Silvicultural Practice in Wandoo Forest and Woodland

Sustainable Forest Management Series

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GOVERNMENT OF WESTERN AUSTRALIA

DEPARTMENT OF Conservation AND LAND MANAGEMENT
Conserving the nature of WA

DEPARTMENT OF CONSERVATION AND LAND MANAGEMENT

17 DICK PERRY AVENUE

TECHNOLOGY PARK, WESTERN PRECINCT

KENSINGTON, WESTERN AUSTRALIA 6151

TELEPHONE (08) 9334 0300

FACSIMILE (08) 9334 0498

WEBSITE: www.naturebase.net

EMAIL: information@calm.wa.gov.au

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This guideline supersedes Silviculture Specification 2/89. It is Silviculture Specification 2/89 amended according to the requirements of Appendix 5 of the Forest Management Plan 2004-2013.

Cover photograph: Wandoo forest in Talbot block (Taken by Chris Garnett)

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Custodian: Manager, Policy and Practices Branch
Approved by: Director Sustainable Forest Management

TABLE OF CONTENTS

1. Preamble

Wandoo most frequently occurs in open woodlands characterised by clumps of regrowth, groups of mature trees and large gaps. The lack of secondary storey and the low scrub understorey enhance its open nature. The wandoo forest is valuable for many purposes (recreation, catchment protection, timber production, conservation of flora and fauna and honey production) and State forest management practices must ensure conservation of all values.

The clumped distribution of wandoo trees reflects their dependence upon ashbed for regeneration and possibly the limited capacity of those sites. The importance of linking several steps (seed, ashbed, burning and long-term protection) to achieve regeneration after timber harvesting is demonstrated by the scarcity of regrowth in some cutover stands, and the successful restocking of areas where correct procedures are followed.

Havel (1975) recognises 3 site-vegetation types (M, L, Y) where wandoo is the dominant species. These range considerably in fertility, structure and moisture storage. Variations to this specification may be required to meet the distinct needs of each site.

These specifications apply to logging and regeneration operations taking place in areas where timber production is a permissible land use.

The broad objective of these guidelines is to conserve the multiple use values of the wandoo forest and woodland.

2. Silvicultural objective

1. In areas where timber production is a permissible land use the silvicultural objective is to produce wandoo stands which will contain three age/size classes: veterans (> 50 cm diameter at breast height (DBH)), intermediate 25-50 cm DBH) and regrowth < 25cm DBH).
2. A fully stocked stand of this kind should contain about 5 m^2/ha in each class or, in the case of regrowth, the capacity to eventually reproduce 5 m^2/ha.
3. Protect water, fauna and aesthetic values of the wandoo forest.

2.1. Strategies

To selectively cut and regenerate adequately stocked stands so that they will contain a mixed size/age structure with a capacity for continued growth and productivity.

To protect all retained growing stock from damage during harvesting and regeneration operations.

To regenerate understocked areas.

To prevent damage to sensitive regeneration during fuel reduction burning operations.

Maintain fauna habitat.

3. Trees suitable for retention

REGROWTH (< 25 cm DBH) - advanced growth, sapling or pole sized wandoo which has not been damaged and with the potential to grow into a sawlog.

INTERMEDIATE (25-50 cm DBH) - trees with a well-formed crown; preferably containing or with the potential for a sawlog. These may also serve as seed trees in regeneration areas if their crown is large and healthy.

VETERAN (> 50 cm DBH) - trees which are healthy and likely to live for many years. Where regeneration is required these also serve as seed trees and a wide, healthy crown is required.

FAUNA HABITAT - veterans or large intermediates with one or more branch stub or other holes. Sufficient crown to remain vigorous for many years.

4. Treemarking

4.1. Marking for habitat

Retention of elements of fauna habitat within wandoo forest subject to timber harvesting needs to be viewed in the broader context of habitat conservation, and in many cases applied in conjunction with the requirements for the adjoining jarrah forest. This includes formal and informal reserves (e.g. stream zones and diverse ecotype zones) from which timber harvesting is excluded, as well as temporary exclusion areas (TEAS) in which timber harvesting is deferred. Habitat retention within the harvested coupe is an important complement to the structural diversity of the stand and the forest.

Habitat retention within coupes can provide the opportunity for hollow dependent fauna to persist following harvesting, and provide the potential for re-colonisation at a later time.

