

# PRUNING TŌTARA

A Practical Guide to Managing  
Tōtara on Private Land



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## Disclaimer:

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# Introduction – why prune tōtara?

Tōtara are capable of growing very tall with long, straight, and branch-free trunks (boles). So why do we prune? Is it even necessary? Before getting into the technical how-to details, this section will first discuss some of the more theoretical questions around the actual need, value, and role for pruning in managed tōtara forests.

The late indigenous silviculturist, Owen Lewis, liked to quote an overseas arboriculturist who provocatively stated something like: “Pruning should only be done with a stout stick” – conjuring up images of knocking off dead branches within a thick and dark wood. Of course, he was not recommending sticks as the most suitable tool, but rather putting pruning within the larger context of silvicultural management and making the point that other management factors such as stocking-rate, shade, and the timing of thinning etc., may make pruning unnecessary – or at least help minimise the task.

Pruning is only one way to influence the growth-form of a tree and should be considered as part of a suite of silvicultural management options and practices. Therefore, it is useful to understand why and when we should prune.



## Timber as an objective?

Apart from minor incidental reasons to prune, such as to maintain access ways, visibility, or for aesthetics, pruning is mostly relevant to timber production. More specifically, it is a way to increase the potential value of the timber within a sawlog, by increasing the yield of branch/knot-free timber, called clearwood. Clearwood timber usually has a much stronger or wider market demand and commands a premium price. But such pruning is only relevant if your management objectives include maximising potential timber value from a tree or forest, and if the young tree's form is not naturally developing a branch-free bole. It also assumes that clearwood logs will be more valuable - come harvest time.

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## Pruning by forest management

Ideally, pruning to optimise potential timber quality and volume would not be necessary. In established natural forests, many tōtara develop tall branch-free boles without any pruning at all. Such trees grow up within a tall forest structure that encourages them to keep self-selecting a single, dominant leader, and to naturally shut down and abscise their redundant, shaded, lower branches, to produce tall, clean boles, and lightly branched top-logs. Yet, even in such tall forest environments, not all trees will develop a perfectly formed stem – at least not perfect to the eyes of a sawmiller. However, the aberrations are greatly exacerbated in naturally regenerated (second-growth) or plantation-grown stands because they lack a tall overhead canopy to 'draw-up' the young tōtara stems straight and true.

Tōtara is a light-demanding tree species and does not naturally have strong apical dominance (a natural growth habit characterised by a single dominant growing tip, or leader, even in open field conditions). Indeed, in open-grown situations, or in high light conditions, tōtara tend to branch heavily and develop large, spreading, and multi-leadered crowns. Many will do so from near ground level, others as soon as they get above any adjacent vegetation. If inter-planted with manuka this may be only a few metres high, or higher if inter-planted with naturally taller growing kanuka.

While it is impractical to avert or remedy all potential timber defects from the whole stem – at some point the stem will need to branch out into a spreading crown - it is possible to influence the form of the lower stem sections to improve the number, lengths, volume, and timber value, of the potential sawlogs. As far as possible, this should be done indirectly by managing the structure and density of the stand (e.g., by planting tōtara at high-stocking rates, or

planting within a 'nurse' canopy of early successional hardwood species like manuka or kanuka or delaying thinning to retain some side competition from adjacent trees that also providing some shade on the lower stem etc.).

Pruning is very labour intensive and costly, and that effort is required well in advance of any potential return on that investment. It may not be a good economic investment. Therefore, any practical options to reduce the effort and cost of pruning makes sense.

**"Pruning is very expensive – so, as far as possible, try to minimise the need for pruning by managing the forest structure."**

Strategically then, it is wise to try and minimise the need for, or use of pruning, through management of the forest structure, wherever those options exist. Naturally, there are balances to find. Maintaining a higher stocking of trees and delaying thinning may reduce the need for pruning, but also reduces the growth rates of the individual trees.

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## Pruning a practical intervention

Even in highly stocked plantations, where heavy side-branching may be reduced, defects such forking and/or development of steeply-angled branches trying to compete with the main stem are still common. When the latter, sometimes referred to as 'spike-branches', are eventually out-competed and begin to naturally die-back, they can leave large unattractive knots in the timber, or even small pockets of deadwood or rot. Such defects, as with large knots, significantly devalue any timber recovered from such sections of log. Therefore, for many planted and naturally regenerating tōtara forests, pruning is a relevant and useful management option if timber production is an objective.

**"While pruning can increase the timber value of the forest, the economic viability of pruning is not known".**

Indeed, in sparsely stocked developing forests, without the advantages of an existing and tall forest structure, pruning may be the only practical option to manipulate the form of the future harvest trees. Fortunately, it can be very effective.

