

This information applies specifically to radiata pine and generally to eucalypts.

What is pruning?

Pruning is the removal of branches from the main trunk of a tree to improve the quality and value of the timber produced. Pruning can be done by most landowners or by experienced contractors. Pruning must be done properly and must be done on time. Selected stems may be progressively pruned over several years.

Benefits of, and reasons for pruning

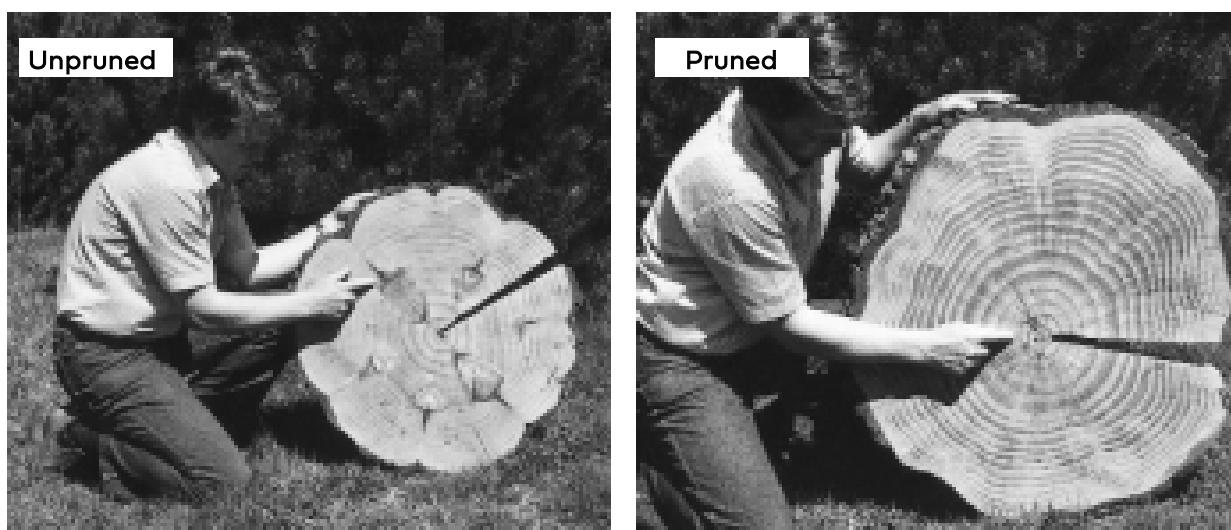
- Pruning is most commonly undertaken to increase the quality and value of wood; pruning removes branches thus producing knot free timber called "clearwood" over the inner defect core.
- Clearwood commands a higher price for sawlog or veneer.

However, pruning also has the advantages of:

- Reducing shade which promotes pasture growth within plantations;
- Improving access and visibility through the forest stand and the circulation of air around the trees. Better air circulation reduces humidity and can lower disease risk;
- Reducing the fire hazard and spread of fire to crowns once the prunings have decomposed; and
- Increasing tree stability in windy areas.

Figure 1: Wood from unpruned and pruned *Pinus radiata* (radiata pine) trees.

Note the large knotty core from a tree (left) that has not been pruned. In contrast, the tree (right) that was pruned at an early age had its knots confined in a narrow core (called the defect core). The defect core includes scar tissue which develops around the cut face after pruning. The wood developing outside the defect core is 'clearwood', knot-free wood that is preferred in the sawmilling industry.



Most trees can be pruned to improve timber quality and value without reducing their growth. Removal of the lower branches of a tree allows the development of knot-free 'clearwood' in this region of stem as it continues to grow. Clearwood is 'appearance-grade' timber and is highly valued. It is strong, easy to saw and can be peeled for veneer. In Tasmania, whether logs are milled locally or exported, pruned radiata pine logs command a price premium. This compares with much reduced prices for unpruned radiata pine sawlogs and pulp wood. However, on poor sites (low in nutrients and low rainfall) where radiata pine grows slowly and has very small branches, unpruned log prices may be more attractive. In New Zealand, the difference in value between pruned and unpruned logs can be 250%.

