 6 million acres, it is necessary to have sub-divisions of the area in order to have units which may be discussed in relation to assessment, sylviculture, management and economics.*

The generally accepted ideals of working circles and logging sections cannot be followed in a young country where there is insufficient mapping and assessment of the area under consideration, and in this State previous plans adopted 'Working Plan areas' as units, about 70 of these areas being defined.

These units have a history and records under the previous Working Plans, and although they are not an ideal sub-division, it is considered desirable to adhere to them with, in some cases, their breakdown to sub-units, A.B.C. etc. They are in no way to be regarded as Working Circles.

In previous plans, prescriptions for cutting dealt with each Working Plan area separately, but in this plan it is considered better to group the areas into 'Planning Sections'.

In designing these 'sections' the main criteria used were:-
[…]

(c) to provide units for which some general forest description was possible, although this latter requirement conflicted to some extent with the other factors. These Planning Sections, nineteen in number, tend to an area of quarter to half-a-million acres each and are numbered and named, commencing from the North, as follows:-

1. *Moore River-Serpentine River.*
2. *Toodyay-Mundaring.*
3. *Mt. Dale-Serpentine.*
4. *Serpentine River-Murray River.*
5. *Murray River-Mornington.*
6. *Collie.*
7. *Bowelling-Darkan-Williams.*
8. *Boyup Brook-Kulikup.*
9. *Kirup-Greenbushes.*
10. *Busselton-Augusta.*
11. *))*
12. *Jarrahwood-Blackwood River.*
13. *Manjimup-Blackwood River.*
14. *East Manjimup.*
15. *Pemberton-Shannon River.*
16. *Shannon River-Frankland River.*
17. *Shannon-Walpole.*
18. *Frankland River-Denmark River.*
19. *Denmark River-Albany.*
20. *Wandering-Beverley.*" (p. 5)

"*Of the area of 6.8 million acres, permits are held covering approximately 3, 600, 000 acres, leaving 3 million acres not held under permit.*

This figure is only of passing interest, in view of the fact that in some cases a whole Working Plan area is held under permit, while in others the area is reserved under prescription for a mill town, although a permit or license may not be issued even during the 5 year period of this Plan.

In Part II 'Prescriptions', it will be found that the whole of the 6.6 million acres is covered by 5 year proposals, with perpetual yield proposals wherever practicable." (p. 6)

Part 1(c) : Sylvicultural Considerations
"*Regeneration follows with comparative ease, any trade cutting of Jarrah and Karri conducted under treemarking and controlled top disposal operations, but it is generally considered that particularly with Jarrah some canopy must be maintained to ensure that the young growth does not fork at an early age.*

Both Jarrah and Karri, therefore, are treemarked under the Group Selection System with a restriction upon the size of the openings, which may be permitted, in the canopy.[…]

Under the present sylvicultural restriction on falling and logging the forest naturally lends itself to cutting cycles of 30 to 40 years representing the approximate time taken for Jarrah trees of 72" girth to reach the economic log girth of 90", and under this system it is seldom that all trees over 90" can be removed without reducing unduly the cover needed for the young crop or without sacrificing trees of vigorous growth.

Thus the timber available for removal in any 30 to 40 year cutting cycle is a percentage only of the total stand. […]

Apart from these sylvicultural considerations, it is necessary in virgin areas which are deficient in the 72" to 90" girth classes to hold vigorous Jarrah trees over 90" G.B.H. and Karri trees over 144" girth for management purposes, in order to provide a cut for the second cycle of 30 to 40 years." (p. 10)

"*Economic considerations today demand that with increasing State population, the whole of the State Forest must be brought under protection and to the increment bearing stage as soon as possible, and to this end any expansion of the industry must be placed in the virgin forests of the far South, rather than being permitted to cut more than the sustained yield from the already heavily cut Northern portions of the Forest.*" (p. 11)

"*This consideration appears to suggest that for the immediate future State forest should be conserved and cutting directed as far as possible to areas being cleared for agricultural settlement and to areas of Private Property with timber reserved to the Crown. Such conservation, however, is not to be taken to extremes, as sawmilling in virgin areas is an essential first step in bringing the forest under management.*

Thus, whatever cut per annum may be determined for State Forest, it is desirable to place as much of it as practicable in the virgin areas of the far South." (p. 12)

Part II : Prescriptions for Future Management
Part 2 (a) : Objects of Management and Period of the Plan
"*The main object of the Working Plan remains as it always has been, to stabilise the Timber Industry; to ensure continuity of operations, regular employment for the men engaged, and long life for the timber trade and the communities and industries dependent upon it; and at the same time, to bring the cutting of the forests to a sustained yield basis.*" (p. 19)

"*While the main object of management of the State Forests is to ensure that such areas are brought on to the basis of sustained yield, this desideratum cannot be accurately obtained until more precise data is available on the forest inventory and the rate of growth of species, and until the whole of the potential State Forest area is dedicated, under fire protection and in thrifty protection and in thrifty condition sylviculturally.*

The approximate permissible cut can at any period be calculated only in the light of current knowledge of many factors, and frequent revisions of the Working Plan are necessary as further data comes to hand.

The determination of a permissible cut has also to be considered in the light of severe losses from fire in virgin forests over the past 3 decades, which losses are still occurring and which have become more apparent as these areas become more fully known. Such areas can be held as reserves for the future, only in theory, unless they are placed under protection, and the introduction of sawmilling becomes necessary as a means to the end of having them 'roaded' and protected." (p. 19)

Part 2 (b) : Determination and Regulation of the Cut and Issue of Cutting Rights
"*This regulation of the cut includes, not only the determination of the gross cut, but also the actual distribution of the cutting. The retention of existing mill towns is an important factor. The necessity to cut and protect large virgin areas which are losing volume by uncontrolled fire has to be taken into account, together with the fact*

that over the past three decades the gross permissible cut on permits issued has never been realised due to losses of mills by fire, to labour shortages and to periods of trade recession." (p. 20)

Part 2 (c) : Detailed Prescriptions for Planning Section
(i)Summary of Part 2(c) Prescriptions
"*All Planning Sections of permanent tenure are covered by prescriptions which permit of sustained yield within each prescriptions which permit of sustained yield within each section itself, or alternatively, the plan prescribes the action necessary to bring about adjustments within a 5 year period to accomplish this end. Areas are held in reserve pending greater refinement of assessment work, which will enable more precise calculations to be made by 1960.*" (p. 22)

"*During the 5 year period of this plan, it is confidently expected that forest assessment and knowledge of growth rates will reach a high standard and that in the 1960 revision of this Working Plan, sustained yield prescriptions will set a standard for the management of Eucalypt forests under Working Circles.*

Part 2 (d) : Miscellaneous Prescriptions
Part 2 (d) (i) Sylviculture and Protection
"*The regeneration and protection of State Forests is supervised by Officers-in-Charge of Division, governed by policy as laid down in the Foresters' Manual and superintended by senior officers.*

The basis of our Sylvicultural work is that the regeneration shall be the result of the fellings themselves and cuttings are controlled to this end as well as for considerations of management.

Close control of treemarking on permits under the 'selection' system ensures the retention of growing stock and its protection during falling operations. Advance burning before milling and top disposal operations after milling, ensure a new stocking of the openings by natural regeneration either from seed or from advanced growth.

Sylvicultural treatment required for special areas is the subject of instructions from the Conservator.