Pruning can even 'salvage' a situation. It is often possible to create a stem with clear potential to develop into a good-quality timber tree, where otherwise only a poorly formed tree with little or no



sawlog volume at all would have developed. Even tōtara trees growing in open conditions can often be pruned to achieve a 4+m clear bole.

While pruning can create and add significant sawlog volume and value to your future forest. The economic viability of pruning operations is not known. Timing and technique are important factors along with site specific variables such as growth-rates, stocking, and practical harvest/extraction options etc.

### Potential health issues

Pruning is an unnatural act to modify the form of individual trees to better fit to our management objectives. It is quite a severe intervention that often drastically reduces the amount of foliage (which is where the tree's energy is produced) and leaves open wounds on the tree trunk that can take years to heal over and potentially exposes the tree to entry of insects and pathogens. As with most attempts to 'correct' or 'improve' nature, it is probably not without some risk of making some ignorant presumptions or creating some surprises in the future. The milling of pruned logs in the future may yet reveal hidden issues resulting from past pruning such as pockets of rot, fungal attack/ discolouration or insect damage, or long-term health effects that we are presently unaware of, or underestimate.

Notwithstanding that, field observations and silvicultural trials to date suggest that tōtara trees are very amenable to timely pruning and survive even severe pruning treatments. Observations to date do not indicate widespread or serious issues resulting from best practice pruning operations. In contrast, poor practices and extreme pruning that creates large wounds, may result in internal defects and localised discoloration of the timber.

Pruning only adds value if done well and before the individual stem reaches a certain diameter. This will be covered in detail further on, but it means there is a limited window of opportunity for pruning tōtara to enhance potential timber value; and pruning outside of that window is probably a waste of effort. Therefore, timing is a critical factor.

**"Tōtara respond well to pruning - and survive even severe pruning treatments. But if pruning is not well targeted, well timed, and well executed, it could be a wasted effort – or worse, even damage the tree."**

### Summary

- Pruning can be an effective intervention to influence the form of young developing trees, increasing the volume and value of potentially recoverable logs and timber.
- There is only a limited time in the tree's development for pruning to be effective.
- Pruning is labour-intensive and costly. The economic viability of pruning is not known.
- While tōtara appear to survive and heal well from pruning wounds, any long-term ill-effects from large pruning wounds are unknown.
- Managing the structure of a forest to minimise the need for pruning is wise.
- If pruning is not well targeted, well timed, and well executed, it could be a wasted effort – or worse, damage the tree.



The rest of this chapter covers key concepts and practical details relevant to pruning tōtara trees.



## 2. Key concepts

Pruning tōtara is not as simple as pruning pine trees. There is not a single prescription or formula. It involves applying a complex mix of varying concepts, strategies, and approaches, and to trees that will often vary significantly in their individual characteristics and according to their location within a stand.

Farm-foresters experienced and skilled at pruning tree species such as blackwoods will find many parallels with pruning tōtara. They may find tōtara comparatively better behaved, with slower growth and less time pressure. However, those trying to manage sparsely stocked and highly variable naturally regenerated stands of tōtara, will find many complicated and confounding trees to deal with.

Some key concepts, that may help the pruner to make appropriate decisions in the field, include:

- Understanding DOS (Diameter Over Stubs)
- Form-pruning rather than straight 'lifts'
- 'Top-down and bottom-up, and tweak in-between' – a practical approach
- Sooner the better and little and often
- Select the best trees - and not too many!
- Consider each tree individually and within its immediate and its future context
- Flexibility rather than rigid prescriptions
- Prune with a realistic programme in mind

These concepts are applicable to both planted and naturally grown tōtara and are explained and discussed in more detail below.

### DOS

**DOS– Diameter over [pruned] stubs.** This is a practical term that relates to one of the most critical concepts of pruning. It is essential for forest managers and field workers alike, to understand the purpose of this parameter (i.e., minimising the defect core, and ensuring sufficient recoverable clearwood, etc.). And to apply this in the field, to avoid wasting your time and effort unproductively pruning trees that should not be pruned or creating a timber defect where a green knot would have been preferable.

DOS is a term that is comprehensively explained on other websites (e.g., Best Practice Guidelines for Silvicultural Pruning 2005: [here](#) (see pages 8 & 10), and on the NZFFA website: [here](#). If unfamiliar with DOS please look it up before reading on.

**“Understanding DOS is essential – It will help select the individual trees to prune and the appropriate timing of pruning operations and help decide which branches to prune at each visit.”**

See section 7, page 25, and video: [here](#) for recommendations on maximum DOS figures and how to apply in the field.