Log value is determined by size and straightness of the tree trunk and number of knots and branches. Large straight, knot free trees command the highest prices. Therefore two types of pruning are conducted:

- **Form pruning** - to produce a straight trunk and control branch size; and
- **Clearwood pruning** - to produce the maximum amount of knot-free wood.

Pruning must be done on time. Premature pruning wastes time and reduces tree growth rate. Delayed pruning damages tree form and results in losses of valuable clearwood. However, before any pruning is attempted attention should be paid to the selection of trees for pruning.

Tree selection for pruning

Good tree form is an essential prerequisite and only the best, straightest and most vigorous trees should be selected for pruning. The following rules should apply for the region of the stem you are pruning, (most commonly to a height of 6.4 m):

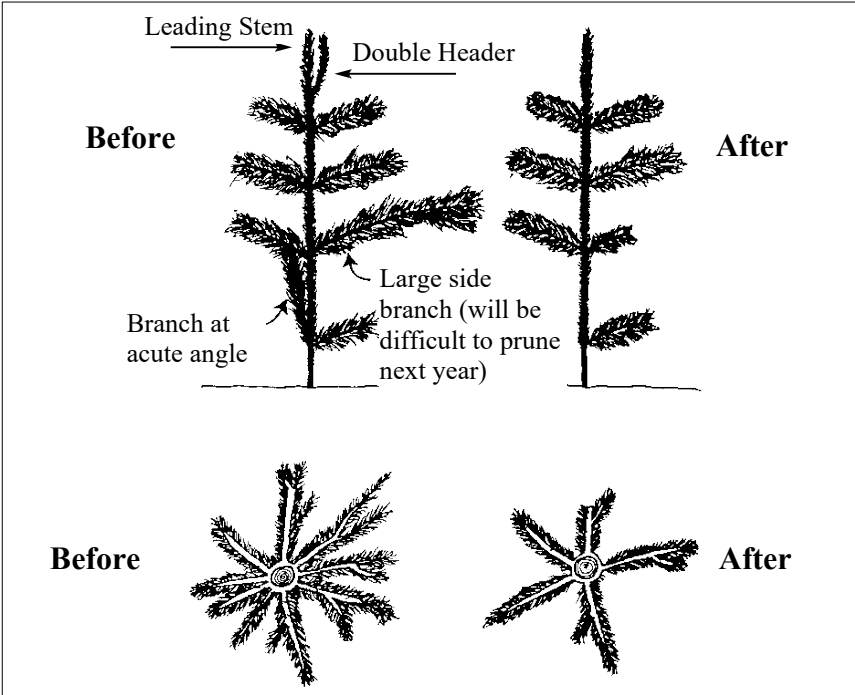
- Single stem and free of secondary leaders;
- Straight stem with no lean from the vertical of more than 5 centimetres (5 cm);
- Stem free of wounds and splits;
- Branches not making an acute angle (less than 30 degrees) with the stem;
- Butt sweep limited to the bottom 0.3m of the stem; and
- In eucalypts, branches should be less than 3cm in diameter at the junction with the stem.

Generally, trees selected for pruning are only the larger trees (dominants and co-dominants). Small trees have only a low potential for growth. A harvestable log of 6m, is the preferred length for sawmilling and for peeling for veneer. Low pruning to 2.7 m from the ground, or higher pruning (above 6.4m) may be possible options. A log that is not pruned is worthless and may only be saleable for pulp wood. Consult Private Forests Tasmania for advice on pruning strategy.

