Eucalypt Plantations

Info Sheet No. 3 – Management Regimes

Private Forests Tasmania

This series on Eucalypts has four parts. Each part can be read individually or as part of the series.

1. Overview
2. Establishment
3. **Management Regimes**
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MANAGEMENT REGIMES

Eucalypt plantations can be managed either as a short-rotation pulpwood crop, or on a clearwood production management regime for high value products. The requirements and benefits associated with these different regimes are discussed below.

PULPWOOD PRODUCTION

Eucalypt pulpwood plantations are generally suited to larger areas of 10 hectares or more. Site productivity, access for harvesting and distance to markets should be considered. The advantage of a pulpwood management regime is the short rotation length (normally around 15 years) compared to a management regime producing high-value products (25+ years).

For small scale plantings, (less than 10ha), the cost of harvesting operations, long transport distances and difficult access may be a disadvantage unless it can be aggregated with nearby plantations to form a larger operation.

Once established, pulpwood regimes require little management. Post-planting weed control and annual monitoring for pests and diseases are the main ongoing management needs. Inventory prior to harvesting to determine growth rates, standing volumes and appropriate harvest timing is also useful.

Potential Regime Options

1. Carry the initial stocking through to harvest (as young as age 12 on high quality sites to age 20 or more on low quality sites).
2. Undertake commercial thinning at age 8-10 (potentially later, on lower productivity sites) with a clearfall final harvest 5-10 years after thinning. This has the advantage of producing earlier cash flows and larger diameter trees at final harvest. Larger diameter trees at the final harvest may be suitable for use as a lower grade sawlog which would be more valuable than pulpwood.

Note: *Commercial thinning requires machinery access during thinning operations. Typically, every 5th row is removed or 20% of the trees. Machinery can then remove selected trees between the remaining rows. Trees thinned between the outrows should be the smaller sub-dominant and suppressed trees, retaining the dominant and co-dominant trees to grow on to final harvest. This is known as thinning from below. The removal of larger trees, or*

thinning from above, is not recommended as it can result in lower total volume being harvested over the regime.

The following is an example regime for pulpwood production with commercial thinning and an anticipated harvest at age 15. Ages indicated for thinning, final harvest and associated management operations will vary with site productivity and landowner intentions.

Year	Time	Silvicultural Operation
-1	~12 months prior to establishment	**Obtain planning permission** from local council (if required). **Undertake site planning** (mapping of area, weed species, etc.). **Pre-planting weed control** - Spray difficult to control woody weeds such as blackberry or gorse (if present).
	~6 months prior to establishment	**Order seedlings.** **Forest Practices Plan** (if required). Determine method of browsing control and obtain **permits** if required.
0	Summer	**Graze** the site heavily to reduce pasture species. **Arrange** site inspections and quotes from contractors for establishment.
	Autumn	**Pre-planting weed control** pre-cultivation with knockdown herbicides. **Cultivation** - Ripping and mounding prior to the autumn break. **Fencing** to exclude stock / browsing animals. **Browsing control**. **Pre-planting weed control** - Apply residual herbicides to planting mounds.
	Autumn to Spring	**Planting** at desired stocking (e.g. 1,000 stems/ha). **Fertilising** 6-8 weeks post planting and ensure that weeds are adequately controlled prior to fertilising.
1	Early Summer	**Stocking survey -** Determine seedling numbers if re-planting is required. (determine reason for failures and address the issue if possible)
	Autumn to Spring	**Re-planting** (if required).
1+	Ongoing	**Post-planting weed control** - Spot or strip application. **Monitoring** - Annual inspections for pests and diseases.
7	Winter	**Inventory** to estimate stand volumes, growth rates, appropriate thinning age and potential volumes for commercial thinning.
8	12-24 months before thinning	**Marketing** - Arrange sale contract and harvesting contractor. **Forest Practices Plan** (required for commercial thinning).
9	Dry conditions	**Commercial thinning.**
13	Winter	**Inventory** to estimate standing volumes, growth rates, appropriate clearfell age and potential volumes for clearfell harvest.
14	12-24 months before clearfall	**Marketing** - Arrange sale contract and harvesting contractor. **Forest Practices Plan** (required for clearfall harvest).
15	Dry conditions	**Final harvest.**

CLEARWOOD PRODUCTION

Growing eucalypt plantations for high-value appearance grade products requires:

- Pruning to produce clearwood. The cost of pruning for clearwood restricts production to sites with moderate to high productivity where the MAI exceeds 15m^3/ha/year.
- Thinning to 150 pruned stems/ha or less at a young age to enable rapid diameter growth and to minimise growth stress and tension wood.