A diameter tape is handy to check stem diameter and the DOS.





## Form-pruning

This idea prioritises pruning decisions and actions that will result in the development of a single, tall, straight tree bole, rather than just pruning all branches from the bottom up, sequentially in stages, often called lifts. Form-pruning is important to maximise log length. In contrast, pruning tōtara in a series of straight-lifts (as is done with pine trees), especially trees growing in relatively open conditions, will tend to promote heavy branching and multiple leaders in the crown – resulting in short-boled trees with poor top logs – or none at all with useable timber.

Form-pruning targets major potential defects such forking of the main stem, steeply angled branches that may compete with the main leader, and heavy branches that may create large knots that would significantly down-grade the timber. It does not target small branches, especially not those that come out at near horizontal angles from the trunk – as many of these will not develop into large branches and will either naturally die-back or stay as small-diameter branches once shaded as the tree grows in height. Small tight knots in timber are acceptable for structural and dressing grade timber. Keep in mind that not all timber has to be knot-free. And ‘green knots’ (i.e., knots from live branches) are preferable to having pruning stub defects in the timber.

Form-pruning aims to maximise potential merchantable log length and sawlog volume rather than just creating clearwood butt logs. Trees in developing young forests will tend to have short butt logs and heavily branched poor-quality top logs – or no merchantable top log. Therefore, form-pruning is important to try and raise the mean bole-length or height of the developing forest. This will significantly increase the total merchantable log volume within the forest at time of harvest.



Form-pruning stems <10-12 cm diameter should target forks, competing leaders, steeply angled, and heavy branches. Small branches, especially ones that come out near horizontally from the stem, can be left to help the tree recover and can be removed later before the target maximum DOS is exceeded.



Two severe form-prunings of this tree up to 2010 (left) created a single straight trunk, and once the crown of the tree had recovered, it was clear-pruned to 4.5m before the maximum DOS exceeded 20cm – as shown 11 years later in 2021 (right), with the same 2.4m ladder for scale.



### Top-down and bottom-up, and tweak in-between.

This phrase tries to encapsulate a hierarchy or sequence of pruning priorities and actions. See photos below and video: [here](#). It hints at the need to consider and apply multiple strategies to achieve a balanced outcome to suit the individual tree. It also tries to avert the problem of one action causing an undesirable growth response somewhere else (e.g., a bottom-up lift encouraging heavy branching and competing leaders in the remaining crown resulting in only a short bole).

Pruning may need to apply a mix of actions variously weighted to suit the individual tree. This will often be a mix of form-pruning that works from 'the top down' (or as high up as is practicable), then a bottom-up clearwood 'lift' executed just in time to avoid an excessive DOS, and then some preventative surgery on the heavy and steeply angled residual branches that are likely to cause problems in future. The latter can be done by removing full branches, or alternatively, to keep more green-crown (foliage), just by cutting the tips off potential problem branches to discourage their continued vigorous growth, known as 'tipping'.

The overall severity of the pruning is usually limited only by concerns to retain sufficient green-crown for tree health, recovery, and maintenance of its growth rates. Do not remove more than two-thirds of the foliage. Many guides recommend not more than one-third, and that is ideal, but necessitates more frequent pruning visits. And some trees simply require more off to salvage the situation.

The pole-sized tōtara tree (bottom left), had previously had some basic form-pruning when it was a sapling. Nevertheless, growing in open conditions it had once again developed several competing leaders and many steeply-angled heavy branches, and with a DBH of 17cm. The image (bottom right), shows the same tree (from a different angle) following pruning which addressed the top of the tree first, then the steeply-angled branches, then a bottom up 'lift' to ensure the DOS was kept below 20cm and then some of the remaining heavy branches were 'tipped' (shortened by about one third), to reduce their vigour, but retain sufficient foliage. This utilised the 'top down, bottom up, and tweak in the middle' approach. Growth in the leader will be promoted. And as the tree recovers, conventional bottom-up lifts will easily create a 6m clear-pruned bole with a maximum DOS well less than 20cm.





### Sooner the better and little and often.

Small young tōtara respond well to form-pruning. Smaller pruning wounds heal faster and with less adverse effects on tree growth. It is better to avert the need for large pruning wounds in the future by nipping potential problems in the bud as soon as they can be identified.

Form-pruning can start with secateurs on small saplings and should continue with loppers influencing the form of the top of the developing pole/tree as far as can be safely reached from ladders.

Useful illustrations of form-pruning and advice is provided in the book: **Blackwood – a Handbook for growers and users**, by Ian Nicholas and Ian Brown, 2002, (pages 50-60). It is available free to view and download on from the NZFFA website: [here](#).