Top disposal and regeneration of all areas of forest cut over in the past are up-to-date, and, subject to the delaying of Top Disposal Burning in a few cases awaiting a seed year, the whole of the country cut over annually by sawmills receives this treatment. Cut over areas of approximately 2 million acres, apart from minor portions, are satisfactorily stocked with regrowth.

Current policy and explanations of sylvicultural work are summarised in the following papers.
[…]
'Regeneration of Jarrah' by A.C.Harris, 1955.

[…]
Fire protection is the responsibility of Divisional and District Officers assisted by the Fire Control Superintendent and his Staff. The permissible cut for future cutting cycles is intimately connected with the success or failure of fire protection and its extension into new areas. It is based upon controlled burning in Autumn, Winter and Spring months, and early suppression of fires in Summer, and its extension into areas at present unprotected is proceeding rapidly." (p. 25)

Part 2 (d) (ii) : Working Plan Control and Records
"*Annual cutting coupes for each Sawmill Permit are approved by the Conservator or his representative.*" (p. 25)

"*Areas cut over quarterly by each mill are recorded on progress plans at field offices, and this information is transferred annually to the record plans at Head Office showing areas cut over for the year, species and loads obtained and a record of the area of each permit remaining to be cut over.*" (p. 25-26)

"*Temporary assessment lines run on each quarter's cutting by the treemarkers themselves assist to keep them aware of the loadages marked and trees retained by them and provide data for Divisional office and Head Office checks against the quarterly and annual cutting records.*

Permanent assessment lines are established as required and serve the dual purposes of recording the loadage remaining per acre for future use and of providing the basis for growth studies for management purposes.

Quarterly Trade Operation summaries from Divisions also record areas cut over within and outside State Forest, and loads obtained by species together with records of sylvicultural work and protection.

With the foregoing information available, the Management Branch incorporates such information as is necessary in the Detailed Annual Report and the Conservator's Annual Report to Parliament. These reports, together with the plans, assessments and tables abovementioned form the records necessary for forest management and the information for periodical revision of the Working Plan." (p. 26)

FORESTERS' MANUAL – 1956

The Foresters' Manual. Part III Fire Control (South-West – 1956). 1956

The Importance of Fire Control
"*745. The problem of fire control is intimately bound up with the questions of reforestation and afforestation and the ultimate success of the Department's efforts in these projects is largely dependent on a strong measure of public sympathy and co-operation in attacking the fire problem.*

746. Of almost equal importance is the proper use of controlled fires in silvicultural and protective operations." (p. 5)

LEGISLATION – 1954

Forests. No. 43 of 1954

"*AN ACT to amend the Forests Act, 1918.*

[Assented to 8th December, 1954]." (p. 193)

Part V.- Financial Provisions
Revenue and Expenditure
"*9. Section forty-one of the principal Act is amended-*

(a) by substituting for the word, 'Three-fifths', being the first word in subsection (2), the word, 'Nine-tenths'; and

(b) *by adding after the word 'concessions' being the last word in subsection (5), the words, 'but shall not include rents derived from dwellings'.*" (p. 195)

FORESTERS' MANUAL - 1953

The Foresters' Manual. Part II, Reforestation and Sylvicultural Operations (Jarrah and Karri). 1953

Operations : Jarrah and Karri
Problems and Methods of Regeneration.
"*618. Foresters need to keep before them at all times the fact that their work is primarily to increase the yield of the forests. Forest management, sylviculture and protection accompanied by efficient utilisation of the mature and overmature trees are necessary to contribute to this end*." (p. 5)

"*619. In Western Australia, we are fortunate in having as our two main species, Jarrah and Karri, which regenerate comparatively easily following trade cutting, but this very fact may frequently cause foresters to lose sight of the importance of studying carefully the effects of burning, treemarking for trade cutting, seed trees, seed years and other sylvicultural problems. The aim is that the regeneration shall be the result of the fellings themselves. Jarrah regeneration is obtained partly from advance growth resulting from seedling coppice. Subsequent establishment of seedlings in the blanks takes place for a few years until complete stocking is secured*." (p. 5]

"*621. Natural regeneration of the forest follows the opening of the canopy resulting from trade cutting, and treemarking therefore, is the first step in regeneration operations, apart from precautionary measures such as advance burning*." (p. 5)

Sequence of Operations
"*622. The sequence of operations, according to existing practice In Western Australian forests to ensure regeneration of the forest is as follows:-*

(a) Advance burn.
(b) Treemarking.
(c) Trade cutting of the older age classes.
(d) Top disposal.
(e) Regeneration operations if necessary.

(a) *Permanent assessment lines.*" (p. 5)

"*627. By cutting in accordance with the group selection system regeneration can be assured and conditions are provided for the satisfactory development of the regrowth.*

628. Standards, for the guidance of officers engaged in treemarking, will be detailed by a Regional Forest Officer and it is essential that officers doing treemarking should realise the important part their work plays in inducing a new crop. Vigorously growing immature trees, whether occurring in groups or isolated, must on no account be marked for cutting.

629. Officers must realise that it is obviously not good forest practice to remove an existing good immature tree or group of such trees to make room for a new crop which will take much longer to reach maturity. It will be realised that definite girth measurements are not an indication of maturity but girth standards are used as a guide to the treemarker. Officers entrusted with the important work of treemarking will receive personal instructions from senior officers on the subject." (p. 6)

Top Disposal
"*639. This operation of vital importance to protection and regeneration is dealt with under 'Fire Control'. In most cases today, this operation completes the work necessary to ensure the establishment of the new crop.*" (p. 7)

Jarrah Regeneration
"*640. In virgin bush this should be the result of the fellings themselves, and as stated above the complete stocking is secured after a few years. In former cut-over bush satisfactory regrowth is becoming established in most places. Earlier it was the practice to carry out ringbarking and minor cutting known as regeneration cleaning. This is no longer done and the term regeneration cleaning has therefore fallen into disuse.*" (p. 7)

Thinning
"*645. The purposes of thinning are, where possible, to cut for sale those trees which will otherwise die in the struggle for existence-in the growing stand, also to effect by selection, among the stems, some improvement in the constituent members of the crop and to provide increased growing space for those trees remaining. The Jarrah and Karri forests are comparatively open forests even for Eucalypts. Those trees which are desirable piles and poles for trade purposes, are the best trees in the forest and are therefore those which should be retained to form the future crop. Only a very limited thinning for some poles, chiefly from the sub-dominant trees, is therefore possible in the Jarrah and Karri forests. The problem is even more accentuated in the Wandoo forest.*" (p. 8)

Temporary Assessment Lines
(Quarterly Assessment)
"*650. All treemarkers, at the close of each quarter, are required to assess a portion of the area cut over and to forward the results of this work to the D.F.O., who summarises the work for various permits and forwards to Head Office with the Quarterly Report.*
651. The objects of these assessments are:-
(a) To inform the D.F.O. and the treemarker himself of the volume he is removing and the volume he is retaining per acre.
(b) To inform Head Office for management purposes and working plan calculations.
(c) To provide data for future use with air photos interpretation.
[…]
653. The Department requires to have on record for application to air photo interpretation, a number of heights of co-dominant trees throughout all parts of the forest." (p. 9)

"*655. The information required for each tree is:-*
(a) Girth at stump height – state whether under bark or over bark.
(b) Total height of tree
(c) Length of log recovered.
(d) Length from ground level to the fork, i.e., the total bole length.
[…]" (p. 10)

Permanent Assessment Lines
Section 1- First Assessment
"*658. Following on trade cutting, it is necessary to establish permanent plots or assessment lines on which the remaining trees are measured periodically to provide data for growth studies and forest management. Permanent lines in lieu of plots have been adopted as standard practice in this State.*

659. Uniformity in all details in all Divisions is important in this work in view of the long term nature of the studies depending on the first measurements." (p. 10)

REFER TO TEXT FOR DETAILS OF:
Selection of Starting Point
Poling the Line
Pegging the Line
The Assessment

Tree Classification
682. Standing Trees
A. Over 90in. G.B.H. (Karri over 108in.).