4.1.1. Objectives

- To ensure the sustained availability of suitable refuge sites for hollow dependent and other fauna, through the retention of a sufficient number and combination of trees, balga, and ground logs within timber harvesting coupes.
- To maintain stand diversity by retaining a representation of mid-storey elements.

4.1.2. Habitat trees

Habitat trees will be veteran and/or large intermediate trees with one or more branch stubs or other hollows. They should have sufficient crown to stay alive for many years, and priority must be given to trees that show current signs of use by fauna (e.g. possum scratch-tracks) and/or contain visible holes and/or broken branch stubs with the potential to develop hollows. In mixed stands there is no preference for species.

In all harvest areas, habitat trees receive priority for marking. Where a choice exists, retain non-sawlog trees as habitat – but do not compromise the quality of the habitat trees to achieve this.

4.1.2.1. Rate of retention

On all areas harvested an average of 3 habitat trees per hectare are to be marked for retention.

During harvesting and subsequent silvicultural operations (including regeneration burns) care should be exercised to avoid disturbance or damage to habitat trees.

4.1.2.2. Pattern of retention

Habitat trees must be marked for retention with a large “H”.

Priority should be given to quality over spacing and where possible habitat trees should be distributed throughout the coupe. Where post-harvesting fuels are high, it is important that tops disposal is carried out to protect these trees from damage that would affect their long-term persistence.

In forest that consists of small thinning patches and regeneration gaps of one hectare or less, aim to mark habitat trees to form groups near the boundaries of these patches.

Isolated large merchantable trees may occur in thinning patches. These may be difficult to remove as part of a harvesting operation without damaging the integrity of the thinning patch. Where this situation occurs it is recommended to retain these large trees as habitat trees rather than to attempt to remove them.

Where the perimeter of a coupe is intended to be a strategic burn boundary then the pattern of retention of habitat trees should recognise the need for subsequent burn security. In this instance trees within the first 100 metres with substantial hollows, which cannot be extinguished, are likely to be felled as part of the prescribed burn security. It is preferable to bias the retention towards habitat tree at the lower end of the crown structure categories within the 100-metre zone.

4.1.3. Balga (grass trees) as habitat

Balga is valuable fauna habitat and when used, large multi-headed balga with long unburnt heads are preferred to small balga with recently burnt heads.

All balga may be used as refuge if adequate grass skirts are present. Any balga may therefore be suitable for retention. Since they are slow growing the larger balga, particularly those with multiple heads, will take the longest to be replaced if removed and because of their size they are also likely to provide the greatest potential as refuge.

4.1.3.1. Characteristics of balga for retention

Where balga occur, the largest (ideally with multiple heads) should be chosen for retention, preferably with intact grass skirt. Only live, healthy balga should be selected for retention.

4.1.3.2. Rate of retention

There is no specific target for balga retention in the wandoo forest. Where possible, balga are to be clearly marked with a white painted ring and are to be protected from physical damage during harvesting and follow-up silvicultural operations. They should not be deliberately burnt during regeneration operations.

Patches of wandoo forest where balga dominates the understorey should be referred to the Department's Senior Silviculturist for advice, prior to marking.

4.1.3.3. Pattern of retention

Balga should preferably be retained in groups. Where groups occur, groups of 2 to 3 large balga per group is preferable to retaining individual balga. Where possible, retain balga as a group with habitat trees.

Since balga pose no significant aerial fire hazard during the mop-up and patrol phase of prescribed burning and fire suppression, there are no restrictions on the retention of these in the 100m strip along strategic burn boundaries.

4.1.4. Secondary storey species

Wandoo suppresses the understorey (through competition for moisture) and therefore there is generally no extensive secondary storey in the wandoo forest. The secondary species can occur as individual specimens scattered throughout a coupe or may form groves or dense thickets in some circumstances (*Dryandra* sp, *Gastrolobium* sp), and where these occur they are an important component of the biodiversity of the flora, and in turn many of these species are important habitat components for fauna as they are significant seasonal food sources e.g. leaves,

flowers, nectar and fruit. They rarely contribute hollows or major physical structures for wildlife.

4.1.4.1. Characteristics

In the situation where species such as *Casuarina* sp, *Hakea* sp, WA Christmas Tree (*Nuytsia floribunda*) etc occur as a secondary tree layer consideration should be given to retaining them where scattered individuals occur.