As some trees do not meet the rules for pruning listed above, it can be seen that it is necessary to plant more trees than will be retained for final harvest. At final harvest, the diameter of the trees at breast height over bark (DBHob, 1.3m above ground) should usually be between 40cm and 60cm. In order to reach this size, the stand density of the final crop

trees will be in the range of 150-350 trees per hectare (trees/ha). Even fewer trees can be retained on sites prone to drought stress or of low inherent soil fertility. If your trees are to be in blocks, plant about 800-1,300 trees/ha (spacing between rows 3m to 4m, within rows 2.5m to 3m). This should provide sufficient trees to select for pruning and only these trees should be pruned. The other trees should be thinned in such a way that the growth of the retained trees is not restricted. If trees are to be planted in one or just a few rows, you may want to prune a greater proportion of your trees. If superior genetic stock has been planted, the numbers of trees meeting the rules for pruning will be increased and make this possible. Alternatively 'form pruning' can be used before pruning for clearwood production commences.

Figure 2: Form pruning of young radiata pine



How many trees do I prune?

Form pruning

Form pruning begins 2 to 4 years after planting and continues until the tree trunk is pruned to the desired height, i.e., the length of log that is to be harvested.

Form pruning is done to assist the tree to meet the rules for tree selection (see figure 2). It is usually undertaken at least one year before first-lift pruning commences and involves the removal of branches throughout the crown. These branches may be large branches which are competing with the main stem or those which are developing at a steep angle (less than 30°).

In radiata pine, branches radiate from the trunk like spokes in a wheel. This is called a whorl. Whorls crowded with branches are called basket whorls. They often occur at 2 to 6 years of

age and lead to poor quality wood. Reduce the number of branches to about four per whorl.

When form pruning radiata pine, concentrate on basket whorls first, then remove acute branches and tip prune large branches. Never remove more than 50% of the green crown, otherwise tree growth will be adversely affected.

Form pruning may be essential in hardwood species e.g. *Acacia melanoxylon* (blackwood) and eucalypts. Control of branch size is critical to minimise the risk of decay entry in eucalypts (see next page). In fast-growing *Eucalyptus globulus* and *Eucalyptus nitens*, lower branches may be retained for a long time even after they have died. In this case, pruning is essential if clearwood is to develop.

Clearwood Pruning

In uniform stands clearwood pruning is normally conducted in a series of 'lifts' to 2.4m, 4.4m and finally to 6.4m. In this case height determines the timing of pruning, with one third of the green crown removed at each lift. However in stands of variable growth rates containing short and tall trees, each tree is pruned as it reaches the desired size.

Guidelines for radiata pine

- Start clearwood pruning when trees are about 4 to 6m tall (see Figure 3);
- Prune lowest branches first, working up the trunk;
- Always leave 3 to 4m of green crown on top of the tree. It is very hard to judge the length of the green crown. However a good guide is to remove only those branches below the point where the trunk diameter exceeds 10cm in slow growing trees or 8cm in fast growing trees. Use a homemade caliper to measure trunk diameter. Alternatively, the caliper size can be calculated by measuring the average diameter of your trees at 3.5m below tip height in eucalypts and 4.0m in pines;
- Form prune above the clearwood pruned trunk to ensure a single straight stem and control of large and acutely angled branches (this is not necessary above the height of clearwood log to be cut);
- Prune the trunk to the desired saleable log length;
- Remove epicormic shoots and sprouts on the stems of all pruned trees (rub off with a gloved hand or use a wire toggle); and
- Record the diameter over stubs (DOS) of the largest pruned whorl. Maintain a uniform DOS from first to last pruning. The DOS (or defect core) determines log quality. Keeping records of DOS can be beneficial for pruning accreditation.

Correct branch pruning involves pruning close to the trunk and at right angles to the branch where possible.

Guidelines for eucalypts

Table 1 outlines a procedure that can be followed for eucalypts based on DBHob and/or height of dominant trees. It will result in a DOS or defect core of about 15cm diameter.

It is recommended that you prune in early spring to coincide with the start of a period of rapid diameter growth because this will allow rapid occlusion (growing over) of branch stubs.

