Radiata Pine

Info Sheet No. 1 – Overview

Private Forests Tasmania

This series on Radiata Pine 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

Radiata pine (*Pinus radiata*) originates from coastal California and small islands off Mexico. As a plantation species it has become the most widely planted softwood species in the Southern Hemisphere. Radiata pine was introduced to Australia in the 1850's. There are now approximately 750,000 hectares growing mainly in southern Australia.

In Tasmania, landholders and industry have long grown Radiata pine plantations with established domestic and international markets. While a number of processors in Tasmania have established their own plantations, they also rely on other plantations to meet the majority of their wood supply requirements.

Radiata pine can be a cost-effective use of marginal land, generate income from forest products or carbon credits, provide farm benefits (shelter, shade, reduced evapotranspiration etc.), and can add value to a property.

GROWTH CHARACTERISTICS AND SITE SELECTION

Radiata pine is robust and a relatively easy species to grow. It is more tolerant of a wide range of soil types and fertility, temperature, elevation and rainfall than most other tree species. On suitable sites its growth rate is rapid. It is a flexible forestry species for landowners throughout most of Tasmania.

Radiata responds readily to both pruning and thinning and is suitable to produce higher value products, particularly in a farm forestry context.

The table on page 2 is a guide to the potential site productivity for Radiata pine plantations in Tasmania. 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.

LAND ATTRIBUTES	Class 1A MAI >30	Class 1B 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 (m)	<500	500 - 600	600 - 700	600 - 700	>700
Mean Annual Rainfall (MAR) (mm/year)	>1100	800 - 1100	600 - 800	600 - 800	<600
Drainage	Rapid	Moderate	Imperfect	Poor	Very Poor
Effective Rooting Depth (ERD)	>80cm	>80cm	45 - 80cm	20 - 45cm	<20cm
Stone	<10%	10-30%	30-50%	50-90%	>90%
Nutrient Status **Phosphorus - P (ppm)** **Nitrogen - N (%)**	 >250 >0.2	 100 - 250 0.1 0.2	 100 - 250 0.1 - 0.2	 <100 <0.1	 <100 <0.1

MAI (Mean Annual Increment) the volume of wood in cubic metres produced per hectare per year (m^3/ha/yr).

Elevation above sea level 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 of 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. The most widespread limiting nutrients in Tasmania are phosphorus (P), measured as parts per million (ppm), 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 lack of nutrients 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.
- The soil profile, nutrient status and moisture availability are often greater at lower positions within the landscape.

TREE & WOOD QUALITY

Establishment and management practices impact upon tree and wood quality. The marketability and returns at harvest can be determined by tree and wood quality.

High planting stockings, pruning and thinning are used to improve the proportion of tight small knots, higher value clear wood and larger diameter trees. Wood density is a significant aspect of wood quality, as it relates to stiffness and strength. Wood density increases with tree age. Despite differences in wood density between latitude and elevation, it is the variation in tree age that is most significant for wood density and subsequent wood quality. Growth rate and rotation age will have the greatest impact upon wood density.

The wood properties of Radiata pine include:

- Light straw-coloured softwood species with medium density.
- Excellent machining, painting and staining properties.
- Good strength to weight ratio, nail holding and gluing ability.
- Relatively easy to saw and dry with suitable equipment.

Unfortunately, on-farm processing for high value end uses is generally not possible. Although logs can be sawn with portable equipment, air-drying is not feasible due to the development of 'blue stain'. Blue stain is a fungus that results in a light blue colour developing within the wood. Although mechanical properties are unaffected, this staining is unacceptable for appearance grade products. Kiln drying to lower moisture content following sawing is required to prevent this staining.

END USES

Clearwood Veneer Logs

- Veneer mills slice clearwood logs for appearance grade veneers.
- Processed in 2.7 and 5.4m lengths.
- Minimum Small End Diameter (SED) of 35cm.

Clearwood Sawlogs

- Processed in lengths of 3.7, 4.9 and 5.5m lengths.
- Minimum SED of 35cm.
- Processors may require trees aged 27-34 due to wood quality issues such as density and brittleness.