4.1.4.2. Rate of retention

Where the above species occur as occasional individuals, mature specimens should be marked for retention. In other instances there is no need to mark them, but machine operators should be instructed to avoid unnecessary removal or damage, except where the material is required to create ashbeds.

4.1.4.3. Pattern of retention

There is no specific pattern of retention for the secondary storey species. They pose no significant aerial fire hazard during the mop-up and patrol phase of prescribed burning and fire suppression, there are no restrictions on the retention of these in the 100m strip along strategic burn boundaries.

4.1.5. Ground habitat

Ground habitat in the form of hollow logs and stumps are also important refuge sites for forest fauna such as Numbat, Chuditch, Western Ringtail Possums, Brushtail Possum and Quenda.

4.1.5.1. Characteristics

Hollow logs provide habitat for a range of fauna species. Naturally occurring hollow logs should, as far as possible, be retained undisturbed. These logs should not be included in heaps to create ashbed.

Characteristics of *logs* preferred for retention are:

- Log diameter: 30-100 cm
- Pipe diameter: 6-30 cm in diameter extending into log
- Length of log: pipe at one end – 1.5 metres minimum
  pipe at both ends - 3 metres minimum.

Hollow logs that have been created as a consequence of harvesting may be included in heaps for ashbed creation if they are required. However where there is adequate other tops or debris that can be used for ashbed creation then logs with a pipe greater than 10 cm diameter and are more than 3 metres long may be excluded to supplement the natural habitat logs.

Characteristics of s*tumps* preferred for retention are:

- Stumps that have existing holes or burrows under them; and
- Stumps that have been lifted, creating a protective underground cavity due to a leaning tree or some other agency.

4.1.5.2. Rate of retention

Where available, retain at least one suitable ground habitat log or stump per hectare, even if it shows no obvious sign of use. Retain all natural hollow logs with a pipe > 10 cm diameter, and length > 3m.

All ground habitat logs and stumps that are to be retained must be marked by the tree-marker with a large "H". These marked logs or stumps should not be unnecessarily disturbed by the harvesting activities, and they must not be pushed into heaps.

4.1.5.3. Pattern of retention

There is no specific pattern of retention required.

4.1.6. Protection of habitat elements

4.1.6.1. Tops disposal

Tops and other residues larger than 7.5 cm diameter are to be removed for at least 10 m from around wandoo habitat trees. They should also be moved away from retained secondary storey trees or groups and ground refuge sites to ensure subsequent protection from fire during the tops disposal burn.

4.1.6.2. Training

Harvesting contractors and machine operators are to be briefed on habitat recognition, retention and protection requirements. For balga and secondary storey species it should be stressed that unnecessary disturbance or destruction of these should not occur at any time. The training should also enable operators to recognise and retain suitable logs and stumps that are identified and / or created during the harvesting activities or just prior to the completion of operations.

4.2. Adequately stocked stands

DEFINITION
An adequately stocked stand contains at least 8 m^2/ha of retainable wandoo trees, or if less than 8 m^2/ha, it contains gaps of less than 20 metres diameter between groups of trees suitable for retention.

Using a 1-factor relascope (Appendix 1), mark to retain 8 m^2/ha of retainable wandoo trees. Preferably 1 m^2/ha [3 stems per hectare (s.p.ha)] fauna habitat, 3 m^2/ha [10 s.p.ha] veterans and 4 m^2/ha [40 s.p.ha] of intermediates. A lower retained basal area (to 6 m^2/ha) is acceptable in stands which are well stocked with regrowth.

4.3. Stands requiring regeneration

DEFINITION
Regeneration is required when gaps between retainable wandoo trees are greater than 20 metres and the basal area of retainable trees is less than 8 m^2/ha.

Mark to retain trees at 4 m^2/ha at a maximum spacing of 40 metres between retained trees suitable as seed trees. Desirable minimum composition: 2 m^2/ha veterans (including 1 m^2/ha fauna habitat), 2 m^2/ha intermediates.

Where existing debris and harvesting would not provide for ashbed creation, additional trees are to be marked for felling. Such trees should be damaged, unthrifty or taken from well-stocked groups. Unthrifty trees include those with more than 50 per cent of the crown dead.

