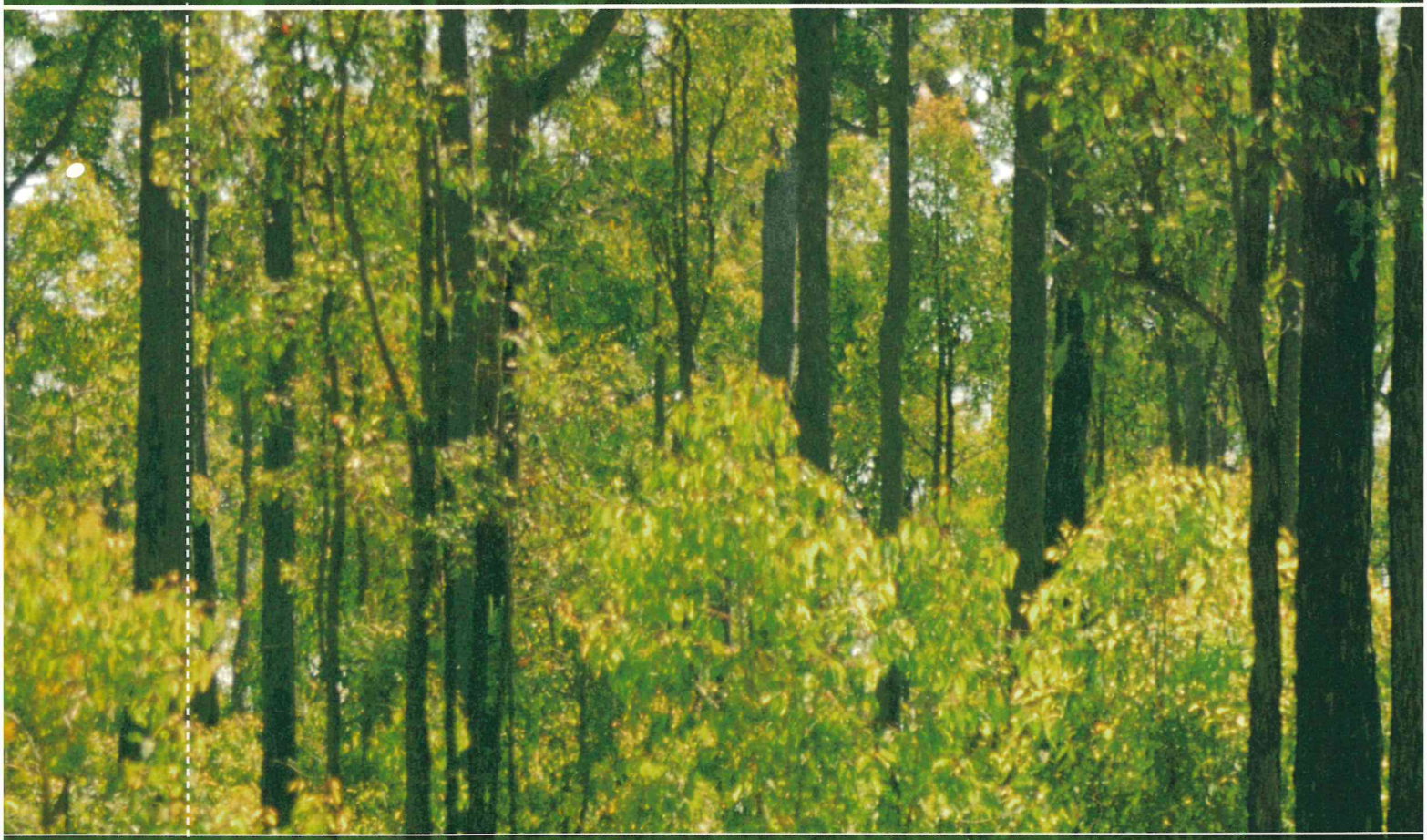
Managing private native forests and woodlands in the south west of **Western Australia**



combining wood production and conservation

GOVERNMENT OF WESTERN AUSTRALIA

Natural Heritage Trust

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Contents

Managing private native forests and woodlands in the south west of Western Australia: combining wood production and conservation

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Introduction

1.6 million hectares of Western Australia's forest and woodlands are privately owned. More than 300,000 hectares of that occurs within the main forest belt of the south west.

The native vegetation on most private land has been cleared and there has been a growing awareness of the importance of retaining as much of the remainder as possible, not only for landcare reasons but also because they are often the only examples of the forest and vegetation that once existed in these areas.

While clearing controls are now in place, protecting remnant vegetation from clearing is not enough in itself to ensure their continued survival in good health. They will need ongoing management if they are to be sustained indefinitely.

Sustaining these forests and woodlands means protecting them so far as is possible from damage by fire, stock, disease and weeds; maintaining an age structure that allows for continuing replacement; and providing conditions for healthy development. A consistent supply of products and services, such as timber, wildlife habitat or even species composition cannot be expected from any small area of forest all of the time – these aspects will fluctuate with the age and condition of the forest and with the time since it was last disturbed by fire. Sustainability means the capacity to go on producing these services from a healthy forest indefinitely, notwithstanding the variations that will occur over time.

How these forests are managed depends not only on what the landowner wants from them but also what the broader community expects from them.

This booklet is aimed at addressing some of the management issues involved in managing private native forests in the south west. It is particularly directed at those landowners who are interested in sustainable timber production as one of their objectives, to assist them in preparing a management plan for their forest and enabling them to obtain the necessary approval for their management proposals.

Introduction

Managing for what?

Land care

For many farm forests salinity control may be one of their most important values, but they may also have a valuable role as windbreaks and for water course protection and turbidity control. The continued existence of these forests is not only important in its own right but also because of the benefits they have for the surrounding land that is managed for other purposes.

The loss of forest and shade trees through old age will have a major impact on the rural landscape if their replacement is not assured.

Biodiversity

Areas of forest throughout an otherwise cleared or exotic landscape are particularly important for providing a haven for native flora and habitat for native fauna. In many cases they provide the only remaining examples of a particular vegetation type. Even those forests that have been simplified to consist of trees with an understorey of grass still provide valuable habitat for a number of fauna species.

Commercial values

Many native forests have the potential to produce valuable products such as timber, pulpwood, firewood or posts, as well as products such as seeds or flowers. Done properly, management for these products need not be detrimental to other values and may well enhance them by providing funds for management and an additional incentive to maintain the forest.

This wandoo stand has been thinned for sawlogs and posts. Young healthy wandoo trees have been retained along with large 'habitat' trees and an intact understorey.

Aesthetics

Patches of forest and even individual scattered trees are an essential part of the character of our rural landscape. Mature trees that were left at the time of clearing are now approaching the end of their lives in areas that were settled early in rural development. Unless their replacement is assured we will be faced with a very different landscape to the present one. Apart from its value to our lifestyle, managing a forest for its aesthetics may well be the greatest contribution it can make to the value of the property.

Issues

Private native forest exists in a whole range of form and structure, with different history, different potential, different values and different problems. They vary according to tree species, their age and their structure, the 'quality' of the trees for different purposes, and the condition and species composition of their understorey. These characteristics have a major influence on what they can be managed for, what their potential is and what management practices are required.

Regardless of the condition of the forest there are a number of issues that need to be considered to manage it. These include:

- What to manage for – is it for one value such as salinity control or biodiversity, or a number of values together, such as salinity control and biodiversity and timber production?
- How to manage for these values – what kind of management is required for these values and what are the trade-offs between them? How will the various values change over time?
- How to maintain what is there – what is the impact of fire, pests, domestic stock, native animal browsing, disease, weeds, excessive tree competition and the age on the forest?
- How to manage it so that it can replace itself over time – what are the regeneration requirements and how and when should they be carried out?
- How do these issues relate to the overstorey and the understorey?
- What are the potential markets for the forest products, how much of the product is in the forest and what is required to grow it in future? How can selling these products be used to enhance other values or achieve other management objectives?
- What are the likely costs and returns of management?
- What are the implications for taxation – how should affairs be arranged for the most favourable outcome?
- What are the legislative controls and incentives that impact on options for management – what state and local government approvals are needed and how are they obtained?
- Does the work qualify for financial assistance under one of the government's assistance schemes?

It is not possible to cover all of these aspects in this booklet. The emphasis here is the management of the tree component of native forest especially where wood production is a major component of multiple use management that also includes land care and biodiversity.