"*(i)Trees retained as growing stock (or will be retained where bush not previously treemarked). Sometimes only fair trees are retained because there is nothing better.*

(ii)Trees held for special reasons. In tree-markedbush this includes logs held-
(a) To prevent damage to immature growth.
[…]
(iv)Trees not at present exploitable. […]" (p. 12-13)

B. Trees between 72in. and 90in. G.B.H. (Karri 72in.-108in.).
"*(i)Growing stock for the future.*
(ii)Trees that could be removed-too defective for future growing stock.
(iii)Trees not at present exploitable because of defects (volumes will be calculated).

C. Trees between 60in. and 72in. G.B.B. (Karri likewise).
(i) Dealt with in same manner as B.
(ii) " " " "
(iii) " " " "

D. **Under 60in. G.B.H. Piles and Poles (tree classes).**
When above 60in. G.B.H. engineers' piles and poles will be classified according to their girth class, but the letter 'E' will be added in the class columns, e.g., BI (E).

Engineers' Piles and Poles.

Poles (all species)
Minimum length 20ft.
Minimum crown diameter 6in.
Maximum crown diameter 9in.

Piles (all species)
Minimum length 20ft.
Minimum crown diameter 10in.
Maximum crown diameter 16in.

Record position, crown diameter and length of engineers' piles and poles. For others down to 24in. G.B.H. record number only, but not on a separate line-see specimen page of field book.

683. Removed Trees.
Jarrah.
Over 90in. over bark-Rl.
Under 90in. over bark-112.

[…]" (p. 13)

REFER TO TEXT FOR DETAILS ON THE FOLLOWING:
687. Survey Ties.
688. Air Photo Interpretation (A.P.I.)

"689. **Sylvicultural Condition**.-*At the end of each 20 chain give a brief summary of 'sylvicultural condition.' e.g.-*
Dense saplings 30ft. high.
Dead tops.
Badly fire damaged.
Good poles.

690. **Understorey.-***At the end of each 20 chain give brief notes on understorey over 10ft. high, e.g., merchantable sheoak, dense banksia.*

691. **General**. *-Leave one line break in booking to indicate:-*

(a) End of each five chain.
(b) Change of forest type.
(c) Change of site quality.
(d) Change from virgin cut-over bush.
(e) Block boundaries." (p. 14)

REFER TO TEXT FOR DETAILS ON THE FOLLOWING:
Field Book.
Method of Measurement
Log Length
Total Height
Painting
Calculation of Volumes
Equipment Required
Plans Identifying Sections of Line Run
Field Books and Head Office Work
Assessors' Journals

Information from Head Office
"*721. Each field book will, after computation, be summarised normally in 50 chain sections, i.e., 10 acre units, unless distinct forest type changes occur when the summaries will be made to conform with types.*
722. This information will be sent to the D.F.O. or District Forester concerned who should, as necessary, pass information to the assessor or other officers concerned." (p. 18)

Section 2 – Re-Assessment
"*723. In re-assessment, the main object is to ascertain the growth rate of the forest. Re-assessments will be made at intervals of not less than 10 years.*" (p. 18)

REFER TO TEXT FOR DETAILS ON THE FOLLOWING:
Increment Calculation
Trees to be Remeasured
Booking During Remeasuring
Locating the Line to be Remeasured
Field Assessment
Measurement of Standing Timber (see Permanent Assessment of Meridian Lines for new classification)

FORESTERS' MANUAL - 1950

The Foresters' Manual, Part I. General District Work (South-West). Section 2. The Timber Trade. 1950

Pile and Pole Licenses

"*111. Owing to serious shortage of intermediate age classes in all areas of State forest and the need to conserve such growing stock to protect the future of the sawmilling industry, the Department for many years past has endeavoured to confine pile and pole getting to private property and land for alienation.*

112. Licenses for the cutting of jarrah piles and poles may be issued only over-

(i) land which is process of alienation or alienated land on which the timber has been reserved to the Crown.
(ii) areas being cleared for pine planting or other purposes;
(iii) land which is held, pending the removal of timber before alienation.
(iv) subject to special head office approval, State forests and timber reserves as a sylvicultural thinning operation (in which case the trees available for cutting must be marked in advance)." (p. 14)

"*113. Licenses for the cutting of jarrah piles 50 feet in length and over on State forest, timber reserves or other Crown land may be issued over additional areas indicated from time to time by instructions from head office. The cutting of these piles is being restricted to certain sections of virgin forest in the extreme South-West. All such piles must be marked in advance of felling …*" (p. 15)

"*115. A pile and pole licence in the form F.D. 202 must be obtained in all cases before piles or poles are cut. Licenses will be issued only to persons holding definite orders for the supply of piles or poles for use within the State who may be required to produce their orders or satisfactory evidence thereof. The term and area for which the license is issued must be clearly shown on the form. In no case should a license be issued for more than three months.*

116. Pile and pole licenses will in all cases set out the minimum and maximum crown diameter of the poles and/or piles authorised to be obtained. […]" (p. 15)

Exemptions to work on Private Property

"*144. Exemption to enable operations being conducted exclusively on private property will only be granted subject to the permit holder agreeing to keep a record of his operations and submit returns monthly in the same manner as is required by the Regulations when operating on Crown lands.*" (p. 18)

FORESTERS' MANUAL - 1950

The Foresters' Manual. Part I. General District Work (South-West). Sections 5. 6. 7. Administration and Land Inspection. 1950

Land Inspection

"*459. All applications received by the Lands Department for land within timber districts are referred to the Forests Department for report. In certain cases there is sufficient information available in head office from past inspection reports, special assessments, etc., to enable a reply to be sent to the Lands Department. In the majority of cases, however, it is necessary to obtain further information by field inspections. The primary object of such inspections is to ensure –*

(1) that good quality forest suitably situated shall be retained for dedication as State Forest;
(2) that the alienation of land shall not interfere with the economic management of State Forest as a result of the loss of necessary water supply, access routes, etc.;
(3) that marketable timber in excess of the quantity required by a settler to effect necessary improvements on land selected shall not pass from the ownership of the Crown or be destroyed in the process of clearing, etc." (p. 13-14)

Form of Inspection Report
"*460. In all cases where no special instructions are issued, a complete report on printed form F.D. 89 is required. When submitting a land inspection report on this form, no forwarding letter is required.* […]" (p. 14)

Method of Inspection
"*462. As he paces along the classification line, the inspecting officer must enter, at 10-chain intervals-*
(a) marketable log timber over 90 inches girth;
(b) marketable log timber under 90 inches girth;
(c) timber removed.
(All the above figures to be given as loads per acre in the round, full volume measure.)
(d) notes on piles, regrowth, understorey and ground vegetation, and descriptive notes of soil types.

