

Pruning to Improve Timber Quality

Summary

- **Pruning trees to improve timber quality can increase the economic value of woodlands.**
- **Formative pruning from an early age is beneficial for tree form and value.**
- **High pruning of older trees, especially broadleaves, increases their value and marketability by removing defects.**
- **Pruning woodlands can produce other benefits such as improved views and amenity; easier inspection; crop measurement and pest control.**

Introduction

The Scottish Forestry Strategy lists improving timber quality as a priority for action because “high quality timber is more likely to meet future markets and is also more likely to find a permanent use thereby assisting carbon sequestration”.

A large proportion of new woodlands are planted with broadleaf trees. While these woodlands may meet their objectives in terms of conservation and landscape enhancement there is a concern that without appropriate silvicultural treatments the opportunity to produce valuable home-grown timber in the future will be missed. Establishing a crop of trees is demanding in terms of time and resources. It is beneficial to allocate time to operations such as pruning to ensure that, wherever possible, woodlands have a commercial potential. If no pruning is carried out the final timber crop may only find a market as pallet wood, pulpwood or chip instead of high value sawlog material for furniture, veneer or flooring. In the worst cases the woodland may have no commercial value at all.

Producing a crop of high quality timber is a slow process; rotation lengths vary from 25 or 30 years for poplars up to 120 years or more for oak and ash.

Pruning, coupled with other silvicultural operations, lays a firm foundation to produce a quality crop.

In Scotland oak, ash, elm, sycamore, poplar, beech, cherry and birch all have the potential to produce quality timber. Other species may have specialised or small-scale markets. All these broad-leaved species are likely to require pruning to achieve their maximum potential timber value.

The main conifer species are Sitka and Norway spruces, larches, Scots pine and Douglas fir. In most cases these will produce high quality timber without pruning and pruning of conifers is rarely carried out.

To produce high quality timber the following are required:

- A clear objective to produce a quality crop;
- Species well matched to site with anticipated growth rates better than the average for the species;
- Good soils and a sheltered location;
- High initial stocking: minimum 1100/ha for poplar and gear, 3,000/ha for pine, oak and other broadleaves;
- Sustained management.



Formative and high pruning over many years mean that this ash tree in a small farm woodland now has the potential to produce valuable timber.

This technical note describes the benefits of pruning, methods applied and possible problems created by pruning woodlands. It is written primarily for farmers wishing to carry out work for themselves and provides background guidance for the tree improvement operations supported by grant aid.

Why prune trees?

Trees do not always benefit from pruning so it should only be carried out after careful consideration of your objectives and inspection of the tree crop. This should include an assessment of the tree's health, habit, stability and structure.

There are many reasons to prune trees, these include the following:

- To remove multiple stems (singling);
- To improve plant form (formative pruning);
- To reduce the occurrence of knots and defects in future wood (high pruning);
- To remove an obstruction or nuisance e.g. with roadside trees or to improve access (brashing);
- To ensure healthy vigorous growth in new plants by removing damaged roots and shoots;
- To maintain health and vigour by removal of dead, diseased and rubbing limbs;
- To improve flowering and / or fruitfulness.

This technical note mostly considers the first four items.

Pruning is beneficial because it prevents the development of major structural defects and ensures that the majority of trees in the crop have the potential to produce higher quality timber.

It is easier, and therefore more cost effective, to remove a defect from a tree when it is young and easily reached. Formative pruning and singling is carried out in establishing crops, usually less than five or ten years old, to create a single straight stem. It is important to "train" the shape of trees showing undesirable form.

High pruning is carried out later to create a straight stem free from external knots. A mature tree that contains large diameter knots, doesn't have a straight stem or is forked, will be worth far less than a tree with a single large diameter, knot free, straight stem. For oak the best price achievable (for veneer quality) is some ten times more than the lowest (timber for firewood, charcoal and fencing) (Brazier 1990).

Hardwood sawmills in particular require large diameter, long straight logs with a good proportion of heartwood. Knots should be restricted to a narrow central core. External knots make the wood structurally weak, may spoil its visual appearance and prevent it from being veneered.