This booklet does not aim to tell you how to manage your native forest but rather to indicate some of the issues to be considered and where to find further, more detailed information and guidance.

At some stage, active steps will need to be taken to establish regeneration if this patch of forest is to be sustained.

Preparing a management plan

No matter how large the forest, any activity you wish to undertake requires some sort of plan. It may vary from the simple to the complex. At the very least it will involve providing sufficient detail of the forest and the management intent to apply for a Clearing Permit or a Commercial Producers Licence and obtain the necessary Shire approvals. At the other extreme it may include a detailed inventory of the forest and its resources, marketing options, operational plans and taxation planning.

This section provides an outline of some of the information that will be required.

Forest condition

- How large is the forest area – is it large enough to manage as a forest in its own right or is it a small patch or remnant surrounded by cleared land?
- Species – what species are the trees – are they growing as pure stands or as a mixture of species?
- What is the condition of the understorey – is it predominantly exotic pasture, or native understorey? Are there rare or unusual species in the understorey?
- Is the forest being adversely affected by grazing by domestic stock, rabbits or native animals?
- What is the age and structure of the forest – is it more or less even-aged or does it contain a range of ages (or sizes)? Is there young regeneration present? Are there old 'veteran' trees present? How 'dense' is the forest? Is competition affecting the health of the trees or the understorey?
- Has the forest been damaged by wildfires in the past? Are existing fuel levels such that bushfire damage is likely?
- Where is the forest in the landscape? Is it on ridge, slope or gully?
- What is the long term average rainfall of the site? Is it in the <1100 mm zone where salinity might be expected to be a problem? Is it in a catchment with special clearing controls (such as the Warren), and if so in which zone?
- Are there any diseases (such as jarrah dieback or Armillaria) present or nearby?
- Is the regrowth or the understorey being damaged by parrots?

Potential values of the forest

- Is the forest important for helping to control salinity, flooding or siltation?
- Is it contributing to biodiversity in a general sense or does it have particular biodiversity value?
- Are there particularly important or rare species in the forest or does it provide any particularly important habitat?
- Does it contain any indigenous cultural sites?
- Does the forest contain any non-indigenous cultural heritage sites?
- Does it contain or have the potential to produce commercial products such as sawlogs, poles, fencing material, chipwood, firewood, honey or seeds? Are there ready or nearby markets for these products?
- Does the forest have aesthetic values that could be adversely affected by management activities? Could aesthetic values be improved by management?

Silvicultural options

There are two principal silvicultural options that are available for actively managing stands of trees - thinning and regenerating.

Thinning

Thinning involves the removal of some trees in the stand, generally to promote the growth of the trees left behind. Regeneration of trees is not the aim and in fact should usually be prevented so that it does not compete with the trees that have been left and so negate the effect of thinning.

Thinning may be aimed at a number of specific objectives, such as: removing slow growing or poorly formed trees to improve the overall 'quality' of the stand, removing a product (such as pulpwood or posts) to provide an early income as well as providing benefits to the stand, favouring a particular species or type of tree, reducing density to increase water yield and to improve the health of the remaining trees or understorey, or simply to improve aesthetics.

The type of trees removed and the density that is left depends on the age and condition of the stand and the purpose of the thinning.

Following thinning, the trees that are left continue to grow and the average tree diameter increases. When the stand becomes too dense, it can be thinned again. This process may be repeated several times throughout the life of the stand.

Regenerating

Regenerating, rather than thinning, is a more appropriate option when there are too few 'good' trees available to be worth 'growing on', when the remaining trees are old, or when a new age class of trees needs to be created to provide recruitment for sustainability. This issue is relevant to habitat management as well as to activities such as timber production. For example if a stand consists mainly of trees about 200 years of age, steps will need to be taken to provide for regeneration if 'hole-nesting habitat' is to be sustained. The reason is that if it takes say 120 years for the trees to form hollows then most, if not all, of the existing trees will be dead by the time replacement hollows are available.

The regeneration phase is by far the most critical stage in the life of a stand of trees. Trees are then at their most vulnerable and the success or otherwise of the regeneration sets the pattern for the forest for the rest of its life.

The fundamental requirements of regeneration for all species are **space to establish and develop, a source of regeneration, receptive seed bed, and protection while young**. The nature of each of these varies with species and the site. A management plan needs to consider how each of these issues will be addressed.

- **Space to establish and develop**. Establishing regeneration under a canopy of existing trees is limited by competition (mainly for moisture) from the existing trees and the understorey. To establish regeneration usually requires a reduction in tree density (by removing some trees) and a temporary reduction in understorey competition. Once established, seedlings need even more space to develop into saplings, poles and eventually mature trees. Harvesting pattern and intensity, and the use of herbicides, fire or cultivation need to be considered.

- **Source of regeneration**. Natural seedfall, artificial seeding, seedlings from a nursery, existing lignotubers and coppice are all potential sources of regeneration. What is most appropriate for your particular forest needs to be carefully evaluated.

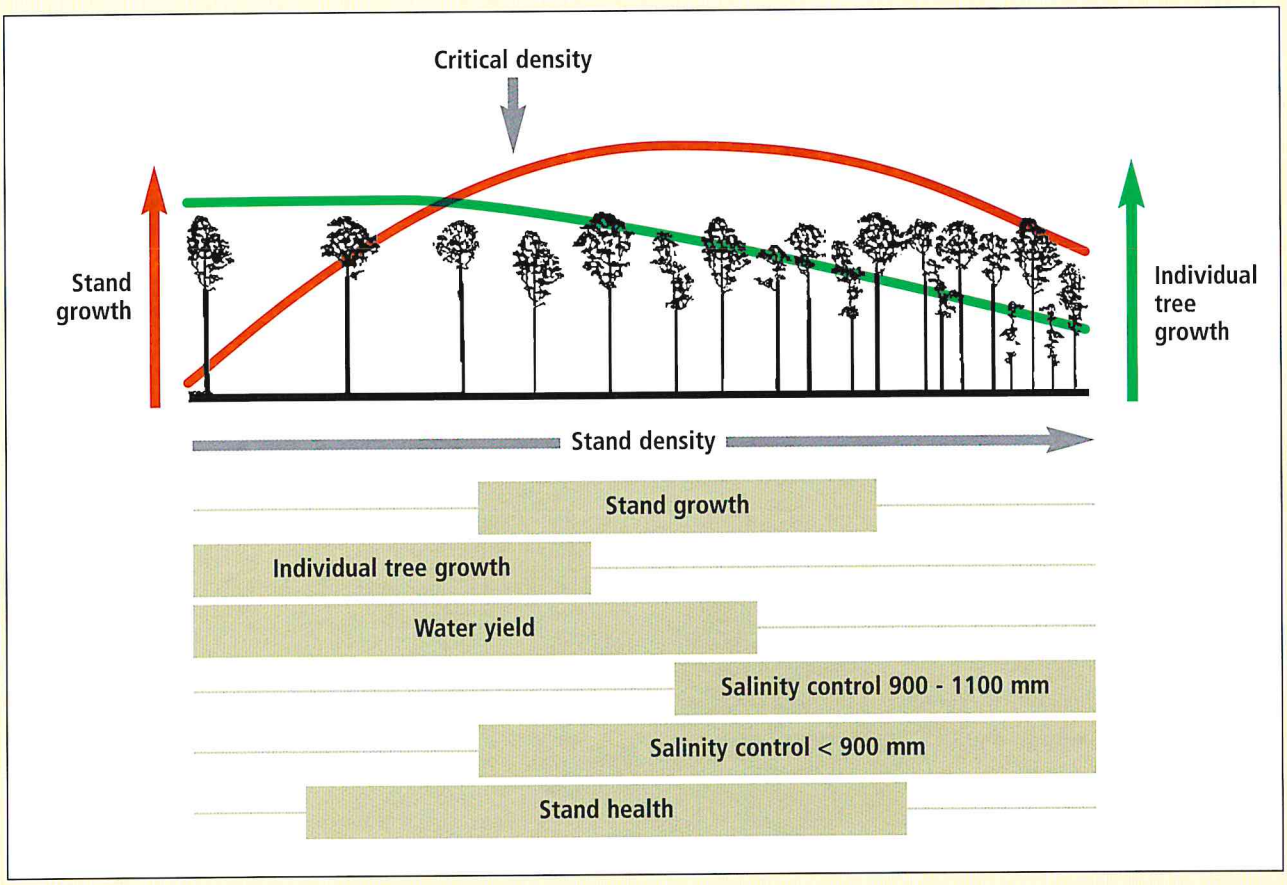
- **Receptive seed bed**. A good receptive seed bed is essential for seed regeneration. New ashbed from the burning of forest debris is ideal and is particularly critical for species such as wandoo and tuart. If planting of seedlings is used then a well tilled seedbed, free of competition for at least the first summer is essential.