As he passes from one type to the next, a line must be drawn in the notebook and separate records kept of the loadages and vegetation on each type." (p. 14)

Recommendations
"*468. F.D. 89 calls for recommendations from the inspecting officer under four headings-*
(1) for immediate alienation;
(2) alienation subject to marketable timber being reserved to the Crown;
(3) reserved until marketable timber removed;
(4) for permanent dedication as State forest.

An officer making a recommendation under these headings must remember that present day timber values are not the only guide and that considerable thought needs to be given to the area under consideration, as decisions made today may have far-reaching affects in the future." (p. 15)

WORKING PLAN – 1945

Working Plan No. 67 : Jarrah, Karri & Wandoo Working Plan Area. 1945

Chapter II : Objects of Management
"*The purpose of the Working Plan has always been to stabilise the Timber Industry to ensure continuity of operations, regular employment for the men engaged, and long life for the timber trade which has been so important in the development of the South West.*" (p. 2)

Chapter III : History
"*The approval of the Jarrah and Karri Working Plans in 1929 and 1927, respectively, was an attempt to correlate all Working Plans and to place the timber industry of Western Australia as a whole on a regulated yield basis. Prior to that date, the volume of timber cut was controlled only by the number and size of the milling plans which happened to be established at any particular time.*" (p. 3)

"*Using a 45-year cutting cycle, figures obtained from the stocktaking were used as a rough basis of the calculation, which was to spread the growing stock over 72" B.H.G. over the next 45 years, in the expectation that the immature trees would provide for the cut at the end of that time. This volume of 20 ½ million loads gave a permissible annual cut of 460, 000 loads (in the log) for Jarrah.*" (p. 3-4)

Chapter IV : Calculation of the Cut
"*A revised estimate shows there are now available for general sawmilling –*

Jarrah 13, 530, 000
[…]

This volume on the basis of a 30-year cutting cycle will provide an annual cut of 600, 000 loads more or less according to the actual location of the mills. At the end of 30 years it is intended that a second cutting cycle, though perhaps with a considerably reduced cut, can begin." (p. 5)

"*A cut of 600, 000 loads in the round means an output, on a 33-1/3% recovery basis, of approximately 200, 000 loads, or 10 million cubic feet in the square.* […]" (p. 5)

Chapter V : Prescription
"*The problem of regulation of the cut includes not only the actual volume to be cut and the relationship between that and the volume to be left as growing stock, but also the actual distribution of the cut. This becomes progressively much more important as the years go on, when the retention by one mill of insufficient country for, say, 40 years becomes an influential factor. For this reason, the cut must be set out by mills, which will form the basis of any future regulation, rather than by a comparison of total volume and annual cut.*

It must be noted, also, that certain assumptions have to be made regarding the degree of utilisation which will be achieved in the trade cutting, and also in the rate of growth that can be expected from the immature growing stock.

The estimates of the cut in the second and third decades are only tentative and given as a guide. They will be subject to correction at revisions of the Plan. Although a cut of more than 600, 000 loads has been estimated and shown on the schedule, the actual cut during the war will be only about 450, 000 loads, and it will take some time after the war's end to reach the prescribed cut." (p. 8)

REGULATIONS - 1935

Forest Regulations. 1935

General
"*124. Any timber worker or other person causing damage to growing trees or other forest produce, or not utilising trees felled or other forest product obtained to the best advantage, or who in felling operations causes waste of timber by felling trees at too great a height above the ground level, shall be guilty of a forest offence.*" (p. 1240)

WORKING PLAN – 1929
[with amendments to 1936]

General Working Plan No. 60 : Jarrah Forest. 1929

3. Present Condition of the Forest
"[…] *In the early days of the industry a very high standard of log was demanded. As early as July, 1905, a regulation restricting the cutting of Jarrah to trees over 90" in girth was gazetted and applied to all leases and permits. Since that date, a regulation prescribing the minimum girth for the felling of trees has continued to operate, but, with extension of silvicultural work, the practice of tree marking according to the Group Selection System is being steadily extended.*

It is found that, with closer control of exploitation, the whole of this cut-over forest will yield further mature mill logs, and on 846, 460 acres the volume of this class of timber remaining is sufficient to warrant the relaying of tramlines for the purpose of further logging operations if permitted.

Certain of this timber is damaged as a result of the earlier falling operations, but the extraordinary durability of Jarrah has prevented any rapid deterioration. […]" (p. 2)

"*Vigorous natural regeneration has followed the falling operations in practically all centres, but absence of cultural or protective measures has caused slow development and damage, so that, generally speaking, the forest is understocked, and there is a serious shortage of older age classes among the regrowth.*" (p. 3)

4. Objects of Management
"*The purpose of this general Working Plan is to establish the sawmilling industry in the Jarrah forests of Western Australia on a sustained yield basis.*" (p. 4)

5. Rotation
"*Pending accurate measurements over a longer period of years, the rotation for Jarrah has been tentatively fixed at 90 years.*" (p. 4)

7. Reforestation Measures
"*The determination of the permissible cut dealt with in Section 8 is based on the assumption that the rapid extension of reforestation and protective measures will provide, within the next few years, that the area being treated annually is at least equal to the area being worked over for mill logs. In effect, this will ensure that the removal of the mature crop is treated as the first stage in regeneration operations, but, in order to increase the total annual increment to a figure which will justify, with as little delay as possible, an increase in the permissible annual cut, it is necessary that such operations be further extended to deal with large areas of prime forest cut over during the past 30 or 40 years. In other words, there is a serious leeway to be made up, and the only method by which the permissible annual cut can be legitimately increased is by expediting treatment which will provide a full stocking of growing Jarrah on each acre of cut over forest, and the subsequent protection and tending of the regrowth to maintain maximum increment.*" (p. 5)

8. Determination of Yield
"*In the absence of even preliminary yield tables and with only a general knowledge of the stocking of immature age classes in the cut over forest, the application of recognised formulae for the calculation of the permissible annual cut is impracticable.*

The total stand of mature log timber suitable for sawmilling is calculated to be 20, 660, 000 loads, and with a present annual consumption of 700, 000 loads, this total volume will provide for nearly 30 years' cutting, which equals the first third of the rotation.

It is evident that there is a serious shortage of the 30-year to the 89-year age classes in the forest, and that these age classes cannot be relied upon to supply requirements from 30 to 60 years on present output. The one-year to 29-year age classes are more plentiful and will greatly assist the position during the final third year of the first rotation." (p. 5)

"*As a further concession to present economic conditions, it is proposed that the first 10-year period of the plan be devoted to bringing the annual log consumption back to 460, 000 loads. This will be accomplished to an appreciable extent by the inevitable closing of mills which have exhausted the virgin forest on their respective permit areas and leases.*" (p. 6)

Part III
"*The purpose of this addendum, which shall be referred to as Part III of the General Working Plan for Jarrah, is to extend the Working Plan approved by the Governor in Council on the 26th March, 1929, to cover hewing operations in the jarrah forests of the State, and shall be read as one with the said Working Plan.*" (p. 1)

11.Objects of Management
"*The objects of management as set out in para. 4 are herby extended to include the regulation of the production of hewn jarrah sleepers from State Forests, Timber Reserves, and other Crown land during the balance of the period of the plan.*" (p. 1)