Knots are formed by the cell structure of the tree being diverted to form a branch. By removing the branch some years before the tree is felled, new rings of growth will have developed providing knot free wood. It is also important to remove dead branches. If this is not done then as the tree increases in girth the bole will "include" or grow over these dead branches. This will produce timber with the worst kind of knots. Dead branch wood doesn't "fuse" with it so when the log is planked and seasoned the knots tend to fall out leaving holes which limit the uses for the timber.

Pruning types

Pruning is normally carried out at various stages of tree growth. Operations occur in the following order.

1) Singling

This is the removal of multiple leaders when the trees are very young, typically less than five years old. If multiple leaders persist to maturity, two or more small, low value stems will develop instead of a single, longer, higher value stem.



Loppers and secateurs are ideal for formative pruning and singling.

Singling is most likely to be required in young spruce crops where bird or wind damage can result in high levels of forking. It is usually justified if more than 15% of trees are forked.

2) Formative pruning

Formative pruning is carried out in the first ten or so years of a tree's life. It should aim to produce a tree which in maturity will be free from major physical weakness or defect:

- Remove crossing & rubbing branches within the crown and those that have the potential to grow into crossing branches;
- Remove coarse lateral branches;
- Remove forks that develop in the crown.

The aim of these first two operations is to develop a strong but well balanced branch structure on a single stem. The only tools required should be a pair of secateurs and/or a pair of loppers.

3) Brashing

Brashing is the removal of all the lower branches to a height of approximately 2 metres (head height). Brashing is labour intensive and is often only carried out where access is needed for draining, crop inspection, game bird rearing and so on. It does have the benefit of reducing the risk of surface fires (grass, bracken, heather etc) developing into crown fires. It is therefore most commonly seen along public paths and rights-of-way. It is also an appropriate first pruning operation for trees that have the potential to produce quality timber.

In dense spruce crops brashing can be carried out usefully to cut inspection racks at intervals through unthinned stands.

A brashing saw is a purpose made saw that cuts only on the backstroke. If the branches are brittle (because they are dead) or are weakly attached to the trunk, as with larch, they can be knocked off using a pickaxe handle. Chainsaws are not appropriate tools for brashing.



Brashing opens up a stand for access.

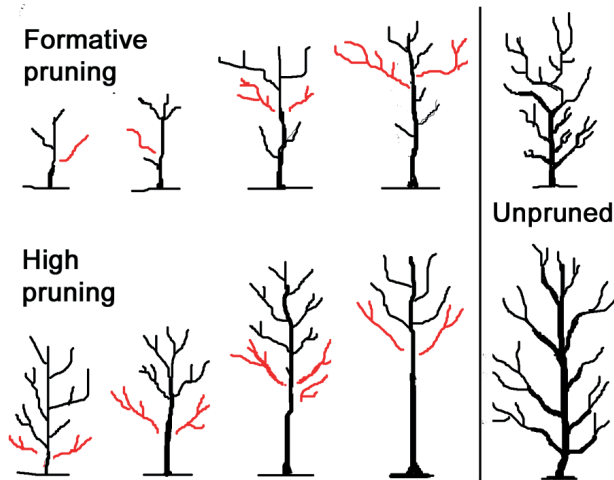
Brushing is a valuable amenity operation but does not normally contribute to an improvement in timber quality.

4) High Pruning

High pruning is similar to brushing in that it involves the removal of all lower branches but up to a greater height. This operation is usually reserved for final crop trees that have the potential to produce valuable saw logs. These are mainly broadleaf species grown on long cycles of up to 150 years, such as ash, oak, walnut, beech and sycamore. Some conifers of exceptional value are also pruned, usually Douglas fir, Scots pine and larch. The woodland owner determines the length of branch clear stem required. Pruning heights commonly vary from 4 metres to 10 metres.



High pruning in larch; protective equipment is particularly important when pruning above head height.



Formative pruning removes only those branches that will distort the tree. High pruning removes all branches up to a specified height.