The production of high-value logs from clearwood regimes requires specialised and timely silvicultural activities such as pruning and thinning, usually by age 10. If pruning and thinning are left too late, smaller log sizes with an increased possibility of growth stresses is likely.

Growth stress can result in end-splitting in logs after felling and in sawn timber during drying, and can cause distortion during sawing, therefore reducing the recovery of sawn timber from sawlogs.

Tension wood is formed from wind exposure, leaning trees, or unbalanced crowns. Tension wood can lead to checking (splits) within sawn timber during drying, reducing recovery. Maintaining even spacing and crowns will minimise the production of tension wood.

Clearwood Silviculture - Pruning

Knots and associated defects are the major limiting factor to the recovery of appearance grade products from plantation grown eucalypts. *E.globulus* and particularly *E.nitens* exhibit poor self-pruning and do not effectively shed their branches at normal plantation stockings. Pruning is therefore required to produce logs with a component of clearwood free from branch knots. Pruning is usually carried out in 'lifts' of about two to three metres with three lifts often occurring on selected trees at a frequency determined by the growth rates of the stand. Pruning is usually completed to a height of 6.4m to produce a log at length that mills are familiar with processing and maximizes the range of products that can be produced.

When pruning:

- Select trees with suitable spacing (final crops trees should be spaced no closer than 6m apart), form, and vigour to achieve the desired stocking rate.
- Achieve a consistent maximum Diameter Over Stub (DOS) of approximately 15cm for all lifts. Diameter over stubs refers to the diameter of the stem at the point of pruning, including branch stubs.
- Prune live branches (green pruning) when branch size is small (<3cm) to reduce the size of the pruning wounds and increase the rate of occlusion (healing) of pruned branch stubs. This will minimise the risk of decay. Pruning in winter, early spring will minimise the time for the wound to heal.
- Retain sufficient foliage to maintain growth rate to ensure rapid occlusion of branch wounds and overall tree size in comparison to neighbouring trees (dominance). Up to of 50% of the green crown depth can be performed without loss of growth.

Note*: Stands should be assessed for form and clearwood pruning requirements on an annual basis from age 2 onwards. Growth rates, particularly on high quality sites, can be rapid and delaying pruning by 6-12 months can lead to excessive diameter over stubs.*

Form pruning may be necessary where poor form, low initial stockings or poor survival rates result in a low selection of trees with suitable form, vigour and spacing. Form pruning should concentrate on:

- Removal of double leaders and high angled branches. It is recommended that assessment for form and spacing be undertaken at age 2 when it can be conducted with relative ease from the ground. Form pruning later than age 2, particularly on the lower stem, may not be effective.
- Shortening or removing large vigorous branches above the height of current clearwood pruning. Such branches will often exceed 3cm in diameter if retained until the next clearwood pruning lift.

An alternative to fixed lift height pruning is variable lift pruning. The easiest method to ensure that all trees receive a similar level of pruning is to use a stem caliper. For most sites, a 10cm caliper is considered adequate and is placed around the stem to identify the point below which all branches below are to be removed by pruning.

High quality pruning equipment is recommended including bypass loppers, holster (for carrying loppers when climbing ladder), pruning ladder (lightweight aluminum in 2.4m and 4.2m lengths) and safety harness for use with ladder. Safety must be a priority when working at any height above ground level.

Clearwood Silviculture - Thinning

Unlike softwood species such as *Pinus radiata*, eucalypts do not tolerate intense between-tree competition. To achieve large diameter trees in relatively short rotations, a final stocking of 150 stems/ha or less is recommended. This requires an average spacing of 8 metres or more between trees.

Thinning at an early age results in fast diameter growth and shorter trees, compared with tall, small diameter trees from stands left unthinned. New Zealand experience has shown that *fast-grown tall trees* are difficult to mill due to growth stresses, whereas *fast grown, large diameter logs* can remain stable.

The effect of stocking upon tree characteristics - (Figure 1)

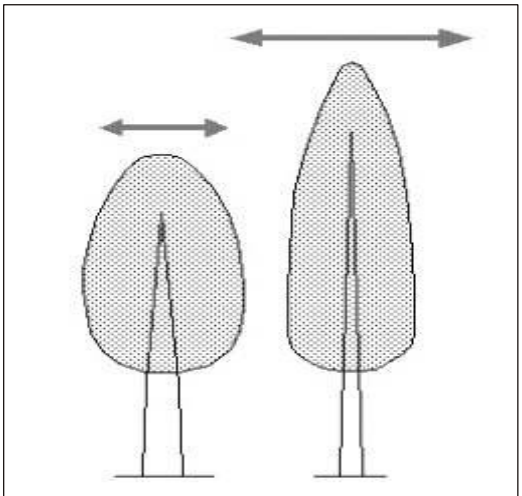

Figure 1

Low Stocking - Represented by the tree on the left

1. Fast diameter growth (reduced competition)
2. Reduced height (relatively short, wide crowns)
3. Reduced wind sway (indicated by the arrows)
4. Reduced growth stresses and tension wood
5. Improved recovery of quality timber