10. **Determination of Yield (Hewing)**

"*It is impossible to arrive at any sustained yield basis for the production of hewn sleepers from State Forests, Timber Reserves and other Crown lands carrying jarrah timber during this period of the plan. Detailed investigation of the timber which may be utilised for this purpose in various districts has indicated that, with the present high standard required by buyers of hewn sleepers, an output of 20, 000 loads per annum is considerably in excess of the quantity which can be maintained for a period of 10 to 15 years without prejudicing the future of the sawmilling industry. In arriving at the volume of mature jarrah timber remaining on the forests of the State at the time of the first periodic revision of this Working Plan, it will be necessary to deduct the volume of timber taken out as hewn sleepers from the total estimated quantity of mature jarrah set out in the tabulation in para. 1.*" (p. 1)

"*13(b). The following numbered areas have reference to areas delineated on Plans D, E, F.*

AREA NO. 50

No provision will be made for a continuous programme of hewing, but not more than 5 hewers may be employed intermittently for the purpose of removing suitable timber from areas to be cleared for pine planting or in advance of regeneration work. […]

AREA NO. 51

Not more than 12 hewers may be employed operating on forest cut over intensively for sawmilling and which it is proposed to treat for regeneration in the immediate future. […]

AREA NO. 52

Not more than 30 hewers to be employed, 20 on the eastern fringe of the State Forest (Brady Block) on cut-over forest accessible to Jarrahdale bush line. […]

AREA NO. 53

Not more than 20 hewers to be employed, and at any one time no more than 12 shall operate within six miles of Dwellingup. Order of working to be regulated by proposals for carrying out of silvicultural operations and the comparative urgency of removal of overmature hewing trees in favour of second growth jarrah." (p. 4)

AREA NO. 54

Not more than 15 hewers to be employed, of whom not more than 10 shall operate within a radius of 5 miles of Inglehope at any one time. Order of working to be regulated by proposals for carrying out of silvicultural operations and the comparative urgency of removal of overmature hewing trees in favour of second growth jarrah.

AREA NO. 55

Not more than 20 hewers to be employed, who shall first operate on heavily cut over country recently treated or in course of treatment for regeneration, in the immediate proximity of the Yarloop, -Nanga Brook and the Yarloop-Hoffman Mill tramlines. Careful consideration must be given at an early date to the possibility of the two mills referred to drawing a proportion of their log supplies from this forest and the desirability of the whole or portion of the hewers referred to above operating on country cut over by the mills under tree marking conditions at the head of their respective bush lines." (p. 5)

"*AREA NO. 57*

[…] *Operations will be commenced on treated country on the Arklow Block and order of cutting will be regulated by silvicultural proposals.*

[…]

AREA NO. 62

On compartments which are considered unsuitable for the operation of small mills not more than 12 hewers shall be allowed to operate in advance of regeneration cleaning.

AREA NO. 63

(a) Not more than 10 hewers may be employed operating on heavily cut-over compartments which have already been treated or on which regeneration work is proposed in the immediate future.

(b)This area is reserved for the operations of small mills, and working plan proposals for logging sections have already been prepared under a local Working Plan. […]" (p. 7)

"*AREA NO. 66*

This area includes a large proportion of marginal jarrah forest, certain of which can be recommended for excision from State Forest when properly cut out. Not more than 10 hewers may be employed on the area, either in advance or regeneration work on better forest to the north-east or on the removal of all marketable timber from poor-quality forest to the south and on the east of the railway line." (p. 8)

"*AREA NO. 68*

Following the cutting out of timber on the Nannup Settlement Area by hewers, provision may be made for not more than 20 hewers to operate on country which has been cut over for sawmilling under tree marking conditions, and which is in the course of silvicultural treatment or listed for regeneration work in the immediate future." (p. 8)

"*AREA NO. 69*

At the present time there are a considerable number of hewers operating on country recently released for settlement to the south-east of Nannup. No other cutting will be made available on this area until hewing operations are nearing completion on the settlement area. Before this occurs, steps will be taken to examine various Blocks included in this area, with a view to laying down a programme which will provide for the employment of not more than 20 hewers in several camps where the volume of milling timber remaining will not justify further milling operations, and where it is desired to arrange for the removal of the balance of the overmature timber in connection with regeneration work." (p. 8-9)

"*AREA NO. 7O, known as Manjimup District. There is still a considerable volume of timber remaining on land in course of alienation or proposed for alienation in this District, and for the period of the Plan, operations will be confined to such land, with the possible exception of the removal of a limited amount of hewing timber in advance of regeneration work, on which not more than 10 hewers may be employed throughout the District.*" (p. 9)

"*The Conservator shall have discretionary power to temporarily allow additional hewers in any district on marginal forest country which has been, or which it is proposed shall be, made available for settlement, provided the total output fixed in the Working Plan is not exceeded.*" (p. 10)

FORESTERS' MANUAL -1927

Amendment to The Foresters' Manual. Part I. 1927

[

NOTE: INCLUDED AS INSERT IN THE FORESTERS' MANUAL. PART I. GENERAL DISTRICT WORK (SOUTH-WEST). 1926

"*1. By deleting paragraphs 84, 85 and 86, and inserting in lieu thereof the following:-*

84. Except in the case of Working Circles where regeneration operations are in progress (see para. 85 as amended) the cutting of piles and poles is confined to-

(1) townsite reserves and country that has been or is in process of being made available for group or other settlement, subject to the reservation of timber;

(2)country that is not required to be set apart for permanent dedication as State Forest or Timber Reserve, i.e., country that may be released for settlement in the near future, after the timber has been removed." (p. 1)

FORESTERS' MANUAL -1927

The Foresters' Manual. Parts II, III, IV, and V . 1927

Regeneration Operations
Scope and Sequence of Operations
"*Natural regeneration of the forest follows the removal of the old trees, and therefore trade cutting is the first step in regeneration operations.*

In every Eucalypt forest there area varying number of worthless trees and trees of useless species which are unsuitable for trade purposes, and, in consequence, trade cutting operations must be supplemented by other work which we term regeneration cleaning.

The sequence of operations, according to existing practice in Western Australian Jarrah forests, is as follows:-
(1) Advance burn.
(2) Tree marking
(3) Trade Cutting (of all mature and overmature trees).
(4) Regeneration cleaning.
  (a) Removal of useless trees and understorey on blanks where regeneration is desired, with the retention of certain worthless trees where needed as seed trees.
  (b) Final burn.
  (c) Removal (by complete ringbarking) of worthless seed trees after regeneration is secured.

It may be accepted as desirable that the operations set out above shall follow in an orderly sequence during a period of not more than two or three years. In practice, it will be found that problems of management render this impracticable, and exceptions will be found in a number of Working Plans, for example:- …
(a) On heavily cut-over bush Regeneration Cleaning may be undertaken without provision for the prior removal by hewing of the limited number of mature and over-mature logs remaining. […]" (p. 15)

"[…] *A feature of regeneration work which must not be lost sight of is that, under the 'selection' system adopted, each and every compartment may be worked through for logs at regular intervals of possibly 20 to 30 years.*" (p. 15)

2. Tree Marking
"*370. Tree marking in the Jarrah forest is carried out in accordance with the Group Selection System. Tree marking is the marking for removal for trade purposes of mature and over-mature trees which possess utilisation value.*

It is important that officers doing tree marking should realise the part their work plays in inducing a new crop. As tree marking is a vital part of regeneration operations, it must not be regarded as entirely independent of, or of secondary importance to, regeneration cleaning.

Vigorously growing immature trees, whether occurring in groups or isolated, must on no account be marked for cutting.