- **Protection of the seedlings during their critical early stages**. Seedlings and regrowth are vulnerable to moisture stress, fire, grazing, parrot damage, frost and insects for varying lengths of time. The risk from each of these sources needs to be assessed and addressed in any regeneration operation.

Stand density and thinning

Stand density has a profound effect on the way a stand grows and its capacity to meet different management objectives. Manipulating stand density is one of the most important silvicultural tools available to a forest manager.

- **Effect on growth**: Total stand growth can be maintained over a wide range of stand density (see below). Overstocked stands may have reduced growth, and mortality of some trees will eventually occur at maximum density. At very low density, stand growth will reduce again because there are too few trees remaining to occupy and use the resources of the site. Individual trees however will continue to grow faster at lower density. Thinning to 'critical' density will allow the maximum stand growth to be put onto the fewest trees.
- **Effect on water yield and salinity**: Reducing stand density will increase water yield because there are fewer trees to use the water. At low density, the water table will rise. Where there are saline soils or groundwater, this rising water table will create a salinity problem if it reaches or approaches the ground surface. A stand density of more than 15 m^2/ha is generally required to prevent this in the 900-1100 mm rainfall zone, though <10 m^2/ha may be sufficient in areas of lower rainfall where the water table is deeper.
- **Effect on tree health and vigour**: The main limitation on tree growth in our climate is soil moisture. Overstocked stands (i.e. stands with unthrifty, suppressed and dominated trees beneath the general canopy level) become stressed, all the trees have thinner crowns, the weaker trees eventually die and even the dominant trees slow down in growth. They are particularly affected in drought years and they may become more susceptible to insect attack and drought death. Maintaining a moderate stand density by regular thinning increases leaf density and vigour of individual trees and improves their capacity to withstand drought.



Typical stand density range for different management objectives.

Retaining mature elements

Retaining old trees or other trees in decline has no real value for timber production and may have little value for salinity control or aesthetics. However they often provide valuable habitat for some birds and mammals, especially if they contain hollows. Tree hollows, especially large ones, take many years to develop so that retaining some of those that may already exist is important if these habitat values are to be maintained until new hollows develop in some of the trees in the next generation. Ironically it may sometimes be necessary to reduce the current supply of hollows in the regeneration process, in order to ensure their sustainability in the long term.

Retaining these trees comes at some cost to timber productivity because of the space that they occupy. Deciding on the appropriate balance between production of timber and the production of those wildlife values is a decision that needs to be made, as will the means by which these values are to be sustained in the future.

Role of commercial products

If the trees to be removed for thinning or for regeneration purposes can be sold as commercial products, then not only will the operation provide an income but the costs of 'setting up' the forest for future productivity may be largely offset. However it is rarely possible to sell all of the trees that may need to be removed for satisfactory silviculture and some 'non-commercial' removal of trees will need to be done if 'high-grading' is to be avoided.

This karri stand has been thinned once for chipwood and can be thinned several more times in the future for high quality sawlogs.

Old trees provide an important source of hollows for hole-nesting birds and animals but steps need to be taken to ensure they are replaced before they eventually fall over.

'High grading' is the process of repeatedly removing the best trees from the forest and leaving behind the poorer trees or less desirable species to occupy the site. While the value of the forest for biodiversity, salinity control or aesthetics may not be adversely affected by this process, its value for future timber production is seriously degraded. Regrettably this is the condition of many private forests in the southwest that have been harvested for sawlogs one or more times in the past but without appropriate follow-up silvicultural treatment. The result is that the forest contains very few high quality products and may require a significant investment (e.g. 'non-commercial' thinning) and a substantial waiting period before the forest will again be economically productive.

One of the greatest challenges for timber production or any other forest activity that involves tree removal, is finding markets for the smaller and lower grade products that are inevitably produced as part of the process of managing for high value products. Estimating the likely yields of wood in the future and the level and timing of appropriate investment in the forest is a major part of developing a management plan.

Silvicultural options

Forest structure and management options

Forest structure varies as a consequence of past regeneration events, and has a major influence on management options. Stands of younger healthier trees are likely to require thinning, while stands of mature trees may require regeneration treatment.

More or less single storey even-aged regrowth forest	Two- storied uneven-aged forest with variable patch sizes	Single storey mature forest

Some typical management options

- Grass understorey - Do nothing for the time being. Continue grazing.
- Natural understorey - Do nothing to the overstorey for the time being. Maintain the understorey diversity by prescribed burning at appropriate intervals. Remove or control grazing.
- Actively manage the overstorey:

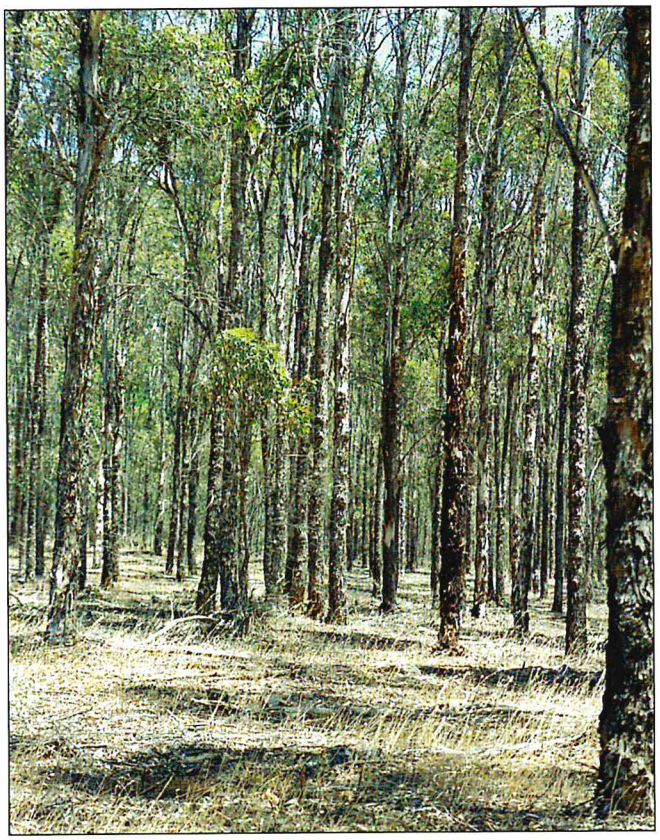
More or less single storey even-aged regrowth forest	Two- storied uneven-aged forest with variable patch sizes	Single storey mature forest
• Thin to appropriate density, control coppice if necessary • Retain some larger trees for hole-nesting habitat and to provide structural diversity • Maintain understorey diversity by prescribed burning at appropriate intervals. • Remove grazing from areas with native understorey • Control rabbits and reduce kangaroo browsing pressure if necessary to maintain native understorey.	• Thin groups of younger trees and control coppice • Remove some patches of older trees and regenerate the gaps by releasing lignotubers, coppicing from smaller trees or planting or seeding • Retain some larger trees for hole-nesting habitat and to provide for structural diversity. • Protect regeneration from fire for 10-20 years • Remove grazing from areas with native understorey • Control rabbits and reduce kangaroo browsing pressure if necessary	• Remove some patches of older trees and regenerate the gaps by releasing lignotubers, coppicing from smaller trees or planting or seeding • Retain some larger trees for hole-nesting habitat and to provide structural diversity • Protect regeneration from fire for 10 - 20 years and remove grazing