For eucalypts, the time of year pruning is conducted is not critical as a tool for minimising decay entry. However, the length of exposure of the cut branch to fungal spores before occlusion occurs is important.

In blocks of trees planted at 800-1,300 stems per hectare, first-lift pruning can be timed to coincide with canopy closure (at age 3-4 years, **see Table 1**). In fast growing *E. nitens*, up to 50% of green crown length can be removed without any significant impact on height and diameter growth of the pruned trees compared to unpruned trees (**see Figure 6**).

This occurs because time of pruning coincides with a natural tendency for crowns to lose their lower foliage at canopy closure. The tree is able to compensate for this loss in growth potential by increasing the activity of the retained crown for several months after pruning.

In slower-growing trees and in more open grown trees, this ability of the trees to compensate for loss of growth potential is reduced. Hence the need to remove less green crown length at pruning to avoid reduced growth. Be more conservative pruning in these situations.

Pruning, disease entry and decay (eucalypts only)

Decay (rot) may invade the stem through the cut face of branch stubs of eucalypts following pruning. Stubs of living branches are much more susceptible to decay than those of dead branches and the probability of decay increases greatly as branch size increases. Ways to minimise the risk of decay when pruning live branches are:

- Prune branches before they reach 3cm in diameter;
- Avoid trees that have branches forming an acute angle (less than 30°) with the stem. The area of the cut face is greatly increased on the stubs from these branches;
- Do not damage the branch collar. Although pruning the branch as close as possible to the stem reduces the width of the defect core (**Figure 4**), any damage to the collar drastically increases the likelihood of decay (**Figure 5**);
- If using a pruning saw, first make an undercut on the branch to avoid tearing bark off the branch collar. Undercuts must be closer to the stem than the final cut from above to prevent a ridge being formed on the cut face. A ridge holds moisture and makes an ideal site for infection by pathogens;
- There is anecdotal evidence suggesting commercial fungicides used in orchards would be effective in the treatment of pruning wounds in eucalypts. However there has been no detailed assessment of the effectiveness of fungicides; and
- There is no time of the year when the risk of decay from pruning is significantly increased. However, if pruning in summer to mid-autumn, avoid warm to hot days if rain is imminent. These moist, warm conditions are optimal for the spread and survival of decay fungi.

Table 1: Age and stand condition for pruning eucalypts on high quality sites*(Where > is greater than)*

Age	Stand conditions	Operation
0	Initial stocking	Plant 800 - 1,200 stems/ha
3 or 4	250 prunable trees/ha DBHob of prunable trees 8 – 10 cm height of dominants >9.5m	Select and low prune best 250 stems/ha to 2.7m height
4 or 5	DBHob of pruned trees 10 - 12cm Height of dominants >9.5m	Prune selected stems to 4.5m height
5 or 6	DBHob of pruned trees 11 – 13cm Height of dominants >12m	Prune selected stems to 6.4m height

Pruning tools

Specialist equipment is available and for best results should be used:

- Secateurs - for small branches;
- Shears - for larger branches, but can't cut very large branches easily;
- Saws - better for larger branches and can cut closer to the stem than shears;
- Ladders - used to prune branches above head height, usually lightweight and sturdy;
- Extension poles - saw or shears on long poles allow higher branches to be cut from the ground;
- Chainsaw - easier for larger branches, but can damage the stem if the user is careless; and
- Hydraulic/Air powered saws/shears - used for some larger commercial jobs.








The preferred tools for pruning are:

- **Shears** – double action shears especially designed for branch pruning are ideal. They are easy to use from the ground but require the use of two hands. A safety harness is therefore required if used for branches above head height when working off a ladder;
- **Saws** - saws are useful for very large branches, allow greater maneuverability when working off a ladder and can cut closer to the stem than shears.

Professional pruning tools are more than worth the investment.