Work is normally carried out from the ground using a “high pruner” or “pole saw”. The pole saw is an extended version of a brushing saw. By adding detachable handle sections, normally constructed from aluminium, you can prune to the required height. The high pruner is also extendable but severs the branch with a lopper activated by pulling on a cord. Using these hand tools can be arduous work. In recent years we have seen the development of powered high pruners. These have a similar look to a trimmer but have hydraulically powered chainsaws at the end. They are usually worn on a harness but older versions have the engine on a backpack.

Viability of Pruning

Formative pruning is relatively cheap and can be carried out during other operations such as weeding or tree shelter maintenance or removal. It makes financial sense to formatively prune the crop on an annual or biennial cycle for the first ten years or so.



The fork in this tree is structurally weak and the tree has no timber value other than as firewood.

Brushing and high pruning are more time consuming and expensive. They are only worth carrying out if the price differential between knotty and knot free timber will cover the cost of the operation.

Generally speaking pruning of broadleaf crops is more important than conifer crops because:

- Hardwood timber commands higher prices if free of defects, such as knots, as it is often used to create very visual products such as furniture. Softwoods are often used in the construction of timber-framed houses, paper and particleboard production. It is not necessary for this timber to be knot free. Broadleaf trees normally have a greater potential for improved retail value.
- Broadleaf trees naturally develop rounded crowns with substantial lateral growth (branches), whereas conifers develop a more conical shape with less lateral growth. Conifers continue to have one main leader/stem throughout their life (referred to as apical dominance) but broadleaves lose this trait in maturity and display rather unpredictable growth patterns. Dense initial stocking will reduce the development of lateral growth and help produce straight boles regardless of whether the crop is of broadleaves or conifers.
- Broadleaf trees are more prone to damage from grey squirrels. Pruning of lower branches may reduce the occurrence of bark stripping around the area of the most valuable sawlog material, as there are no perching sites.

As you increase the height to which you prune the operation will become accordingly more expensive/time consuming. Therefore it is generally felt that pruning above 6 metres is not financially viable in broadleaf crops. Pruning up to 10 metres in exceptional quality stands can sometimes be justified.

Pruning Techniques

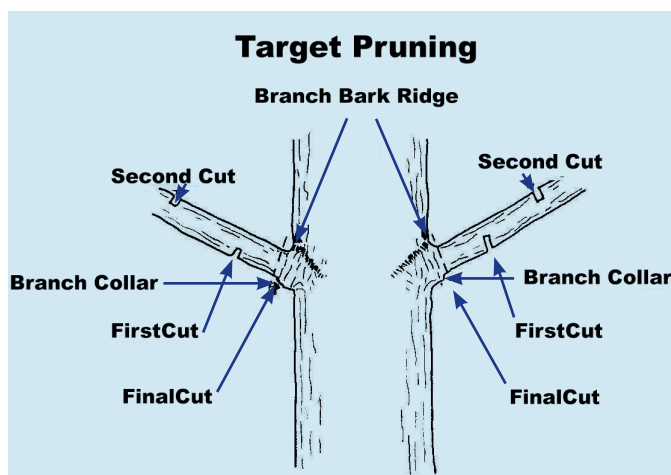
Pruning is usually beneficial, but if carried out incorrectly it can be detrimental to the health of the tree and to the quality of timber produced. Pruning is an unnatural occurrence for the tree. The wounds that develop are a potential site for colonisation by fungal and other pathogens but trees can stop the spread of decay organisms through a process of "compartmentalisation". We can aid the tree in doing this by:

- Avoiding damage to the tree's bark;
- Pruning at the correct time of year (see below);
- Target pruning.

1) Target Pruning

Target pruning, as shown below, is the term used to describe a pruning cut that is made just beyond the "branch bark ridge" and the "branch collar". By leaving anatomical parts intact you minimise damage to the bole's tissues but avoid leaving a "peg". Flush cutting is unfortunately commonly seen on pruned trees. Cuts flush with the bole damage the branch collar and branch bark ridge and thus open up a route for colonisation by pathogens. Leaving pegs behind is also detrimental. The deadwood left behind provides habitat for wood decaying organisms to colonise.

Secondly, leaving pegs defeats the purpose of pruning. As the tree increases in girth it will grow around the deadwood left behind and produce knots anyway.