Silvicultural options for major forest types

Issue	Karri	Jarrah	Marri	Wandoo
Regeneration options	Planting (seed is usually too limited to consider artificial seeding or the use of seed trees on small holdings)	Release existing lignotubers. Coppice from small stumps	Coppice small jarrah stumps. Release existing lignotubers. Plant jarrah (usually ample marri natural regeneration present)	Coppice small poor formed stems. Natural seed on ashbed Plant on ashbed
Site preparation – grass understorey	Herbicide ± ripping and follow-up herbicide	Herbicide for planting and follow-up herbicide treatment	Herbicide for planting and follow-up herbicide treatment	Herbicide for planting and follow-up herbicide treatment
Site preparation – natural understorey	Burn ± heaping ± ripping	Burn lops if releasing lignotubers or if coppicing – for fire protection reasons. Burn if planting	Burn lops if releasing lignotubers or if coppicing – for fire protection reasons. Burn if planting	Burn lops in autumn to create ashbed
Stocking of regeneration	Plant at 1600-2000 seedlings per hectare if sawlog objective. Plant at 1600 spha but in small patches between marri lignotubers in mixed marri/karri stands	Varies according to the type of regeneration (seedlings, ground coppice, stool coppice etc and between the wetter southern forest and the drier eastern forest. See CALM for advice	Varies according to the type of regeneration (seedlings or coppice) and between the wetter southern forest and the drier eastern forest. See CALM for advice	Autumn burn when seed in the crowns OR Plant at 10 seedlings per ashbed OR Seed at 250-300gm seed per ha of ashbed Result required – 10 seedlings per ashbed on 70% of ashbeds one year after regeneration.
Sensitivity of regrowth to fire	Protect from fire for 15-20 years	Protect from fire for 10-15 years after saplings begin to develop	Protect from fire for 10-15 years after saplings begin to develop	Protect from fire for 10-15 years after saplings begin to develop. Clumps of regrowth with high fuel accumulation beneath them remain sensitive to fire
Potential products from thinning	1st thinning (15-30 years old) -chipwood, some small sawlog Later thinnings - Sawlog, some transmission poles, chipwood	Thinning up to ~ 60 years old mainly non-commercial except for posts, poles, small firewood. First thinning after that - posts, firewood, small sawlog. Increasing sawlog in later thinnings	Thinning up to ~ 60 years old chipwood or non-commercial. Later thinnings mainly chipwood for trees < 60cm diameter. Marri sawlog production uncertain but better prospects in southern areas and if protected from damaging fires	Commercial thinning in >30 year old stands initially for posts and later for sawlog when trees > 30 cm diameter
Potential products from large trees	Sawlogs, chipwood	Sawlogs, transmission poles, firewood	Limited sawlogs unless very high quality trees	Sawlogs, strainers, firewood
Approximate 'critical density' for pole stands (lower figure on harsher, drier sites)	16-20 m^2/ha	10-15 m^2/ha	10-15 m^2/ha	7-10 m^2/ha

Silvicultural options

Multi-stems are a common problem with planted jarrah. Early 'form pruning' or coppicing will improve form.



This stand of well-formed wandoo poles developed from the coppicing of poorly-formed planted stems at the sapling stage.

Planted seedlings

Planting is a useful regeneration option. Conditions for successful establishment are usually less restrictive than they are for seeding (natural or otherwise), but because fewer individuals can be planted there are less trees from which to select the future 'crop' trees so that it is essential to ensure good survival.

Karri

Planting is the most common form of regeneration for karri and planting at the rate of 1600-2000 seedlings per ha (spha) will produce fine-branched trees for future sawlogs. Survival is usually good but infilling in the second year without controlling the understorey competition is usually unsuccessful. Surplus trees are readily saleable as chipwood at the time of first thinning to about 300 trees per hectare.

Planted seedlings of jarrah, marri, blackbutt and wandoo tend to produce multi-stemmed, forked or poorly formed stems and for that reason are not commonly used.

Jarrah

Planted at 1300 spha in the wetter southern forest with a typical southern understorey it can be expected to produce sufficient (150 trees per hectare) well spaced potential sawlog trees but is less reliable in drier sites. In small holdings it may be feasible to 'form prune' saplings to produce well formed trees. Alternatively deliberate coppicing of badly formed saplings can be expected to produce stems of better form.

Marri

Form is usually better than jarrah but marri planting is less common because its natural regeneration is usually more plentiful and its commercial potential is low.

Wandoo

Planted wandoo often produces poorly formed saplings as well but coppicing is likely to improve it.

The role of fire in native forest management

Fire has an important role to play in:

- **Fuel reduction burning** to reduce the potential damage by wildfires. It may be related to the burning of logging debris after harvesting or as a more regular burning of leaf litter and other fine fuel,
- **Regeneration**, where it may be used to establish and prepare the seed bed (including ashbed), induce seedfall when the seedbed is most receptive and temporarily reduce understorey competition to allow regeneration to establish,
- **Nutrient cycling and forest health**, by releasing scarce nutrients from the litter, and
- **Biodiversity**, by periodic regeneration of elements of the understorey.

While the relatively more intense regeneration burns are carried out only once in the life of each generation of trees, fire for all of the other reasons needs to be carried out on a much more regular basis. There is no 'right' regime that is ideal for all values in all forests and circumstances and compromise to achieve a reasonable balance is necessary. Intensity, season and frequency are all important variables.

Maximum flora diversity is likely to occur between about 3 and 7 years after fire in the major forest types suggesting that a fire frequency of twice that might be a reasonable rule of thumb. However maximum diversity is not necessarily the most appropriate objective since any particular regime will favour some species and disfavour others, so that a knowledge of presence of any critical species is important. Similarly fire control risks vary with a number of factors and there is no one regime that is appropriate for all situations.

Private forests present a particular difficulty with respect to fire since most of them are relatively small and surrounded by grassland of some kind. Too-frequent fire will encourage the encroachment of grasses and weeds and this will limit the options for many forests.

Some guidelines to the management of fire and native vegetation can be found at www.environ.wa.gov.au

This stand of jarrah makes an important contribution to biodiversity (especially for hole-nesting species), salinity mitigation, aesthetics and microclimate despite the absence of native understorey.

Silvicultural options

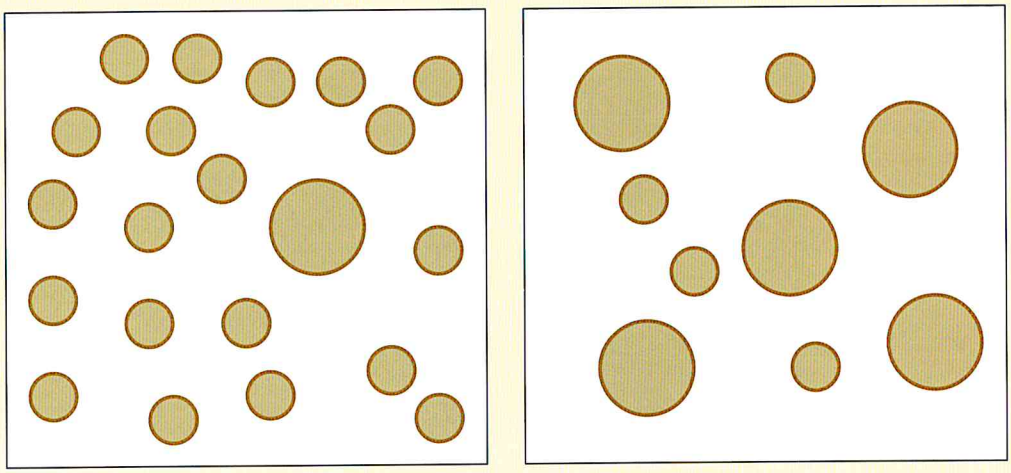
This densely stocked jarrah regrowth stand can be thinned to yield sawlogs, poles and firewood, improving tree vigour and future productivity while still retaining its conservation values and maintaining water quality.

Measures of stand density

Stand density is an important indicator of 'crowding' or 'competition' within a stand . It is usually expressed in terms of tree numbers (trees per hectare) or as basal area (square metres per hectare).

Tree numbers per hectare or average spacing is simple to visualise but to measure it you need to establish a sample plot of known size and measure all the trees in it – it can be a time consuming process. It is perhaps the most useful means of dealing with young stands before they have started to compete, but it does not give a very useful measure of competition (or crowding) if you don't also know the size (diameter) of each tree.