Note: Where tops are greater than 25 m from a potential seed tree artificial seeding will be required.

5. Management of tops

Tops disposal is critical in wandoo stands. Wandoo crowns are sensitive to fire damage and trees burn down relatively easily. Bole damage provides an entry site for termite and fungal attack.

All tops must be snigged at least 10 metres from all retained trees and regrowth clumps.

Where ashbed is required for regeneration:

1. bunch small tops and debris so that ashbeds will be at least 2 metres in diameter;
2. cut or crush tops so that the crown lies relatively flat to facilitate complete burning of the wood; and
3. spread tops at an approximate spacing of one per 400 m^2 (20 m x 20 m) of gap.

Where tops are not required for regeneration they should not be pushed up and burnt but left for potential fauna habitat.

6. Site preparation

Where there are insufficient tops available to create ashbeds at the required density and there are no suitable or available trees to fell, it is necessary to artificially prepare the soil for regeneration.

Blade off all understorey to expose the topsoil over a 3-4 metre diameter area and rip compacted soil. Prepare one area per 400 m^2/ha of gap.

7. Seed prediction

A prediction of the seed crop is required to determine whether natural seed fall will be sufficient for regeneration. The task should be undertaken during the summer prior to burning. Details of seed prediction procedure are included in Appendix 2.

If the crop is insufficient, regeneration burning must be held over until seed is available, or seed must be applied manually to each ashbed.

A moderate or good seed crop should provide an adequate seed supply to all seed beds and regeneration burning should proceed in autumn.

8. Regeneration burning

Regeneration burns are undertaken to provide suitable conditions for new seedling regeneration but it is essential to also protect retained trees from damage during this burn.

As wandoo is sensitive to bole and crown damage from fire, burning objectives must be considered carefully in areas where both regeneration and protective burning are required.

8.1. Protection of retained trees

Retained trees, in particular clumps of regrowth, must be protected from fire during regeneration burning. Where there are at least an average of 5 clumps per hectare over a minimum 5-hectare area, one of the following must be undertaken:

- burn the clumps under mild condition (ROS < 20 m/hr); or
- exclusion of the patches from the burn.

8.2. Regeneration burning

Burning for regeneration is conducted in autumn under conditions which obtain complete log removal but do not cause significant damage to retained trees.

Wandoo seed matures in late summer and natural seed shed commences soon after. It is preferable to burn in early autumn whenever natural seedfall is being used.

Where artificial seeding is to be used burning may occur later in autumn.

A detailed prescription for regeneration burning is given in Appendix 3.

9. Artificial seeding

Where natural seed fall is predicted to be inadequate or there is a poor stocking of seed trees, artificial seeding should proceed as follows:

9.1. Ashbeds

Sow in July-August at the rate of 250-300 g of seed per hectare of ashbed. Sow only on ashbeds but avoid thick white ash, particularly where the tree's bole has burnt away. (Sowing time will be refined following further trials).

9.2. Prepared seed bed

Scarify prepared seedbed and spread bulked seed and fertiliser. Each hectare of prepared seedbed to receive 250-300 g of seed and 470 kg of fertiliser, comprising 400 kg of diammonium phosphate (DAP), 50 kg of potassium chloride (KC1) and 20 kg of trace elements.

10. Establishment survey

A survey for the establishment of seedlings is required 12 months following the burn. Its purpose is to determine the success of the regeneration treatment and where, if any, infilling is required.

Standard: 10 seedlings per ashbed on 70 per cent of ashbeds is the minimum acceptable standard.

11. Infilling

Where insufficient seedlings are established, infill by planting each understocked ashbed in June to bring stocking up to 10 per ashbed.

Space seedlings evenly and fertilise with 200 g of diammonium phosphate in tablet form.

12. Protection of regeneration

Clumps of wandoo regeneration are sensitive to fire for many years. In the lignotuber stage regular burning of regrowth is acceptable, but once saplings are formed even a mild fire easily damages them. As they grow taller the clumps accumulate litter fuel more rapidly than the surrounding open grassy woodland. However as the grasses are only ready for burning late in the spring, a single lighting then will invariably result in damage to trees in the clumps.

12.1. Fire exclusion

Once regeneration establishes dynamic growth it must be excluded from fire until it has reached a height and bark thickness where it will not be damaged by a mild fire. This is at least 10 years following the regeneration burn.

