# Eucalypt Plantations

Info Sheet No. 1 - Overview

Private Forests Tasmania

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

1. **Overview**
2. Establishment
3. Management Regimes
4. Labour Estimates

## OVERVIEW

*Eucalyptus globulus* and *Eucalyptus nitens* are the dominant eucalypt species planted in hardwood plantations in Tasmania. Other native Tasmanian species have been trialed in plantations but do not perform as well as *E. globulus* or *E. nitens*.

*E. globulus* (Blue gum) is a Tasmanian eucalypt, generally from lower elevation sites in southeast Tasmania. It is a dense, strong and relatively durable timber that has been used extensively for heavy construction and flooring and is an excellent pulpwood species. It is a very successful plantation species, having become the most widely planted eucalypt in the world.

*E. nitens* (Shining gum) is the most common plantation eucalypt species in Tasmania. In its natural environment it is primarily a sub-alpine species from high elevation sites in eastern Victoria and NSW, with excellent frost resistance, growth and form. Uses include construction, flooring, joinery and pulpwood.

## GROWTH CHARACTERISTICS AND SITE SELECTION

*E. globulus* and *E. nitens* establish rapidly with high growth rates. Both species will respond to pruning and thinning regimes. Species selection between the two is driven by elevation and frost (frequency and severity) with *E. nitens* being less susceptible to frost and cold damage and therefore more productive at colder or higher altitudes. End use and wood quality considerations may also influence the decision between *E. globulus* and *E. nitens.*

The table on page 2 is a guide to the anticipated site productivity for *E. globulus* and *E. nitens* plantations in Tasmania[2]. The most limiting factor on any site determines the likely productivity class. The most accurate estimate of productivity can be gained by measuring growth of existing adjacent or nearby plantations with similar land attributes.

**Table 1: Site Productivity**

| Land Attributes | Class 1A MAI>30 | Class 1A MAI 20 - 30 | Class 2 MAI 15 - 20 | Class 3 MAI 10 - 15 | Class 4 MAI <10 |
|---|---|---|---|---|---|
| Productivity | Very High | High | Medium | Low | Very Low |
| Elevation *(E. globulus)* | <300 | <300a | 300 - 400b | 400 - 600 | >600 |
| Elevation *(E. nitens)* | <600 | <600 | 600 - 850c | 600 - 850 | >850 |
| Mean Annual Rainfall (MAR) (MM/year) | >1100 | >1100 | 850 - 1100 | 700 - 850 | <700 |
| Drainage | Rapid | Moderate | Imperfect | Poor | Very Poor |
| Soil profile | | | | | |
| *Effective Rooting Depth (ERD)* | >80cm | >80cm | 45 - 80cm | 20 - 45cm | <20cm |
| *Stoniness* | <10% | 10 - 30% | 30 - 50% | 50 - 90% | >90% |
| Nutrient Status | | | | | |
| *Phosphorus – P (ppm)* | >250 | 100 - 250 | 100 - 250 | <100 | <100 |
| *Nitrogen – N %* | >0.2 | 0.1 - 0.2 | 0.1 - 0.2 | <0.1 | <0.1 |

a) Limit is lower in colder areas.
b) Milder coastal areas.
c) Sites with good air drainage, minimal frost severity and snow damage with limited exposure.

**Elevation** can be used as a guide to the average temperature and length of the growing season (both decrease with increasing elevation) and the incidence and severity of frosts (increased with increasing elevation).

**Mean Annual Rainfall** (MAR) is a measure of moisture availability. It can be affected by other factors such as soil type and depth (water holding capacity), aspect and slope.

**Drainage** is an indicator to the extent of waterlogging, as it is detrimental to the growth of trees. Ripping and mounding may reduce the extent of waterlogging during the establishment phase.

**Effective Rooting Depth** (ERD) is the depth to which a physical barrier impedes deeper root development, such as bedrock, solid clay subsoils, waterlogged zones or stone horizons containing little or no fine earth. Deep ripping can shatter compacted subsoils or cemented pans to increase the ERD in some conditions.

**Stone** is the percentage of stones and rocks within the ERD soil profile.

**Nutrient status** can be determined by soil analysis of the top 10cm of mineral soil, although this may not always be a true indication, depending upon soil type. The most widespread limiting nutrients in Tasmania are phosphorus (P) and nitrogen (N), although other nutrients may be limiting in some soil types. Fertilisation can offer a significant increase in growth on many soil types if it is the most limiting factor to site productivity.

**Position in the landscape** may impact upon the previous land attributes:

- Sites with poor cold air drainage, resulting in lower temperatures and frost hollows, can occur even at relatively low elevations close to the coast;
- Northern aspects will have higher temperatures than southern aspects;
- Southern and westerly aspects usually experience greater wind exposure than northern and eastern aspects; and
- The soil profile, nutrient status and moisture availability is often greater at lower positions within the landscape.