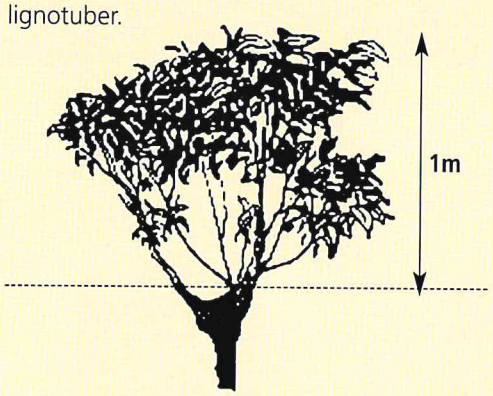
Basal area is the total of the cross-sectional areas (measured at 1.3 m above the ground) of the trees in the area - expressed as the number of square metres per hectare. It has the advantage that it takes account of both tree numbers and size as a measure of competition. It is easily measured using 'angle count' methods.



These two 'stands' have different number of trees but the same basal area i.e. the same degree of 'crowding' or 'competition'.

The role of lignotubers in regeneration

Many eucalypt species form lignotubers i.e. small swellings at the base of the stem, just below the ground surface. These swellings contain large numbers of dormant buds so that if the shoot is damaged or removed by fire, grazing or cutting for example, the plant will re-shoot again. It is an extremely important survival mechanism. They are not however immune from drought for many years and continuous heavy grazing will also eliminate them eventually. Of the species discussed here only karri does not form a lignotuber.



Jarrah provides an extreme example of the role of the lignotuber. In natural stands seedlings that survive a regeneration event will form a small lignotuber within about 12 months and it will gradually increase in size while the roots penetrate deeper into the soil. The above ground plant becomes a small bush. This small bush will only develop into a sapling if the tree competition around it is reduced (eg. by fire or cutting) and then only when the lignotuber has reached a certain size and become what is known as 'ground coppice'. In the northern jarrah forest this is when the lignotuber is about the size of a fist, which may take up to 20 years to develop. In many parts of the forest a large 'pool' of these lignotubers has developed beneath the forest canopy, and as soon as the trees above are cut and removed, the 'ground coppice' will rapidly develop into saplings and regeneration is assured.

Large veteran trees can dominate the site to the virtual exclusion of understorey and regeneration. Reducing the density of these trees will allow regeneration to become established.

Established jarrah 'ground coppice' will quickly develop into saplings when the overstorey trees are removed.

Silvicultural options

Wandoo coppice developing from ground level can produce trees that are stable and of good form

Stump coppice of this type is unstable.

Pros and cons of coppice

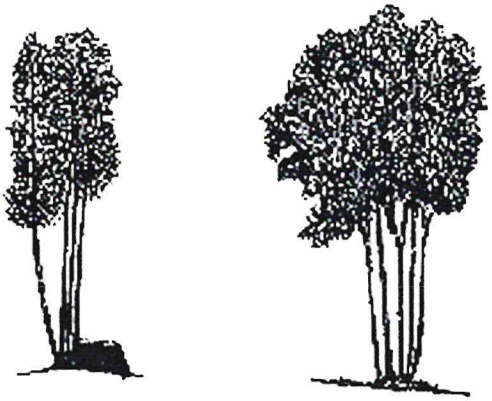
Stump coppice are the shoots that develop from a stump cut above ground level. The shoots may develop at ground level or further up the stump.

Stool coppice are the shoots that develop at ground level from a small stump.

Coppice is a key survival mechanism and can be a valuable source of regeneration but it has advantages as well as disadvantages. Because it already has a large root system it grows very fast and its survival is virtually assured. It is particularly valuable as regeneration in drier sites where 'ground coppice' may be few and regenerating new seedlings is very difficult because of moisture stress.

Stump coppice emerging from high up on the stump is not desirable because it is likely to be blown off by the wind as it gets larger. Coppice developing from ground level is usually very stable, but multiple stems trap leaves and can cause butt damage in future fires. This is specially a problem with wandoo. Cutting back to a single stem will prevent this.

Deliberate coppicing of poorly formed or fire damaged trees, especially those below about 25 cm diameter, can be a good way to achieve regeneration or improve the quality of the regeneration. The new coppice will achieve the height of the original saplings or small poles in a very short time and usually with better form.



Stump coppice **Stool coppice**

Coppice can be a problem if thinning is the aim because the new growth will quickly negate the thinning. Herbicide application (applied by notching to standing trees or to the stumps of felled trees) is usually required for the effective thinning of jarrah, marri or wandoo stands. It is not usually necessary in karri thinning.

Case studies

The following case studies are used to illustrate the kind of information that is required in developing a plan for multiple use management for private native forest. They illustrate the minimum requirement for planned management but include the information that is required for assessment of a Clearing Permit by the Department of Environment or a Commercial Producers Licence from the Department of Conservation and Land Management.

Case 1

Location and rainfall

25 km NE of Boyup Brook in the Blackwood River catchment. Approx 33° 42′ S, 116° 37′ E. Shire of Boyup Brook.

Long term average rainfall is 625 mm per year (520 mm/yr over the last ten years)

Forest area and type

2.5 ha cleared or part cleared for farm infrasructure.

Of the forest area approximately 200 ha is wandoo dominated and 50 ha is dominated by jarrah.

The following Mattiske and Havel Vegetation Complexes occur on the site: Dalmore 2 and Lukin 2 predominate with some Kulikup 2 and Darkin 3.

Forest condition and management history

The existing forest is dominated by regrowth that originated after heavy ringbarking to encourage pasture growth about 1890. The forest was selectively cut in the 1950s, 1960s and again in 1986. Further harvesting began in 1991 for strainers, struts and posts and more recently dead (ringbarked) wandoo has been harvested and milled for posts.

In 1997 the area was registered under the Land for Wildlife Scheme.

The forest is fully stocked (typically about 15 m^2/ha with some small areas >30 m^2/ha) and competition for soil moisture has resulted in generally thin crowns in the wandoo trees and some deaths of jarrah.

Approximately 1.5 ha in the south west corner of the forest is waterlogged and salt affected.

There are no rare or endangered species known to occur in the forest.

The understorey vegetation is relatively weed-free except for the external boundaries where there is grass invasion from neighbouring pasture. Grazing has been excluded since 1960. The relatively sparse understorey is probably a consequence of heavy tree stocking and dry conditions together with grazing pressure form kangaroos and rabbits.

About 30 ha in the northwest corner was burnt in a wildfire in Autumn 1981. An area to the south of the block as burnt in 1987 and part of the central area was burnt in 1993.

Evidence of *Armillaria* infection occurs in patches throughout the forest and jarrah is attacked by jarrah leafminer on a regular basis.

The owner has a portable sawmill on site.

Management objectives

- To maintain the overstorey and the understorey in a healthy condition.
- To produce a regular flow of forest produce for sale or farm use, and maintain potential for future production.
- To maintain wildlife habitat.
- To improve the aesthetics of the forest.
- To prevent any deterioration of land due to the effects of salinity.

Principal strategies

- Keep wet areas and areas adjacent to water courses free of disturbance by harvesting (four areas – total 23 ha).
- Gradually promote the development of an uneven aged structure in the forest by:
  - Retaining large veteran trees as habitat trees
  - Thinning regrowth stands to provide sawlogs, strainers, posts and firewood while retaining good quality trees to grow on. Conduct associated thinning to waste where necessary to achieve the target density.
  - Where stand stocking is low, regenerate these patches using coppice, planting or seed regeneration on ashbeds.
- Improve the ability of the forest to withstand drought and improve the vigour of the overstorey and the understorey by thinning.