Knotty sawlogs

- A range of sizes and quality is processed for domestic use and for international export.
- Higher quality knotty sawlogs are commonly processed for structural timber and, to a lesser extent, as appearance grade products for furniture and building products.
- Lower quality knotty sawlogs are usually processed for low value products such as pallet material, or rotary peeled for construction grade plywood.
- Markets for knotty sawlogs, both domestic and export, generally fall into two broad categories depending upon quality. The following figures are a guide only, as different processors vary depending on log and branch diameter specifications. For example, a maximum Large End Diameter (LED) of 70-90cm may be specified, depending upon the purchaser.
  - *Category 1* SED > 30cm with small branches (<5-7cm).
  - *Category 2* SED > 20-30cm and logs with larger branches (>5-7cm).
- Common sawlog lengths are 3.7, 4.3, 4.9, 5.5 and 6.1 metres. Longer lengths of 7-11 metres may attract a premium.
- Other mills can process small diameter knotty sawlogs (15-34cm diameter) in 4.9 and 5.5m lengths.

Posts & Poles

- Slow grown timber with small branches, minimum age of 17-18 for strength purposes.
- SED of 50-300mm, with 25mm increments.
- Lengths of 1.8m to 3.0m (0.3m increments), 3.6m, 4.8m and 6.0m.

Pulpwood

- Minimum age 15, with 17-18 year old trees preferred.
- SED of 10cm to a LED of 40cm.
- 2.4m to 11.0m lengths.
- Export pulpwood markets can be cyclical, depending upon international markets, exchange rates, and shipping costs, etc.

Future Markets

Despite a large Radiata pine resource, particularly on mainland Australia and overseas, there is some concern regarding future shortfalls of quality pruned and unpruned sawlogs in Tasmania. It is expected that high quality Radiata pine plantations will be readily marketable, with timber prices traditionally keeping pace with inflation.

PESTS & DISEASES

Although Radiata pine is generally a very hardy species, some pests and diseases can impact upon health and productivity. A wide range of fungi and insects can infect Radiata pine throughout Tasmania. Most are of relatively minor significance. The following are some of the more common and damaging pests and diseases.

Dothistroma Needle Blight

Present in all Radiata pine stands in high rainfall (>1,200 mm/year) areas, particularly at higher altitudes. The disease is common in young trees, with resistance developing with age. Needles of all ages can be affected. Reddish coloured bands can be observed on the

needles. Needles turn brown and are cast. Infection progresses from the base of the tree to the crown. Defoliation reduces volume production. Increasing airflow through thinning and pruning can reduce incidence of the disease. Severe infestations can be controlled by aerial application of copper fungicides.

Spring Needle Cast

A significant disease of Radiata pine in Tasmania which is caused by a range of fungi. It mainly develops on higher elevation sites (>400 m) with high rainfall (>1,200 mm/year). Symptoms appear at the time of canopy closure. The current season's needles (<1 year old) turn red-brown and are cast, resulting in partial defoliation of affected trees and tree suppression. The proportion of trees affected within a stand increases with higher altitude and rainfall. Onset of the disease can be delayed by thinning prior to canopy closure. There are currently no control methods.

Cylaneusma Needle Cast

Occurs in all areas of Tasmania and is of moderate significance. Young needles are infected, turning yellow then yellow-brown before being cast in their second or subsequent years. Affected needles occur in the lower crown and the disease progresses further up the crown, with increasing severity. It is rare in trees less than 3-4 years of age. There are currently no control methods.

Sirex Wood Wasp

Females of the wood wasp (*Sirex noctilio*) lay their eggs in the sapwood of standing trees and introduce a wood-decay fungus. Affected trees are those that are under stress through competition, primarily in unthinned stands subject to drought, poor nutrition, defoliation or damage due to wind or hail. Tree mortality is common, although usually concentrated on smaller diameter trees. Good plantation management (e.g. appropriate thinning) minimises the risk.

Phytophthora Root Rot

The soil-borne fungus *Phytophthora* causes infection and rotting of the roots. Mortality is usually restricted to trees less than 3 years of age. A minor problem within Tasmanian plantations, damage is restricted to areas that are flat (<5% slope) with poor drainage. Avoid planting on high-risk sites.

Armillaria Root Rot

The fungus *Armillaria* causes infection and decay of the bark and sapwood of the roots and lower stem. It is widespread throughout Tasmanian plantations, especially those established on ex-forest sites. Mortality of trees less than 4 years of age can occur, although it is usually insignificant. Stump removal from previous tree crops can be used to limit impact.