Officers must realise that it is obviously not economical to remove an existing good immature tree or group of such trees to make room for a new crop which will take much longer to reach maturity. It will be realised that no definite girth measurement can be given to indicate when a tree may be regarded as mature, and in tree marking the rate at which a tree is growing must be given due consideration irrespective of size.

Tree marking must be regarded primarily as a silvicultural operation and not an effort to secure a quantity of timber for milling or hewing from a specified area." (p. 15)

"*373. The coupes must be blazed by the Forester or Assistant Forester in Charge. On no account may this work be left to an overseer.*" (p. 15)

"*374. The Forester, or Assistant Forester in Charge, must make regular inspections of coupes claimed to be cut out before allowing fallers or cutters to move on to the next coupe.*" (p. 15)

"*376. It is not in the best interests of either the Forest Department or the sawmiller that useless timber shall reach the mill landing. The responsibility for preventing this lies with the company concerned, and is among the duties of the bush boss. Strict supervision of fallers is necessary to prevent avoidable damage due to careless falling causing split butts and broken crowns.* […] *He must also see that logs are long-butted when necessary and properly headed off.*" (p. 16)

Trade Cutting Operations
"[…] *For permits for which a Working Plan has not been prepared specifying the location and extent of forest to be cut over each year, it is necessary for the Forester in Charge to know at all times that portion of the permit area which will be worked over during the ensuring twelve months.*

Not later than August 15th each year such information must be set out on a plan. This plan will form the basis for advance burning, irrespective of whether tree marking and regeneration cleaning or merely top disposal operations will follow the trade cutting." (p. 16)

"*379. For the purpose of preparing this programme of work, the Forester shall obtain in July of each year a plan showing approximately the log lines to be constructed or location of cutting for the ensuring twelve months from mill managers concerned. In this connection, the attention of Foresters is drawn to Regulation 29, by virtue of which the Department is empowered to confine operations on a permit area to certain defined sections. Accordingly it is the duty of the local officer to see that operations are strictly confined to the section agreed upon, and that no departure from this is allowed except by express permission in writing from the Conservator.*

[…]

[…]*When such Regulations are gazetted it may not be necessary to apply for the information in July as instructed above, but a map of the annual logging proposals for each permit area must be prepared by the Forester at the beginning of August each year as a basis for controlled burning operations.*" (p. 17)

Regeneration Cleaning
"*The Silvicultural System, or method by which the bush is treated is called 'Selection by Groups.'*" (p. 17)

"*The actual work carried out by departmental employees is termed 'Regeneration Cleaning,' which is a supplementary operation to 'Trade Cutting' – the first phase of Regeneration Operations.*

Regeneration Cleaning consists in clearing up or forming 'blanks' (or openings) in the forest in order to encourage the development of regrowth.

These 'blanks' are formed either by ringbarking worthless Jarrah and useless species, or by enlarging existing openings in the same way. Where an underwood, or lower cover, composed of such species as Banksia, Wattle, large shrubs, and Blackboys, exists in the openings so formed, this growth must be felled.

In forming, cleaning up, and extending these blanks, the following points should be noted:-

Good centres for the commencement of blanks are to be found in the openings caused by the removal of trees either in trade cutting operations, or through natural causes such as fire and wind.

No opening or blank will be made if it will be less than one chain (66ft.) across its smallest dimension (i.e., a blank must be more than one chain wide)." (p. 17)

Details of Works in the Blanks

"*381. All malformed or seriously damaged saplings and poles which cannot possibly develop into satisfactory logs if less than 15in. B.H. will be felled at one foot from the ground, except that such saplings less than 12 in. at ground level will be cut as close as possible to the ground to induce self-rooted coppice growth.*

All Jarrah trees above 15in. diameter at B.H., and which are unlikely ever to possess utilisation value, will be ringbarked." (p. 18)

"*Where regeneration from seed is necessary, the ringbarking must be only partial, leaving at least one half o the bark not severed.*" (p. 18)

"*The larger Marri will be 'sap-rung,' and any Marri below one foot diameter will be ringbarked.*" (p. 18)

"*Groups of good Sheoak will be left intact; other Sheoak, Banksia, large shrubs, and Blackboys will be felled. Banksia grandis and other species which coppice vigorously should be cut off at a height of several feet above the ground.*" (p. 18)

"*Groups of good immature trees, pole stands, etc., should not be disturbed, and no cutting must take place in such groups.* […]" (p. 18)

"*No cutting or ringbarking of suppressed trees, worthless trees, useless species, Blackboys, scrub, etc., which stand under the trees in these groups will be carried out.*

The tops of fallen trees, and any other litter, will be cleared away for a distance of about three feet from around the good trees, piles and poles which are left standing.

All groups of good Jarrah saplings remaining unharmed after advance burning will be preserved." (p. 18)

"*Areas treated, whether whole compartments or portions of compartments, will be burnt by as severe a fire as possible in the summer following, but no burning may be carried out without directions from the Divisional Forest Officer, who will specify the area to be burnt. If there is not sufficient advance seedling and coppice growth for full stocking, the subsequent burning must be delayed until immediately prior to seed fall in a good seed year. In the cases where regeneration from seed must be relied upon, all Jarrah trees partially ringbarked in the first operations must be completely ringbarked after the seedling growth is established on the ground, and before the summer following.*" (p. 20)

General Points

"*(1) It is important to remember that the object of this work is to develop regrowth on the non-productive patches in the forest.*

By non-productive patches is meant those parts, often many acres in extent, which carry only worthless jarrah, or trees of useless species.

(2)When in doubt, it is better to err on the light side. It is always possible to go back and cut trees which should have been destroyed, but the converse is not possible.

An officer should not be afraid to leave patches of forest severely alone if he is doubtful. He should go to a centre where a small opening has been caused by 'falling operations,' or by other means, and start again.

(3) Good saplings, piles, poles and immature trees are preserved because obviously they will reach maturity more quickly than the seedlings which would replace them if they were destroyed." (p. 20)

Improvement Work (In Groups)
"*385.There is considerable scope for improvement work in existing groups. This work falls naturally into two main divisions:-*

(a) Removal by trade cutting of merchantable over-mature Jarrah and removal by ringbarking of useless over-mature Jarrah and large Marri which are over-shadowing and tending to suppress young growing Jarrah.
(b) Thinning of poles, piles and saplings in groups of different ages.

The removal of large over-mature trees suppressing young growing Jarrah is work requiring early attention, and the extent to which is to be carried out simultaneously with regeneration cleaning will be a matter for direction on each Working Circle. More intensive improvement work in groups, such as thinning, although needing attention, will, generally speaking, be held over until a crop is established on the blanks. […]" (p. 21)

Artificial Regeneration
"*386. Regeneration of a forest by natural means (i.e., from seed trees standing on the area) is the primary aim and object of all regeneration operations. Artificial regeneration as an operation of any extent must be undertaken only as a last resort when the natural regeneration secured is insufficient to fully stock the area. The presence of advance seedling growth on any area should be determined before the burn, and where it is considered portions of a compartment will require spot sowing such portions should be definitely pegged before burning.*" (p. 21)

Fire Control
"*The problem of fire control is intimately bound up with the question of reforestation and afforestation, and the ultimate success of the Department's efforts in these directions is entirely dependent on a strong measure of public sympathy and co-operation in tackling the fire problem.*

Of almost equal importance is the proper use of controlled fires in silvicultural and protective operations. The extent to which controlled burning is desirable and necessary is completely set out in the following pages …[…]" (p. 24)