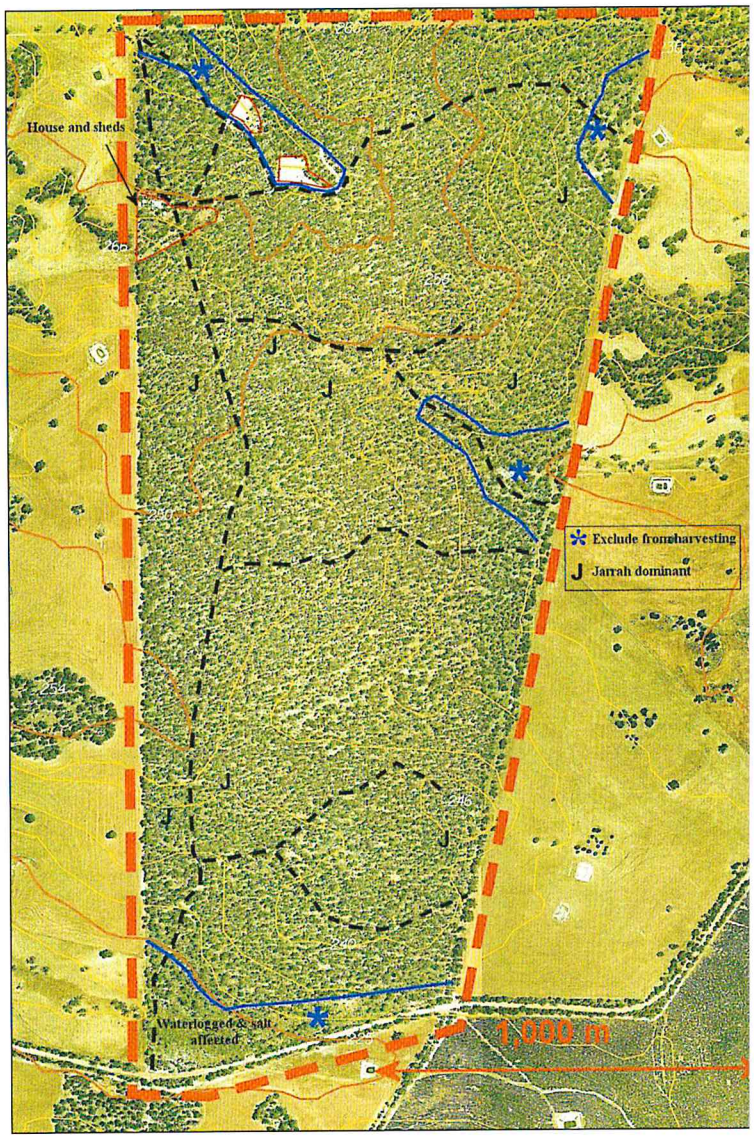
- Control stand density increase by controlling coppice development in thinned areas.
- Control excessive grazing pressure by kangaroos should it become necessary in order to maintain the understorey.
- Avoid an increase in the level of the water table by moderate thinning intensity and limiting the area treated each year.
- Minimise the spread of *Armillaria* by avoiding thinning in patches showing symptoms of the disease.
- Reduce the potential for damage by wildfire and maintain a healthy understorey by regular prescribed burning on a mosaic across the forest.

Action

Demarcate areas to be retained undisturbed by harvesting when activities are proposed near the area.

Prescription for harvesting areas (similar to CALM prescription for wandoo woodlands No 2/89)

- Retain three large habitat trees /ha where they exist
- Thin regrowth stands to 8 m^2/ha retaining potential 'crop' trees of any size, providing a yield of usable product where possible.
- Where a thinning density (8 m^2/ha) cannot be retained, aim to regenerate any gaps >20m diameter
- Remove dead trees not required for habitat.
- Control coppice in thinning patches using Glyphosate applied immediately to the stumps or by spraying coppice shoots when they are about 0.5 m high.
- Regenerate understocked patches by:
  - Coppicing existing poor formed trees.
  - Creating heaps of debris and burning them in autumn when there is seed in the crowns of surrounding trees.
  - Plant on ashbeds where natural seedfall regeneration is not feasible.
- Monitor regeneration success after the first summer and take remedial action if required (planting in the next winter).
- Maximum area to harvest over the next 5 years – 80 ha.
- About 5 years after harvesting, coppice malformed regrowth, reduce stump coppice to one stem.



Aerial photograph indicating areas for harvesting, access tracks and areas to be excluded from harvesting.

Fire management

- Burn sections of the area defined by existing tracks with a spring burn on a cycle of about 15 years. Maximum area to be burnt in the next 5 years is 50 ha.
- Burn harvested area 1 year after harvesting (or when seed is available if necessary) to remove the fire hazard of the debris and create ashbed if necessary. Protect these areas from fire until the regrowth will withstand fire. Burn in autumn if ashbed is required.

Browsing management

Monitor browsing intensity by fencing small exclusion plots to gauge the impact of browsing and take remedial action if necessary.

Case 2

Location and rainfall

18 km south of Manjimup in Zones C and D of the Warren catchment. Approx position 34° 24′ S, 116° 11′ E. Shire of Manjimup

Long term rainfall is 1100 mm per year.

Forest area and type

104 ha of 1945 karri/marri regrowth,

9 ha of 2000 karri/marri regrowth, and

167 ha of mainly bluegum plantation (1997), cleared pasture and other vegetation and dams.

The neighbouring land to the west is pasture, with private forest to the south and public forest to the east.

Forest condition and management history

The forest was heavily cut and regenerated in about 1945 with some further selection cutting of some parts in the late 1950s.

89 ha of the mostly even-aged regrowth that resulted from that harvesting was thinned in 1998.

9 ha of poorly-formed fire damaged forest was clearfelled in 1999/2000 and regenerated by planting with karri seedlings in 2000. These activities were carried under a licence issued under the Soil and Land Conservation Act.

18 ha adjacent to the Warren River and a tributary have been set aside from harvesting.

The thinned regrowth forest is of good to excellent quality. Co-dominant height is 40m+, with a basal area of 18-24 m^2/ha. The co-dominant trees about 45 cm dbh. The two northern sections are less dense (14-18 m^2/ha). There are few veteran trees remaining.

The following Mattiske and Havel Vegetation Complexes occur on the site: the Warren complex on the slopes of the Warren River, Crowea complex on the ridge and the Wheatley complex along the creek tributary. All of these are well represented in crown land reserves. There are no rare or endangered species known to occur in the forest.

The understorey has not been burnt since the thinning operation and is still relatively open. There are no stock being grazed in the forest and there is only limited blackberry and pasture weed invasion.

There is good internal access (some gravelled) but limited access to the steep southern slope adjacent to the Warren River.

The area was last burnt 10-15 years ago.

Management objectives

- Maintain a healthy forest.
- Maintain species diversity.
- Reduce the likelihood of damage from wildfire.
- Provide a periodic income from timber production.
- Maintain or enhance visual quality values, especially adjacent to the SW Highway.
- Maintain water quality.

Management options

Thinned stand

The current stand density of the older regrowth forest is optimum for individual tree diameter growth and close to maximum for total volume growth and will remain so for at least 10 years. There are several options available for the next stage of management:

1. Re-thin the entire stand in about 2013 to 22-24 m^2/ha to yield mainly sawlogs with some pulpwood residue; OR

2. Carry out a highly selective individual tree thinning, removing some of the largest trees for sawlogs, to the extent possible without damaging other trees and while maintaining a minimum basal area of about 16-18 m^2/ha. This is likely to be possible only for the next five years after which it is likely to cause excessive damage to retained trees. By that time the larger trees will have increased in diameter by about 5 cm and in volume by about 20%; OR

3. At any time from about 2013, remove patches of trees (about 100 m diameter), concentrating on patches with the largest regrowth trees. Regenerate these patches, and thin the intervening patches to about 22-24 m^2/ ha. Repeat this process at about 10-20 year intervals.

Case studies

The total long term production would be similar for all options. The first two options are simpler to implement, especially with respect to fire management. The main purpose of the second option is to provide an earlier cash flow if this is required but at the expense of some long term volume production.

The third option would provide a significant early cash flow, a long term aesthetic benefit, but it would be a significantly more complex fire management issue because of the constant presence of fire-sensitive regrowth.

All options include the retention of all existing veteran trees.