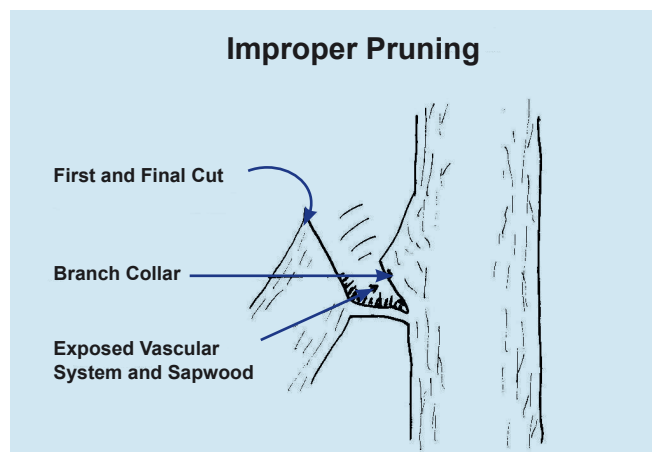


Target pruning: Always leave the ridge of bark at the base of the branch undamaged.

2) Step Cutting

This technique avoids the damage that may occur when a heavy branch peels back and tears at the bark of the main bole.

- 1) Make the first cut in the underside of the branch about 30cm from the trunk and to 1/4 - 1/3 of the diameter.
- 2) Make the second cut on the topside of the branch about 35cm from the trunk. Continue cutting until the branch falls.



Improper pruning.jpg How not to do it! Always avoid damaging the tree.

- 3) Make a final cut to the immediate outside of the natural branch shedding point (refer to diagram for details), leaving an intact branch bark ridge and branch collar.

Timing

Traditionally, pruning has been carried out at all times of the year. There is now some evidence that it is not the best time to prune when the tree is coming into leaf or when it is just shedding its leaves. The ideal pruning times are just before bud burst in late winter or when in full leaf in late summer.

Other benefits to summer pruning include:

- Immediate closure of the wound in advance of winter;
- Increasing the amount of light into the inner canopy;
- In deciduous trees dead wood can be more readily seen;
- The climate is more equitable for outdoor work i.e. warmer and drier.

However this can be a rather impractical time of year for farmers and landowners. So, if the tree is in a healthy condition and has sufficient energy resources to defend itself, pruning at most times of the year is acceptable. There are though several exceptions, listed below.

- Maples and birch – these 'bleed' if pruned from January until in full leaf, and although this is not injurious to the tree itself the resulting staining is often deemed unsightly and may degrade the timber.
- Walnuts - Extensive bleeding will occur if pruning is carried out at any time the tree is not in full leaf.
- Cherries and plums - Early summer pruning reduces the risk of infection from diseases such as Silver Leaf (*Chondostereum purpureum*).

The presence of wildlife may affect your timing. Great care must be taken to avoid damaging any bird nests or bat roosts that are active or under construction. You can face fines of up to £5,000 for every bird or bat displaced under the Nature Conservation (Scotland) Act. To remove a branch that houses a nest or roost you must first seek a licence to do so from Scottish Natural Heritage.

Selection of Tools

A wide range of tools are available:

Hand Tools

A wide variety of hand tools are available. These include the Pruning Knife, Secateurs, Loppers, Pruning saws and high pruners in a wide variety of designs.

Power Tools

A range of powered tools are also available; these may be hydraulically, electrically or pneumatically powered. These include Power Secateurs; Power Saws and High level pruners.

Tools must be fit for use and should be selected for a specific purpose:

- Pruning Knife for small diameter lateral branches less than 15mm. in diameter.
- Use of a Lopper for pruning lateral branches up to 35mm. in diameter (size of a large thumb).
- Brushing saws and Pole saws for branches up to 15 cm. in diameter.
- Bow saws for branches up to 20cm. inches in diameter.
- Chainsaw and powered high pruner use is limited only by the length of guide bar and the users certification.



Powered tools are available but are heavy to use.