12.2. Two-staged burning

Once clumps of regrowth are able to withstand fire they may be burnt only under the mildest conditions. At such time (usually during winter) the surrounding forest will not burn, hence two lightings may be necessary to achieve satisfactory fuel reduction.

13. Records

Records of harvesting, regeneration requirements and timing, and protection period are to be entered into SILREC. Hardcopies of seed sampling and regeneration results are to be maintained in District records.

14. References

Havel, J.J. (1975). Site Vegetation Mapping in the Northern Jarrah Forest (Darling Range). 1. Definition of Site-Vegetation Types. Forests Department Bulletin 86.

Appendix 1: Construction of a 1-factor relascope

Materials:

Small piece of Perspex; and
String 80-90 cm long.

Method:

1. Cut perspex to 6 mm diameter (at least 30 mm long);
2. Drill a hole at one end of the perspex and pull the string through it; and
3. Hold perspex so that it is exactly 30 cm from your eye while an assistant ties the string tightly at the back of your neck.

Note: If you wish to hold the relascope further from your eye when using it, at 45 cm the perspex must be 9 mm diameter and at 60 cm – 12 mm diameter.

Appendix 2: Seed prediction

Equipment:

Binoculars; and
Rifle.

Aim:

To determine prior to burning, whether sufficient seed is present in the crowns of seed trees for regeneration.

Method:

1. Timing

Seed prediction should be undertaken in late summer, ideally a few weeks before burning. If burning is delayed into April, seed monitoring should be repeated.

2. Sample sites

Select 10 different sites where seed tree regeneration will be required. These sites should cover the range of conditions within the area to be regenerated.

3. Assessment of the capsule crop

Examine, with binoculars, the seed trees at each site. For each site subjectively rate the quantity of capsules on the seed trees as either light, moderate or heavy. Enter on the attached form.

4. Assessment of seed quantity

From one tree in each site, selected in 2 above shoot down sample branches and remove 25 capsules. Place them in a marked and sealed envelope. Forward all samples to the Seed Store for assessment of seed quantities and fill in results on the attached form.

5. Results

Where 4 or more sites are likely to yield poor results the burn should either be deferred or artificial seeding used.

If it appears that one site type (eg. sandy soils) is consistently providing poor results further investigation is warranted. Artificial seeding may then be confined to only a specific portion of the area

Wandoo Seed Prediction Survey

BLOCK _____DATE OF SURVEY _____

COUPE _____

SAMPLE SITE	CAPSULE CROP *	SEED QUANTITY [a]	SEED QUANTITY [b]
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			

No. OF POOR SITES = _____

If number of poor sites exceeds 3 either:-(1) Defer the burn, or
(2) Plan to artificially seed.

* Capsule crop = light, moderate or heavy

[a] Seed quantity = low (<100 seeds/gram), intermediate (100-200 seeds/gram), high (>200 seeds/gram).

[b] Likelihood of seeding success.

		CAPSULE CROP		
		LIGHT	**MODERATE**	**HEAVY**
SEED QUANTITY	LOW	Poor	Poor	Satisfactory
	INTERMEDIATE	Poor	Satisfactory	Good
	HIGH	Satisfactory	Good	Excellent

Appendix 3: Wandoo regeneration burning guideline

Objective:

Provide conditions suitable for natural regeneration of wandoo by burning tops to provide ashbeds and stimulate natural seedfall.

As a regeneration burn is of greater intensity than required for fuel reduction, and wandoo is susceptible to fire damage, retained trees need to be protected. In particular young regrowth and pole groups should be excised from the burn as in Section 9.1.

As it is an autumn burn at a relatively high FDI, protective buffers/edges will need to be carefully considered.

Description:

Forest type: Wandoo, predominant height 20-25 metres.

Scrub type: 6

Slopes: Generally flat to mild, occasional steep slopes on minor valleys.

Fuels: Litter/scrub 2-4 years old (3-5 tonnes per ha), tops 1-2 years old.
Prescription acceptable scorch 10-12 metres (preferred at lower end).

ROS Range: 28-40 m/hr (4:1 wind ratio)

Min SMC: 7-9 %

Lighting: 1400 to 1500 hours

SDI: Greater than 1400