Regenerated stand

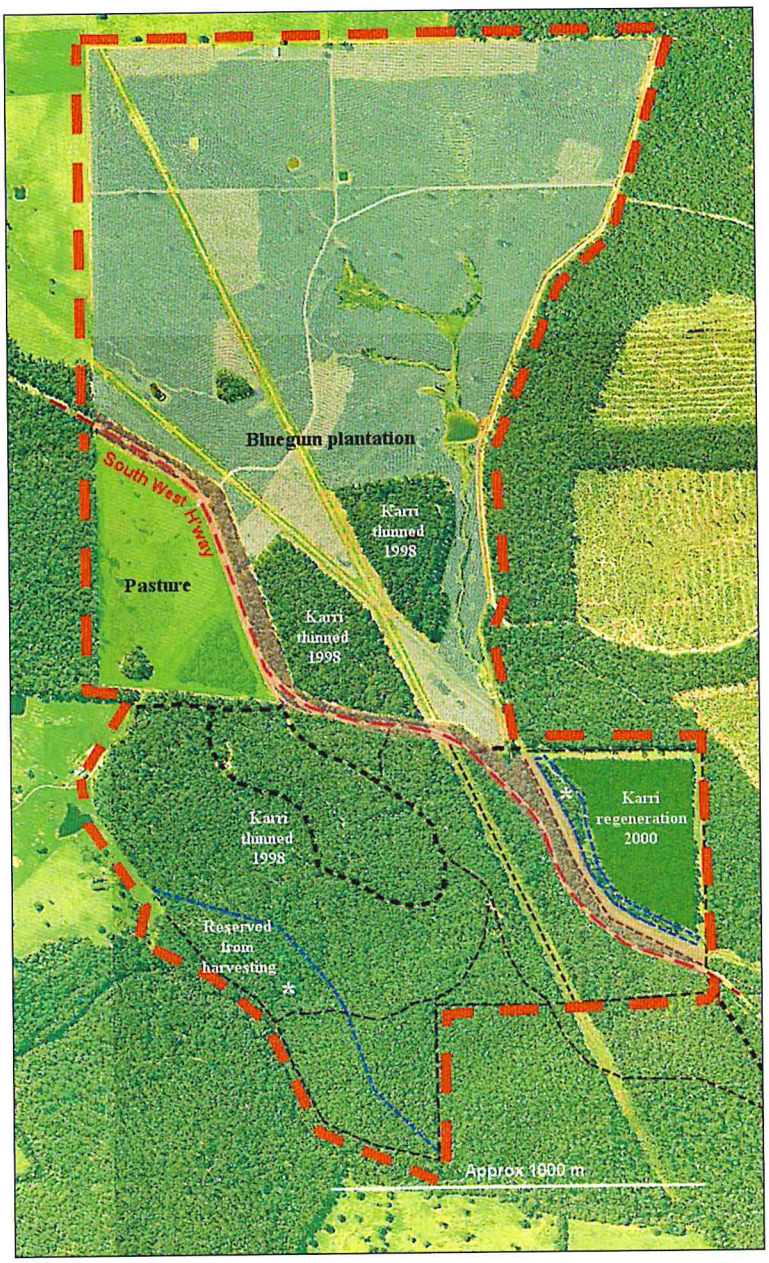
The stand that was regenerated in 2000 should be ready for a commercial thinning for pulpwood from about 2025.

Fire management

This forest is a valuable commercial asset that carries the risk associated with a build-up of heavy fuel inherent to the karri forest, and with limited opportunity and resources for fuel reduction burning. However there is good highway access to the forest and it is surrounded by well managed grazing, bluegum plantation and high value State forest, all with well developed fire protection strategies and a mutual protection interest. The principal protection strategy is the maintenance of access to facilitate fire suppression and fuel reduction associated with future harvesting where this is practicable.

Young karri regrowth will be protected from all fire until after the first thinning (i.e. about 25 years of age) after which time it may be burnt under very restricted conditions.

Older regrowth stands may be burnt in the spring in association with future thinning. Depending on fuel conditions it may be burnt prior to or after thinning. This would equate to a 10-15 year burning cycle. A decision on timing will be made one year prior to the planned thinning date



Aerial photograph indicating property boundary, changes since photography and recent sivicultural history.

Action

Next five years:

Maintain tracks by removing any trees that fall, and slashing overhanging vegetation where necessary. Grade where necessary to prevent erosion.

Control blackberries, especially any new infestations.

Five years onwards:

Dependent on the choice of management option.

Controlling legislation

Actively managing any native forest is likely at some time to involve the removal of some trees or other vegetation or the use of fire. To do so you will first require either a Clearing Permit from the Department of Environment or a Commercial Producers Licence from the Department of Conservation and Land Management.

Clearing Permit

The *Environmental Protection Act* applies to all types of native vegetation, including those found in aquatic and marine environments. It includes all native grasses, shrubs and trees, including dead vegetation, but does not include intentionally sown native vegetation, such as that found in a garden, plantation or other crop, unless it was established under a written law, funded by a person other than the owner, or a binding agreement such as a covenant.

In the *Environmental Protection Act 1986*, clearing means the killing or destruction of; the removal of; the severing or ringbarking of trunks or stems of; or the doing of any other substantial damage to, some or all of the native vegetation in an area, and includes the draining or flooding of land, the burning of vegetation, the grazing of stock, or any other act or activity that causes these things to some or all of the native vegetation in an area. In other words, harvesting timber, silvicultural operations and regenerative burning could be considered clearing under this definition.

If the native forest management/harvesting activities are defined as clearing under the *Environmental Protection Act*, then a clearing permit will be required from the Department of Environment.

Under the Environmental Protection Act, certain activities are regarded as exempt from the requirement for a clearing permit[1]. A clearing permit is not required for activities listed in regulation 5 of the *Environmental Protection (Clearing of Native Vegetation) Regulations*. These are routine activities which are considered to have a low impact, and include:

- erection of a lawful building;
- erection and maintenance of a fence line;
- establishment or maintenance of an access track, firebreak or walking track that is more than 100m from a suitable cleared area;
- regrowth control around buildings or on land was used for cultivation or forestry in the past ten years;
- burning for hazard reduction purposes outside of the restricted or prohibited periods (until 7 July 2005);
- harvesting domestic firewood, building materials, fence posts or craftwood for use by the owner or occupier from dead trees or from live trees if they are not killed (i.e. coppicing). Firewood and craftwood may be given away but not sold; and
- clearing of isolated trees (more than 50m from other native vegetation)

There are restrictions and limitations on these exemptions. For further information on exemptions, refer to the brochure on the DoE website or contact the DoE on 1800 061 025.

Exemptions in regulations such as those above do not apply in environmentally sensitive areas. To see if you are in an environmentally sensitive area, please check with the DoE or visit the Department's website at www.environment.wa.gov.au.

A permit is also not required for requirements or approvals under another law, such as:

- clearing done in accordance with a Commercial Producers Licence issued under the *Wildlife Conservation Act* by CALM or for
- burning carried out under a permit issued under the *Bushfires Act*

The Department of Environment will consider the application for a clearing permit against the following principles.

Clearing of native vegetation would generally not be approved:

a) if it comprises a high level of **diversity** of plant species.

b) if it comprises the whole or a part of, or is necessary for the maintenance of, a **significant habitat** for fauna indigenous to Western Australia.

c) if it includes, or is necessary for the continued existence of **rare flora**.

d) if it comprises the whole or a part of, or is necessary for the maintenance of a **threatened ecological community**.

[1] *There are few exemptions in catchments defined under the Country Areas Water Supply Act*

e) if it is significant as a **remnant of native vegetation** in an area that has been extensively cleared.

f) if it is growing in, or in association with, an environment associated with a **watercourse** or **wetland**.

g) if the clearing of the vegetation is likely to cause appreciable **land degradation**.

h) if the clearing of the vegetation is likely to have an impact on the environmental values of any adjacent or nearby **conservation area**.

i) if the clearing of the vegetation is likely to cause deterioration in the **quality of surface or underground water**.

j) if clearing the vegetation is likely to cause, or exacerbate, the incidence or intensity of **flooding**.

However a clearing permit is likely to be approved if it can be demonstrated that the clearing and management activity proposed will provide for the sustainability of those values and that the disturbance constitutes a temporary impact or may indeed be a necessary part of ensuring sustainability. The clearing application is effectively a 'statement of intent' which provides the opportunity to show how particular forest values will be sustained if that is the management intent.

For more information on how to apply for a clearing permit, refer to the DoE website.

Commercial Producers Licence (CPL)

If you intend to sell any products from the activity (even if the activity is exempt under the Environmental Protection Act) you will need to obtain a Commercial Producers Licence (CPL) from the Department of Conservation and Land Management. You will not require a clearing permit if a Commercial Producer's licence is issued, for the clearing covered by that licence. The Commercial Producers Licence will only cover those clearing activities directly associated with the commercial harvesting, such as the actual harvesting, or associated damage to vegetation. It does not cover the removal of trees that are not being sold (such as in non-commercial thinning), nor other forest management activities such as roading or regeneration or protective burning. Where an application, or the associated forest management plan, includes other clearing of native vegetation not directly related to the harvest operation, CALM will refer the application to the DoE where it has the potential to be seriously at variance with the clearing principles. A separate clearing permit from DoE is required for those activities.