WORKING PLAN – 1926

Working Plan No. 1 : Mundaring Working Circle. 1926

Part I : Summary of Facts
Foreword
"*Owing to the abnormal state of a great deal of the forest within the Working Circle, it has not been possible to apply the principle of sustained yield according to any recognised system. The guiding consideration in many instances has been sustained work for staff and overseers, and with such sustained work is inevitably associated sustained yield. The Jarrah forest extending from Mundaring District in the North to Manjimup District in the South is geographically one forest. Owing to the fact that heavy exploitation by sawmilling and hewing has proceeded for seventy years, while forest management on the simplest lines has only been introduced within the past five years, the problem of sustained yield is one of great difficulty. Any attempt at sustained yield must envisage the whole 2, 000, 000 acres of Jarrah forest as one unit. The problem is being investigated on these lines.*

The forest between Mundaring on the North and Karragullen on the South was the first area of Jarrah to be brought under the provisions of a Working Plan, and with this object a preliminary Working Plan took effect from September 26th, 1921. Since this date 24 other Working Plans have been prepared and put into operation. The form and provisions set out in the attached Plan are the result of experience gained in the intervening period." (p. 3)

7. Past Management
"*Prior to July, 1920, the only forest management practiced on the area comprised in this Working Circle was policing and revenue collecting.*

In September, 1921, a Preliminary Working Plan drawn up by Mr S.L. Kessell was approved by the Governor in Executive Council.

[…]
In December, 1923, a commencement was made with regeneration cleaning under the Group Selection System, and at the same time control of trade cutting by Tree-marking under the Group Selection System was instituted." (p. 12)

Part II : Future Management
9. Division and Allotment of Areas
(b) Formation of Working Sections
"*The Working Circle has been divided into three Working Sections according to the different silvicultural systems employed in each.*

Working Section A.-
Jarrah Forest. Group Selection System. Includes the following Blocks:-
Zamia. Canning. Illawarra. Kalamunda. Occidental. Bartons. Thompsons and portions of Sawyers Block.

Working Section C.-
The area of 17, 220 acres in ringbarked in 1903 and now carrying dense regrowth, malformed and ruined by repeated fires. Clear felling followed by regeneration from coppice. Includes the Reservoir Block and the greater portion of Sawyers Block." (p. 16)

10. Proposals for the Respective Working Sections
10A : Working Section 'A' : Jarrah Forest – Group Selection System
1. Silvicultural System – Selection by Groups
"*Regeneration operations. The general practice will be as follows:-*

The formation of openings or blanks in the forest by the marking for removal for trade purposes of such trees as possess utilisation value, and by the destruction by felling and ringbarking of adjoining worthless Jarrah and useless species such as Marri, etc. Where an underwood or lower cover composed of such species as Banksia, Wattles, large shrubs and Blackboys exists in the openings so formed, this growth must be removed. These blank areas will subsequently be burned by as severe a fire as possible. The details of these operations will conform with the procedure laid down in the latest Departmental circular of instructions referring to this work." (p. 16)

Improvement Work
"*The removal of worthless Jarrah and trees of useless species, dominating useful groups of young Jarrah, is called for. This treatment will not be carried out in any Compartment for a period of four years following Regeneration Cleaning in that Compartment, when instructions for this work may be given by the Divisional Forest Officer in writing or from Head Office. A four-year period is set down in order to allow sufficient time for the ringbarked trees in the blanks to lose their leaves and bark, and so become a less dangerous fire hazard before any further ringbarking takes place.* […]

Thinning. – It is not expected that any thinning will be required during the period of the plan. If any thinning should be required, directions governing such operations will be given by the Conservator." (p. 16)

2. Methods and Order of Operations
"*Department operations will consist of Advance Burning, Tree Marking, and Regeneration Cleaning.*

[…]
The various operations in the bush will be carried out in the order, and in accordance with the instructions, given below." (p. 16)

(a) Advance Burning
"*The country to be worked over during the ensuing year may be burnt by a light controlled fire in either late or early summer. Details will conform with the latest circular of information referring to this work.*" (p. 17)

(b) Tree-marking
"*All trade cutting operations will be controlled by 'Tree-marking', which, carried out in advance by fallers or cutters, will be the system, Selection by Groups.*

[…]
Tree-marking will be performed only by a Forest Overseer or other officer authorised by the Conservator of Forests.

The tree-marking will be carried out by coupes, to which the fallers or cutters will be restricted as the Forester shall direct. The size of a coupe shall not be greater than is sufficient to provide one month's cutting." (p. 17)

(c) Sawmilling Operations
"*Falling and hauling will follow the tree-marking.*

Sawmilling operations will be governed by Sawmill Permits under the Forests Act and by the following special conditions:-

(1) Only trees marked with an F.D. brand by an Officer of the Department may be felled and converted.

[…]
(3.) The mill manager must exercise strict control over his men with regard to avoiding damage to regrowth and useful unmarked timber in falling and hauling operations, and in the use of fire." (p. 17)

(3) Determination of Cut
"*Before the present ruined stand can be replaced by a new crop, utilisation of the remaining mature timber must be effected, and for this purpose sawmilling and hewing, conducted according to silvicultural rules, under control by tree-marking, is necessary.*

The principle of sustained yield according to any recognised system is not possible for the following reasons:-

(i.) Practically nothing but mature timber remains, the forest being very deficient in the younger age classes.
(ii.) The volume of this mature timber is very low, averaging about four (4) loads in the round per acre. (This loadage should not be accepted as an indication of the yield per acre which may be expected in the second crop when the forest should be more or less normal.
(iii.) The smallest capacity mill that can operate under existing conditions, particularly in regard to the large size of the logs, is about ten (10) loads in the round per day. Such a mill has a hauling limit of 1 ½ miles, and from one mill site about 4, 000 acres of average country is the maximum area that can be cut-over. This area is only sufficient to keep the mill operating for five and one-half years.

[…]

(v) *The Barton's Mill has a large capacity, cutting about thirty (30) loads in the rounds per day. Pending the revision of the working plan, certain tramline extensions into relatively inaccessible country have been allowed. The stock-taking associated with the revision of the plan has shown that the maximum life which this mill can be allowed is about four years, having regard to the necessity for continuity of work on the Working Circle.*

With the exception of the small mill operating in the Sawyers Block, only one mill will be allowed to operate on the Working Circle when the Barton's Mill closes down in four years' time. This mill shall not have a capacity greater than ten loads in the round daily. For such a mill it is estimated that the 25, 000 acres of country which will then be available for sawmilling will provide a life of thirty-five years." (p. 18)

"*On the other hand, the rate of hewing cannot be reduced below a certain minimum for the following reasons:-*

(i.) *Hewing must be conducted over the area to be treated for regeneration annually.*

[…]" (p. 18)

10c Working Section 'C'

"*(Ringbarked country in the Sawyers and Reservoirs Blocks.)*" (p. 22)

(1.) Silvicultural System

"*The silvicultural system will be clear felling followed by coppice regeneration.*

Details of operations will conform with the instructions given in the latest circular referring to this work." (p. 22)

12. Fire Control

"*The whole of the Working Circle shall be considered as under Fire Control Measures.*

These measures will vary according to the conditions of the forest. Complete protection will be afforded to:-

(a) *Areas treated and regenerated, except that, where the crowns of the young crops have reached a sufficient height to be beyond damage by a light surface fire, instructions may be given by the Conservator for controlled early burning under such stands.*