ALTERNATIVE PINUS SPECIES

Pinus radiata is the dominant pine species being grown for timber; however, other species have the potential to expand the plantation estate and reduce risk associated with single species dependency including:

Pinus contorta (Lodgepole pine)

Pinus contorta has a broad geographic coverage of around 26 million hectares in Canada and the USA. It is a relatively fast-growing fire adapted species, and its broad natural distribution offers adaptability to a wide range of ecological and environmental conditions.

Because of the extensive natural range, there is appreciable variation in form and vigour between provenances and subspecies. South coastal origins should not be used, while Alaskan provenances are best suited for use in nursing mixtures. If pure stands are being planted, then Skeena or other interior provenances should be used – expert advice will be helpful.

Pinus contorta is a pioneer and light demanding species which adapt to and grow well on a wide range of nutrient poor soils and can be used as nurses for more sensitive species. It is resistant to winter cold, spring frost, exposure, air pollution and salt-laden winds. Interior provenances will tolerate dry conditions. The more vigorous and coarse coastal provenances can be seriously damaged by wind and snow.

Pinus nigra ssp. Laricio (Corsican pine)

Pinus nigra is a hardy species with a well recognised potential for timber and roundwood production.

Pinus nigra is a very reliable species on cold and exposed sites where radiata pine is at risk. It is the most site-tolerant conifer of use in the high country with commercial possibilities up to at least 800m above sea level. Not only is it tolerant of a wide range of soils, but it also withstands snow well and will survive weed competition and animal grazing more readily than other conifers. It can also tolerate drought prone sites, although growth rates are slowed considerably, and wood quality may be poorer. Despite this, it is usually the best commercial choice for high altitude, flat, dry sites. It tolerates exposure and pollution and will grow well on sand dunes provided it is not directly exposed to salt spray.

Pinus ponderosa (Ponderosa pine)

Pinus ponderosa is often bracketed with *P. nigra* as a timber species for hard high-country sites.

Pinus ponderosa is susceptible to Dothistroma, a needle fungus. It is recommended for moister sites; as on thin, droughty soils yields can be low and dieback a problem. It stands up well to exposure, suffering little damage from wind or snow. Early growth tends to be slow but on good high-country sites (over 800 mm rainfall annually) height growth will soon average over 50 cm annually with mean annual volume increment exceeding 20 m3/ha.

Ponderosa pine volume growth is generally 10-15% faster than Corsican pine and between 60-80% that of radiata pine. On the wetter sites the species is up to 20% slower than Douglas fir.

Pinus pinaster (Maritime pine)

Pinus pinaster is native to the central and west coastal region and islands of the Mediterranean and the Atlas Mountains of North West Africa. It generally occurs naturally in

warm temperate regions with a maritime influence on climate, mainly in humid and sub-humid areas, where annual rainfall is greater than 600mm. Seems not to withstand temperatures below -18 °C and is only moderately tolerant of exposure.

A light demanding pioneer species adapted to acid, poor or medium fertility soils and of moderately dry to moist soil moisture status. It does not tolerate peat or wet gley soils and is not suited to alkaline sites.

Pinus pinaster shows a high degree of genetic variation over its natural range. Visual evidence suggests variations in growth, stem form, branching habit and frost tenderness, but there is little confirmed information directly linking this to provenance.

FURTHER READING

Maclaren, J.P., (1993), Radiata Pine Growers' Manual, FRI Bulletin No. 184, New Zealand Forest Research Limited.

TAS Land & Forest, (2003), Management Regimes for Low Rainfall Radiata Pine Plantations, Report for Private Forests Tasmania. This report outlines potential regimes, growth rates and markets for Radiata Pine plantations grown on low rainfall sites (<1100mm annual rainfall) in Tasmania.

Lodgepole Pine (LP): https://www.forestresearch.gov.uk/tools-and-resources/tree-species-database/131587-lodgepole-pine-lp-2/

Corsican pine (CP): https://www.forestresearch.gov.uk/tools-and-resources/tree-species-database/131590-corsican-pine-cp-2/

Maritime pine (MAP), *Pinus pinaster*: https://www.forestresearch.gov.uk/tools-and-resources/tree-species-database/133194-maritime-pine-map/

Trees and Stars – Site specific species search: https://www.treesandstars.com/sppchc/

REFERENCE

[1]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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