Country Areas Water Supply Catchments (CAWS)

Clearing activities in the catchments of the Wellington and Harris River Dams, the Mundaring Weir; the Kent and Warren River reserves; and the Denmark River Catchment Area have special requirements. In summary:

- If the activity is restricted to timber harvesting for sale – A CPL (from CALM) and a CAWS Clearing Licence (from DoE) is required.
- For activity that is not directly related to or is additional to timber harvesting for sale:
  - If compensation has previously been paid – a Clearing Permit (from DoE) plus a CAWS Clearing Licence is required.
  - If compensation has not been paid – A Clearing Permit is required

Licence to sell timber for woodchipping.

A licence from the Commissioner of Soil and Land Conservation is required to sell any wood products to be used for woodchipping. Evidence of a CPL or a clearing permit, with any conditions attached, must accompany the application.

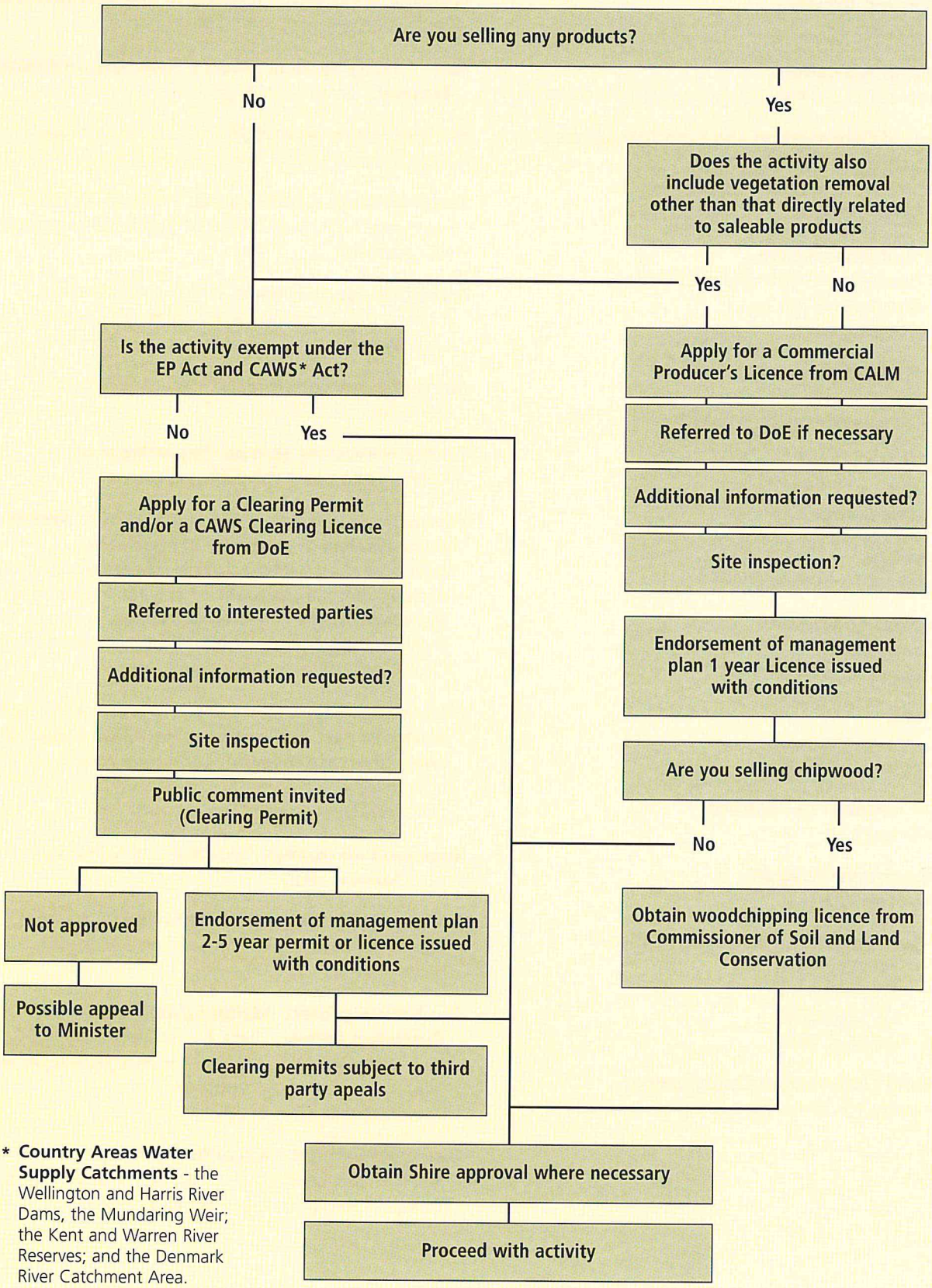
Aboriginal Heritage

The Aboriginal Heritage Act provides for the protection of Aboriginal sites. If there is any reason to believe that a site exists in the forest you should contact the Department of Indigenous Affairs for advice and make provision for it in the management plan.

Shire approval

Each Shire has its own policy with regard to tree removal. You should be aware of their requirements before preparing your management plan or clearing application.

Process for obtaining approval for the sustainable use of native vegetation



* **Country Areas Water Supply Catchments** - the Wellington and Harris River Dams, the Mundaring Weir; the Kent and Warren River Reserves; and the Denmark River Catchment Area.

Contacts and information

Contacts

Association of Consulting Foresters
www.australianconsultingforesters.org/

Australian Forest Growers.
www.afg.asn.au

Department of Agriculture.
www.agric.wa.gov.au/default.pasp (search 'farm forestry')

Department of Conservation and Land Management
General. Contact nearest local office
Commercial Producers Licence 08 93340455
Land for Wildlife Program 08 93340455

Department of Environment
Clearing Permits and CAWS Clearing Licences
www.environment.wa.gov.au
Free call 1800 061 025

Department of Indigenous Affairs.
Aboriginal sites.
www.dia.wa.gov.au/Heritage/IntroForDevelopers.asp

Department of Land Information.
Aerial photos
www.dola.wa.gov.au

Farm Forest Line
www.farmforstline.com.au/index.html

Forest Products Commission
www.fpc.wa.gov.au
Advice: Nearest local office

Forestry Tools
www.forestrytools.com.au
www.prospectors.com.au

Institute of Foresters of Australia
www.forestry.org.au

Master Tree Grower Program.
www.mtg.unimelb.edu.au

Regional Farm Forestry Development Officers
Albany 08 9892 8418
Bunbury 08 9780 6100
Moora 08 9651 0545
Northam 08 9621 2400

Soil and Land Conservation Commissioner
Woodchipping licence 08 9368 3282.

Further reading

A landowners guide to managing private native forests in Gippsland, Greening Australia 2002, 133 pp.

Eucalypt woodlands – A guide to management (2000). Agriculture WA Misc Pub 17/00

Farm forestry toolbox. Free CD from Private Forests Tasmania. Email: admin@privateforests.tas.gov.au

Fire and native vegetation in Guidelines for native vegetation protection. www.environ.wa.gov.au

Forest hollows: wildlife homes Whitford, K.(2002) Landscope 17:4 (Department of Conservation and Land Management)

Managing your bushland, B.M.J. Hussey and K.J. Wallace, 1993. 196 pp (Department of Conservation and Land Management)

Managing your dry forests, Forestry Commission, Tasmania, 1991, 56 pp

Timber Harvesting Manual. Department of Conservation and Land Management

Private native forests in the south west of Western Australia. Part 1. A review of legislative, administrative and marketing issues relevant to sustainable management of private native forest in the south west of Western Australia. Spriggins, D. (in review) (Revegetation Systems Unit, Department of Conservation and Land Management)

Private native forests in the south west of Western Australia. Part 2. A review of technical knowledge and experience in managing native forest. Spriggins, D. (in review) (Revegetation Systems Unit, Department of Conservation and Land Management)

Regeneration surveys (Department of Conservation and Land Management)

Silvicultural Guidelines for (Jarrah/Karri/Wandoo) Forest (Department of Conservation and Land Management)

The Farmer's Forest. Multipurpose Forestry for Australian Farmers. Reid, R. and Stephen, P. RIDC Publication No R01/33, 2001. Available from Australian Master Tree Growers Association www.mtg.unimelb.edu.au

Tree measurement manual for farm foresters. T. Abed and N.C. Stephens (2002). National Forest Inventory, Bureau of Rural Sciences, Canberra 88 pp.

Notes

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