Note the branch should be pruned as close as possible to the branch collar, but without damaging it (*see figure 7*). The collar is a raised area of bark at the base of the branch, more prominent in eucalypts than pines. Damage to the branch collar causes an increase in the scar tissue in the knotty core and, in eucalypts, there is an increased risk of decay entering the log. Damage to the collar is more common when using saws than when using shears.

Figure 3: Pruning guidelines for radiata pine

Pruning Visit	1	2	3	4	5	6	7
Type of Pruning	Form Pruning		Form and Clearwood Pruning			Clearwood Pruning	
Tree Height (metres)	1.0-2.5	2.5-3.5	4-5	5-6	6-7	7-8	8-9
Pruned Height (metres)	-	-	1-2	2-3	3-4	4-5	5-6
9-							
8-							
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Pruning visits will be every 6-8 months depending on tree growth rate and quality of timber desired to be produced	<p>Prune</p> <ul style="list-style-type: none"> - Large branches - Acute branches - Double leaders - Basket whorls <p><i>Using pruning shears</i></p>		<ul style="list-style-type: none"> - Prune up the trunk leaving 3 to 4 metres of green crown. - At each visit never remove more than 50% of the green crown. - Continue to form prune large and acutely angled branches and basket whorls. - Rub off any shoots on the pruned trunk between visits. - Continue clearwood pruning until the desired log length is reached – this may take 3 to 6 pruning visits <p><i>Using pruning shears and saws and pruning where necessary.</i></p>				

Cost

Pruning is a significant cost in managing your stand if you pay for labour. On average sites where trees have average size branches, a contractor will charge least per tree for pruning the first lift from the ground and increase the charge per tree for pruning subsequent lifts off a ladder (e.g. Table 2). Careful selection and timely pruning of the right number of trees not only ensures high quality wood, it also minimises your costs.

Figure 4: Well pruned eucalypt stub. The cut was close to the stem (so the stub is short) but caused no damage to the collar. The cut face is clean with no ridges.



Figure 5: Poorly-pruned eucalypt stub. The cut has damaged the collar and left a ridge at the base. The chance of future decay entering through the stub is high, particularly if the branch was living when pruned.



Table 2: Estimated time for pruning pine trees

Height (m)	Time (mins)
0 – 1.5	3
1.5 – 3.0	4
3.0 – 4.0	5
4.0 – 6.0	6

Figure 6: Diameter growth of *Eucalyptus nitens* following green pruning.

The trees were pruned at age three years at canopy closure. There were three treatments, no pruning, 50% and 70% removal of green crown length. Note that diameter growth was reduced when 70% of the crown was removed.