High Stockings - The tree on the right

1. Slow diameter growth
2. Increased tree height
3. Increased wind sway
4. Increased growth stress and tension wood
5. Reduced recovery of quality timber

Non-commercial thinning of all unpruned stems should be done at, or prior to, the completion of pruning to 6.4m. This is recommended for smaller areas.

Commercial thinning can be considered in larger plantings where the scale of the operation offsets the associated costs. The primary product from thinning will be pulpwood. Commercial thinning usually occurs at age 10-12 and should be in combination with an earlier non-commercial thinning to release pruned trees at, or prior to, the completion of pruning to 6.4m. Retaining all unpruned stems until commercial harvesting increases potential windthrow risk of pruned stems, while non-commercial thinning to release pruned stems from competition ensures rapid diameter growth and the rapid occlusion of pruning wounds.

The following is an example regime for clearwood production, established on a high-quality site with commercial thinning and anticipated harvest at age 25. Ages indicated for pruning, thinning, final harvest and associated management will vary with site productivity and landowner intentions.

Year	Time	Silvicultural Operation
-1	~12 months prior to establishment ~6 months prior to establishment	**Obtain planning permission** from local council (if required) **Undertake site planning** (mapping of area, weed species, etc.) **Pre-planting weed control** - Spray difficult to control woody weeds such as blackberry and gorse (if present). **Order seedlings** **Forest Practices Plan** (if required) Determine method of browsing control and obtain permits if required.
0	Summer Autumn Autumn to Spring	Graze the site heavily to reduce pasture species Arrange site inspections and quotes from contractors for establishment. **Pre-planting weed control** pre-cultivation with knockdown herbicides. **Cultivation** - Ripping and mounding prior to the autumn break. **Fencing** to exclude stock / browsing animals. **Browsing control** **Pre-planting weed control** - Apply residual herbicides to planting mounds. **Planting** at desired stocking (e.g. 1,000 stems/ha) **Fertilising** 6-8 weeks post planting and ensure that weeds are adequately controlled prior to fertilising.
1 1+	Early Summer Autumn - Spring Ongoing	**Stocking survey -** Determine seedling numbers if re-planting is required (determine reason for failures and address the issue if possible) **Re-planting** (if required). **Post-planting weed control** - Spot or strip application. **Monitoring** - Annual inspections for pests and diseases.
2	Spring	**Form pruning** - Remove double leaders and excessive branches.

3	Spring	**First Lift** - Variable Lift Pruning (~200 stems / ha).
4	Spring	**Second Lift** - Variable Lift Pruning (~175 stems / ha).
5	Spring	**Third Lift** - Variable Lift Pruning (~150 stems / ha).
6	Spring	**Final lift** - Variable Lift Pruning. Conducted on those trees not yet pruned to 6.4m during the third lift. **Non-commercial thinning** - Release of pruned stems. (can be performed at an earlier age)
8	Winter	**Inventory** to estimate stand volumes, growth rates, appropriate thinning age and potential volumes for commercial thinning.
9	12-24 months pre-thinning	**Marketing** - Arrange sale contract and harvesting contractor. **Forest Practices Plan** (required for commercial thinning).
10	Dry conditions	**Commercial thinning**
23	Winter	**Inventory** to estimate standing volumes, growth rates, appropriate clearfell age and potential volumes at clearfell harvest.
24	12-24 months pre-clearfell	**Marketing** - Arrange sale contract and harvesting contractor. **Forest Practices Plan** (required for clearfell harvest).
25	Dry conditions	**Final harvest**

FURTHER READING

Montagu, K., Kearney, D., and Smith, G., (2003). Pruning Eucalypts - The biology and silviculture of clearwood production in planted forests, Rural Industries Research & Development Corporation. (www.rirdc.gov.au/reports)

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Washusen, R., (2001). 'Is high quality solid wood from blue gum plantations a realistic option?' Agroforestry News, 10, Issue 3, pp. 22-23.

Bootle, K.R., (1983). Wood in Australia, Types, properties and uses, McGraw-Hill Book Company, Sydney.

Haslett, A.N., (1988). A guide to handling and grade-sawing plantation-grown eucalypt, FRI Bulletin No. 142. Forest

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