A new innovation is the "rope saw". This is a length of saw-chain attached to a sturdy rope that allows the operator to cut through fairly large diameter branches while staying on the ground.

Hygiene Measures

The following sterilisation procedure is recommended if there is the likelihood of transference of diseases such as Silver Leaf or Fireblight (*Erwinia amylovora*) in apples, cherries or rowans:

- 1) Brush off all loose debris from tool.
- 2) Remove any oil, grease or residues with paraffin (or suitable alternative solvent).
- 3) Wash or swab with detergent and water.
- 4) Immerse the tools in the sterilising fluid, if practicable and leave to soak for a few minutes. Alternatively, swab liberally with the fluid and repeat three times.
- 5) Rinse and dry to prevent corrosion.

One part domestic bleach to one hundred parts water is an effective sterilising solution. The solution should be freshly prepared on each day of use, as diluted bleach soon loses its sterilising properties, especially if organic matter is present.

Sharpening Hand Tools

Always keep hand tools sharp and in a safe condition. It may be useful to carry spare blades which you can change during the day.

- If using a sharpening stone the surface should be cleaned prior to use with a suitable solvent such as paraffin. A light engineering oil should be applied to the stones surface and the full length and width of the stone used when sharpening the pruning knife or secateur blade where possible.

Personal Protective Clothing (PPE)

Items of PPE suitable for pruning may include:

- Thorn proof gloves must be worn when handling thorny plant species, and when using a hand saws. Use chainsaw gloves if using a powered high pruner.
- Safety work boots with a good grip and including a steel toecap must be worn (complying with BSEN 20345).
- Any operator using powered high pruners should possess a first aid kit or large triangular bandage and have access to hand washing facilities - waterless skin cleanser or soap and water, with paper towels (see HSE leaflet INDG 214).
- Suitable helmet, ear and eye protection (EN 397 and EN 166) should be worn when working with powered high pruning saws. A helmet and eye protection should be worn when pruning above head height even with hand tools.
- Chainsaw protective trousers and gloves (EN 381) should be worn when operating any type of chainsaw the operator must have the suitable chain saw competency units.

Preparing to Work

- A site specific risk assessment should be completed prior to any work beginning on site. In particular be aware of the presence of any power lines.
- Check that the pruning tools are clean, sharp and in a serviceable condition, and all other equipment is serviceable.

Relevant Legislation

There are many legal instruments that may affect your pruning operations. The list below is not exhaustive:

Provision and Use of Work Equipment Regulations. (PUWER);
Management of Health and Safety at Work Regulations;
Personal Protective Equipment Regulations (PPE Regs);
Plant Health Regulations;
Nature Conservation (Scotland) Act.

Negative Effects of Pruning

One side effect of pruning is the possibility of decay developing in the stem behind the cut. Some species like horse chestnut, birch, and poplar have a weaker defence system and thus cuts must be small. Other species like plane, oak and lime have a stronger defence system and thus tolerate somewhat larger cuts. As a general rule the diameter of the resulting pruning wound must be no more than one third of the diameter of the limb or bole you

have just pruned back to. This ratio should reduce as the pruning wound gets larger.

Avoid removing more than one third of a tree's living branches (crown) while pruning. To remove too much foliage reduces its ability to carry out vital physiological processes such as photosynthesis and respiration. Pruning should be balanced. Avoid leaving one side pruned and the other not. The unequal loading caused can make the tree unstable and prone to structural failure.

The development of epicormic growth (advantageous new shoots developing from previously dormant buds) is common on many broadleaf trees especially *Tilia* (lime) and *Quercus* (oak) after pruning. The dormant buds are more likely to respond and grow if the tree trunk is exposed to direct/bright sunlight, for instance edge trees.

An increased risk of wind throw may occur if edge trees are pruned opening up the woodland to winds not before experienced. To this end avoid pruning the outer most rows of trees in your woodland, especially on the windward (exposed) side. This is particularly important if the woods are used for shelter or game cover as pruning can accelerate wind speeds at ground level.

Grant Aid

Other than for path-side maintenance for public access there is currently no grant aid for pruning work under the Forestry Grant Scheme

References and Further Information

Publications

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