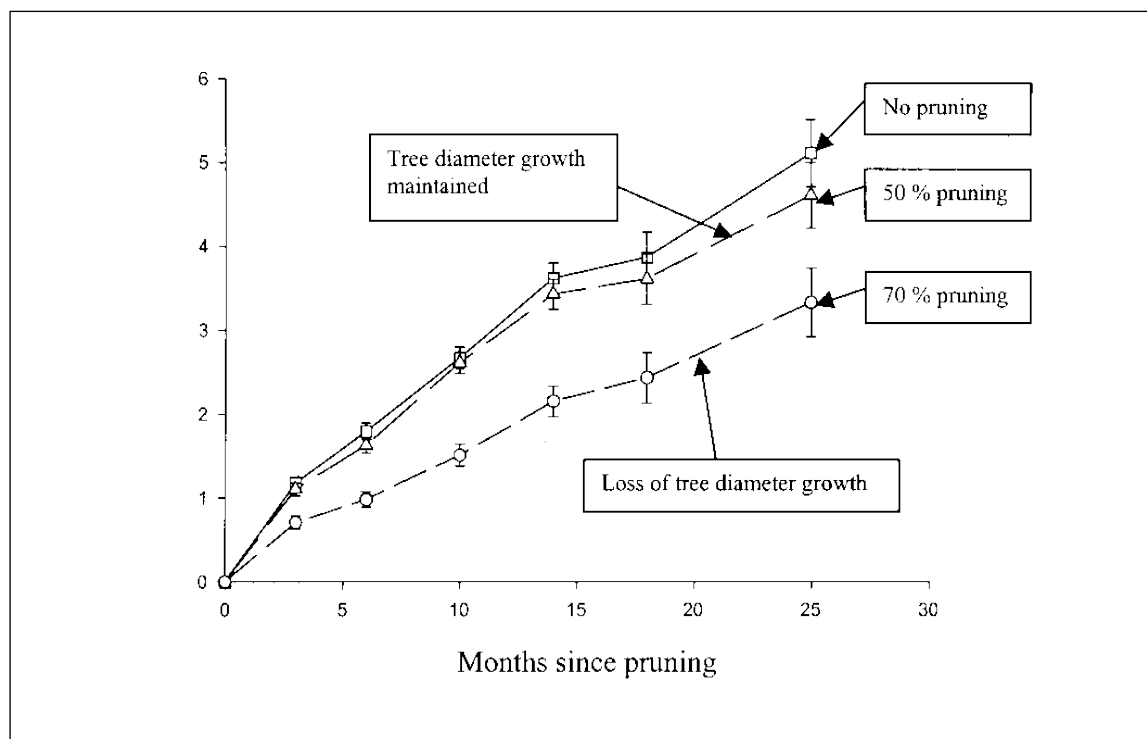
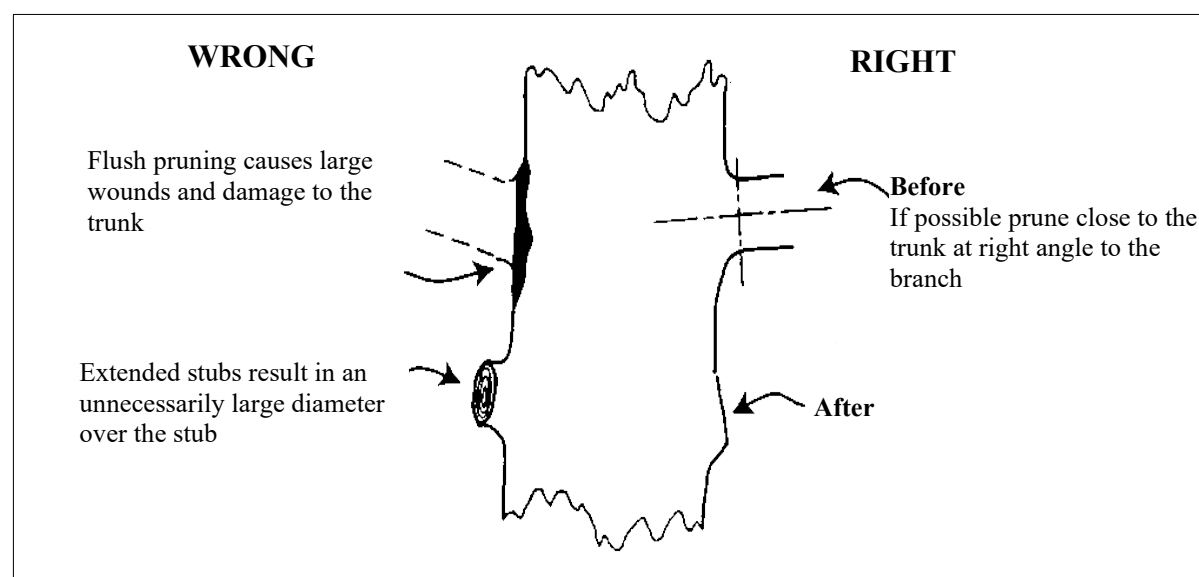


Figure 7: Right and wrong ways to prune branches



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