## TREE & WOOD QUALITY

*E. globulus* and *E. nitens* plantation eucalypts produce a higher grade of pulpwood than mature native forests. Extensive plantation development has occurred across Tasmania to support the pulpwood export industry. *E. globulus* produces a higher quality pulp than *E. nitens*, although *E. nitens* are more widely grown in Tasmania due to greater frost tolerance and productivity, particularly on colder, higher elevation sites

The growing of plantation *E. globulus* and *E. nitens* for sawlog and veneer log has occurred extensively in publicly managed forests. To date, markets for clearwood from hardwood plantation are still in the developmental phase. While plantation grown clearwood logs have been sawn and veneers sliced, such processing has been largely experimental, with mixed results. High quality logs may be produced on rotations of 20-25 years or more, depending upon site productivity. To grow high quality clearwood, attention to pruning, low stocking rates from a young age and large diameter trees are required to minimise growth stress and the formation of tension wood.

Young plantation grown trees can be expected to have a significantly lower density at a very young age. Density, which increases with tree age, is related to timber strength and hardness and the durability of young timber may be less than that of mature timber.

*E. globulus* has a dry density of ~900 kg/$m^3$ and a durability rating of class 3.
*E. nitens* has a dry density of ~700 kg/$m^3$ and a durability rating of class 4.
The above ratings are for the heartwood of mature trees.

> ***Durability Ratings*** *(general description for untreated timber)*
> ***Class 1*** - Very durable: life expectancy of 25 years or more when used in the ground, excellent for above ground use in exposed situations.
> ***Class 2*** - Durable: expected life of 15-25 years in the ground, good for above ground use in exposed situations.
> ***Class 3*** - Moderately durable: generally unsuitable for in ground use, potentially suitable for some exposed situations.
> ***Class 4*** - Non-durable: not suitable for in ground use or exposed situations.

Heartwood is usually difficult to treat with preservatives. The sapwood is not durable and requires preservative treatment if utilised outdoors. The dry sapwood of *E. globulus* and *E. nitens* is also susceptible to insect attack (lyctid borers) and may require chemical treatment. This can be important if trees with a high proportion of sapwood are processed for purposes such as internal framing timbers or flooring. Significant attack by insects can destroy the untreated sapwood of susceptible species.

## END USES

- **Clearwood Sawlogs & Veneer Logs** - with appropriate pruning and thinning regimes, sawing techniques and drying schedules for plantation grown sawlogs, it is anticipated that pruned *E. globulus* and *E. nitens* will become an established source of appearance grade clearwood. Tree breeding programs in the future may target improved characteristics such as improved density and branching habits, as has been undertaken for *Pinus radiata*.
- **Small Diameter Sawlogs** –small diameter plantation grown eucalypts (pruned or unpruned). Logs are sourced with a small end diameter of 16cm to a large end diameter of 34cm and have been exported from Northern Tasmania. Pallet manufacturing has commenced in Tasmania with an increasing demand for hardwood plantation resources.
- **Posts & Poles** - preservative treatment is required. Limited market due to the specific requirements for posts and poles. Eucalypts offer a strength advantage over *Pinus radiata* for posts with similar diameter and branching characteristics.
- **Pulpwood** – export facilities in Northern Tasmania.
- **Firewood** - limited market potential. Young plantation trees have significantly less density and heat value than native forest eucalypts traditionally sourced for the firewood market.

## PESTS & DISEASES

Several pests and diseases are known to impact upon plantations of *E. globulus* and *E. nitens.* Most are of minor significance, although some can cause considerable loss of productivity, particularly when the trees are young (up to 10 years) if monitoring and control measures are not undertaken.

***Chrysomelid beetles***, particularly the Tasmanian eucalypt leaf beetle, can be major insect pests of *E. globulus* and *E. nitens.* Severe defoliation can occur during periods of significant outbreaks. Control can be undertaken with insecticides.

***Caterpillars*** such as the autumn gum moth and Gum leaf skeletoniser, can result in significant defoliation. Control can be undertaken with insecticides.

***Sap sucking insects*** such as coreid bugs can damage leading shoots. Again, control can often be undertaken with insecticides if the level of damage is significant.

***Fungal infections*** can impact upon leaves, stems and roots. The incidence and severity of most diseases are of minor importance.

***Browsing animals*** such as wallabies, pademelons, rabbits and hares can cause significant damage to seedlings following planting and until the trees attain 1.0 - 1.5m in height. Brush-tail possums can cause significant browsing damage, including physical damage such as breaking leaders when climbing. Deer may cause problems in areas where populations are known to occur.