(b) *Areas treated and awaiting final treatment pending seed years.*

[…]" (p. 25)

FORESTERS' MANUAL - 1926

<u>The Foresters' Manual. Part 1. General District Work (South-West). 1926</u>

"*84. As a general rule the cutting of piles and poles on Crown lands is confined to townsite reserves and country that is being made available for group or other settlement, or country that is not to be set apart for permanent reservation as State forest.*" (p. 33)

"*When the holder of a sawmilling or hewing permit granted over group settlement country or any country in process of alienation desires to cut piles and poles, he must apply to the forester for a permit stating the number and dimensions of the piles and poles to be cut.*" (p. 33)

"*92. Except where tree marking has been carried out, under-size trees can be cut on timber leases and permits only after permission in writing has been obtained from the Conservator …"* (p. 35)

"*Only Jarrah and Karri trees of 90 inches in circumference measured over the bark at four feet three inches from the ground may be cut by a permit holder, except in special circumstances. Possible exceptions are as follows:-*
[…] *(2) Sparsely timbered country outside the prime timber belt on which it is never likely to prove economical to carry out forest operations. On this class of country, especially where it is likely to be alienated after being cut over, foresters should recommend that the permit-holders be allowed to cut on a face. Such recommendations will only be given effect to after a re-inspection to be arranged by Head Office.*" (p. 35)

"*97. A permit holder must operate continuously and comply with all conditions of his permit, unless exempted by the Conservator.* […]" (p. 36)

"*Under no circumstances will a continuing or general permission to cut on private property simultaneously with Crown lands be granted.*" (p. 37)

"*102. Sound jarrah logs or saplings must not be used by permit holders and others for erection of bush landings, tents, huts, or stockyards. For this purpose Marri (redgum) is quite suitable and should be used in every case rather than Jarrah.*" (p. 38)

Timber Inspection
"*112.* […] *It is the duty of every forester to see that area under his control is worked to the best advantage and cut out with the least possible waste of timber.*" (p. 40)

Land Inspection
"*319. The object of reference to, and subsequent inspection of land by, officers of this Department is to ensure-*
(b) That prime forest country shall be retained for dedication as State Forest.
[…] *(c) To provide that the alienation of land shall not result in the depreciation of the value of adjacent timber country by depriving such timber country of water supply for milling purposes, access, etc."*(p. 78)

Detailed Inspection
"*323. To be carried out where the preliminary reconnaissance indicates the timber stocking of the area is by no means even such as where the timber occurs in belts or patches. Examples are found on the fringe of the prime Jarrah belt where, owing to the high price ruling for wool, many applications for grazing land are being made.* […]" (p. 79)

Permanent Reservation
"*326. Permanent Reservation. – Prime timber country carrying Jarrah and Karri in reasonably pure formation. In arriving at any conclusion concerning the principal species (Jarrah or Karri), the timber removed, the over-sized timber and the under-sized timber should be taken into consideration. Ocular estimates in the past have usually resulted in a considerable under-estimation of the loadage of timber per acre. The classification plans show the loadage of over-sized timber only, and four loads per acre, or over, has been regarded as a satisfactory indication of Jarrah country suitable for permanent dedication as State Forest. Practically the whole of the country so shown on these classification plans is pure Jarrah forest, and as such plans have in all instances been checked with the soil classification plans prepared by officers of the Lands Department, all interests have been protected.*

Other factors as set out in the standard form of land inspection report, F.D. 89, need, however, to be taken into consideration in making recommendations, but the principal determining factor remains the question as to whether Jarrah or Karri occurs in reasonably pure formation. Among other considerations which may justify a recommendation that an area be included in a State Forest are –
… (4) The protection of the forest from dangerous fire hazards." (p. 83-84)

"*Officers reporting on areas carrying other species of economic value, such as Wandoo, Mallet, Boronia, etc., will be guided by the above general principles, but will usually work under special instructions relating to each particular district.*" (p. 83-84)

327. Temporary Reservation
"*327. Temporary Reservation* - […] *Officers must bear in mind the drastic alterations which have taken place during the last decade, in the class of bush and type of log which it has been regarded as economically possible to work, and they must adopt standards which make every allowance for Jarrah becoming increasingly valuable …*" (p. 84)

LEGISLATION - 1920

Appropriation, 1920-21. No. 34 of 1920

Schedule I.
Improvement and Reforestation of State Forests : Working Plan No. 1
"*Covering all that country within the prime jarrah belt south of the Eastern Railway to the southern boundary of the Jarrahdale concession, the portion to be taken in hand first being the destroyed forest of the Goldfields Water Supply Catchment Area near Mundaring. The work for 1920-21 to include:-*

> *Sylvicultural operations over the destroyed forests and road-making to enable the marketing of firewood which will be cut according to sylvicultural requirements.* […]" (p. 147)

Working Plan No. 3
"*Covering all that country held under coal mining leases in the Collie district and such adjoining country as may be necessary for the provision of an adequate supply of mining timber for the coal mining industry in the Collie district.*

The work for 1920-1921 to include:-

> *A timber survey to determine the extent of existing supplies. Sylvicultural operations, especially over those areas from which all the mining timber has been extracted.* […]" (p. 148)

Classification
"*The classification of the timber lands of the South-West is a necessary forerunner of reforestation work. Three camps of classifiers and compassmen are in active operation and 1920-21 should see the major proportion of this work completed.*" (p. 148)

LEGISLATION - 1919

Forests Act No. 8 of 1919

Working Plans
"*31. (1) The Conservator shall, from time to time, prepare working plans for each State Forest and timber reserve.*

(2) Such plans shall, subject to existing rights under concessions, leases and permits, regulate the management of each State forest and timber reserve respectively for a period not exceeding ten years, to be stated on the plan.

[…]

(4) Every working plan shall be subject to the approval of the Governor, and when so approved shall have effect; and shall not be altered except on the recommendation of the Conservator." (p. 126-128)

Part V. – Financial Provisions
Revenue and Expenditure
"*41. (2.) (a) Three-fifths of the net revenue of the department, to be certified by the Under Treasurer, shall in every financial year be placed to the credit of a special account at the Treasury, and shall form a fund for the improvement and re-forestation of State forests and the development of forestry, and such fund may be expended by the Conservator with the approval of the Minister without any other authority than this Act.*

Provided that a scheme for such expenditure shall be submitted annually to and shall be subject to the approval of Parliament." (p. 130)

Part VII. – Offences, and General Provisions
"*45. Any person who, without lawful authority, fells, cuts, injures, destroys, obtains, or removes in, on, or from any State forest, timber reserve, or other Crown land any forest produce shall be guilty of a forest offence, and liable, on conviction, to imprisonment for not exceeding one year, or to a penalty not exceeding one hundred pounds.*" (p. 136)

"*50. Any person who commits or attempts to commit or aids or abets any person who commits or attempts to commit any of the following offences shall be liable to imprisonment for not exceeding one year or to a penalty not exceeding fifty pounds:-*" (p. 137)

"*73 (2.) The planting of trees, approved by the Conservator, on not less than five acres of any land acquired under the conditional purchase provisions of the Land Act, 1898, shall be deemed an improvement within the meaning of that Act, and the conservation and improvement, to the satisfaction of the Conservator, of indigenous timber already growing on any portion of land acquired under the conditional purchase provisions of the Land Act, 1898, may, with the approval of the Minister for Lands be deemed an improvement within the meaning of that Act.*" (p. 144)