## ALTERNATIVE EUCALYPT SPECIES

*E. globulus* and *E. nitens* are not the only eucalypt species currently being grown for solid timber production, although they are the dominant plantation species for pulpwood production in Australia. Other species currently being grown in southern Australia and New Zealand for solid timber production include:

***E. cladocalyx*** **(Sugar gum)**
Tolerant of low rainfall and poor soils. Low frost tolerance, with slow to moderate growth rates. Currently milled from older shelterbelts in Western Victoria for appearance grade timber (veneers and solid timber) and firewood. Class 1 durability, low growth stress, range of indoor and outdoor uses. Light brown coloured timber.

***E. tricarpa & E. sideroxylon*** **(Red iron bark)**
Very tolerant of low rainfall and poor soils, slow growth rates, moderate to high frost resistance. Class 1 durability, very strong and hard timber, low growth stress, wide range of indoor and outdoor uses. Dark red coloured timber. Sapwood rarely attacked by lyctid borers.

***E. botryoides*** **(Southern mahogany)**
Tolerant of moderate quality soils, moderate rainfall and sites with poor drainage. Tolerance of exposure and saline winds, with moderate growth rates, frost resistance and form. Class 2/3 durability, hard, strong timber, can have high growth stress, range of indoor and outdoor uses. Red timber that is favoured in New Zealand, although pests and diseases have impacted upon growth and survival in New Zealand. Sapwood rarely attacked by lyctid borers.

***E. muelleriana*** **(Yellow stringybark)**
Tolerant of moderate quality soils and rainfall, moderate growth rate and form, low to moderate frost resistance. Class 2/3 durability, hard and strong timber, low growth stress, wide range of indoor and outdoor uses. Increasing favour among New Zealand farm foresters and a favourite of processors due to low growth stress. Small areas planted in NW Tasmania over the last few years with reasonable growth to date on suitable sites. Light brown coloured timber. Excellent ability to recover from fire. Sapwood not susceptible to lyctid borers.

***E. globoidea*** **(White stringybark)**
Species with very similar tree and timber characteristics to *E. muelleriana.* Limited plantings in Australia, although finding increasing favour in New Zealand. *E. globoidea* has attracted plenty of interest in warmer parts of New Zealand because it grows class 2 durable heartwood. It has moderately high density, and high wood stiffness. Frost tolerance: Minus 5 degrees (avoid very cold sites). Rainfall min and max: 800 - 2500 mm/year. Soil

type/drainage: Suited to a wide range of soils except skeletal and stony soils. Wind tolerance: One of the more wind-tolerant durable eucalypts (all eucalypts grow better on sheltered sites).

### *E. macrorhyncha* (Red stringybark)

*E.ucalyptus macrorhyncha* is a versatile species which grows well with good form and survival across a wide range of site types. It is notable for its tolerance of cold, dry conditions. It is also very tolerant of insect pests, and has a light crown, so has potential for agroforestry. It produces class 2-3 pink/brown heartwood. Frost tolerance: Minus 8 degrees. Rainfall min and max: 500 - 1000 mm/year. Prefers low humidity regions. Soil type/drainage: Suited to a wide range of soils except skeletal and stony soils. Wind tolerance: One of the more wind-tolerant durable eucalypts (all eucalypts grow better on sheltered sites).

### *E. fastigata* (Brown barrel)

*E. fastigata* is currently popular and is regarded as a relatively disease-free candidate for diversification of plantations. It has reasonably wide site tolerance, moderately high density, and high wood stiffness. *E. fastigata* often has relatively slow early growth, but it is a stayer, and capable of carrying higher volumes/ha than most other eucalypts. It will tolerate heavy soils of moderate fertility, and most provenances will tolerate frosts of -12°C. Open grown trees tend to be heavily branched, but because it will tolerate relatively close spacing, form in stands is generally good. Produces an excellent timber. *E. fastigata* has the best timber of the ash eucalypts, being the easiest to process. Form can be variable when young, but this is related to seed source. There are few insect problems, but leafspot fungi can appear under warm, humid conditions.

*NB Many of these alternative species have been planted in Tasmania on a trial basis by Private Forests Tasmania, landowners and other organisations. However, while it is to be encouraged, the planting of these or other alternative species in Tasmania should be on a small scale and considered experimental as their performance is relatively unknown at this stage. It is possible that some alternative species may fill a niche role, such as the production of naturally durable timber that can be used for exterior use without chemical treatment. It is not expected that these alternative species could be planted on a large scale, but rather as smaller plantings on suitable sites. Thus, they may offer landowners an opportunity to enter a high-value niche market that is not dominated by larger industrial scale growers. Landowners should seek further advice regarding species and site selection if considering alternative species. Availability of source seed and seedling material may be limiting.*

## FURTHER READING

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

Laffan, M.D., (1997). Site Selection for hardwood and softwood plantations in Tasmania. A methodology for assessing site productivity and suitability for plantations using land resource information. Soils Technical Report No. 3, second edition, Forestry Tasmania and Forest Practices Board, Tasmania.

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