Tōtara often have multiple young branches contending to be the main leader. Helping the sapling or tree make an early choice often results in rapid formation of another metre or so of trunk height. This has sometimes been called 'leader-training' (See: [leaflet](#) ). A few strategic snips at an indecisive growing tuft and the first 3 to 4 metres of bole can often be set in train. 'Tipping' branches that could develop into problems later on, can reduce their vigour and encourage the growth into your selected leader.

### "Leader-training at the saplings stage can be very effective form-pruning".

Don't be too concerned about floppy, arched-over top leaders. They will straighten up by themselves as the tree grows.

Early intervention allows for a focus on leader-training and form-pruning first, with plenty of time to follow-up later with bottom-up lifts to remove side branches before the DOS becomes too large.

Frequent small interventions are better than a severe pruning that removes a greater proportion of the foliage. More frequently staged pruning enables much better manipulation of the tree's form and lessens the risk of significantly slowing the tree's growth-rate or vigour. However, that risk needs to be weighed against the risk of not getting back in time to do the necessary further pruning and the missing the windows of opportunity to control the DOS.

It can be difficult to decide how much to take off at each visit. A realistic silvicultural management plan is required to inform such pruning decisions. Be aware that the stem diameter of vigorous trees may increase by around 6mm – 1cm each year. This potential growth rate should be kept in mind when deciding which branches to remove to keep the DOS below your target.



Form-pruning wounds on vigorous saplings heal very quickly. There are two hardly noticeable pruning scars on the stem above left, and one on the stem above right.





## Select the best trees - and not too many!

### How many to prune?

The ideal final crop stocking rate of any forestry species is often a matter of debate between foresters. And unfortunately, there is presently little tōtara-specific research or case studies to inform the topic for our purposes. Ideas on prospective markets, log value and end uses will affect the target harvest diameters, which in turn effect stocking rates. Moreover, growth rates and the economics of carrying the costs of planting, pruning, and thinning until harvest time, will also shape forest management prescriptions, such as how many trees to prune. And of course, there will be significant differences between plantation clear-fell regimes and single-stem selection systems in naturally regenerated stands.

For plantation-grown tōtara a thinning schedule developed by the Northland Tōtara Working Group (refer to the chapter on thinning) suggests pruning up to a maximum final stocking of 400 fully pruned trees per hectare. This seeks to maximise sawlog stocking and volume productivity. In contrast, European close to nature forestry systems that use single-stem selection approaches, typically only prune up to around 150 trees per hectare. The long rotation lengths put the focus on creating and maintaining high-value, large-diameter trees, and minimising costly silvicultural interventions.

Table: 1 (in Section: 7) sets out a guide on the maximum final number of pruned trees in plantation situations, for various target harvest diameters and DOS values. Up to 400 pruned trees/ha is a target for optimal performance from plantations.

However, finishing up with around 300 well-pruned trees/ha will still be an excellent outcome for most forests. It allows more leeway with maximum DOS, develops plenty of potential crop trees, and retains flexibility for future forest management options, and avoids pruning far too many trees.

**“400 pruned trees/ha with a maximum DOS of 16.5cm is a target for optimal performance.”**

**“However, 300 pruned trees/ha with a 20cm maximum DOS, would still be an excellent outcome for most forests.”**

However, in less homogenous natural stands, it may be hard to find so many good potential crop trees to prune. The forest owner should not be discouraged. Forests with a lower stocking of potential harvest trees can still be wonderful native forests with some high-value timber production potential. Indeed, a more diverse and natural, mixed-species, native forest will be the objective of many forest owners.







### Tree selection - vigour or form?

Selecting the right trees to prune is critical. Only the potential harvest trees should be pruned. These should be vigorous, well-formed, and well-spaced.

European forestry practices usually place priority on vigour (expressed as crown dominance) as the selection criterion, then form, and then spacing. However, particularly, in naturally regenerated tōtara forests, the trees with the most dominant crowns and vigour, often have the poorest form. Typically, they were established first and developed large crowns with poor trunk form in open conditions. Often it is later cohorts, growing in gaps and competing with each other, that have the best form. Selecting these better-formed subdominant or even suppressed trees to prune in such situations is often the only option. This will need to be followed by a thinning operation to prevent the pruned trees being dominated by adjacent trees.

In plantations, tree selection may not be so clear, especially where a vigorous tree could be 'salvaged' by pruning to develop a good butt log. The question is whether any adjacent and better-formed subdominant tree will pick-up its growth-rate if given the chance? Again, we lack specific research to answer that question at present.

Silvicultural trials by the Northland Tōtara Working Group, indicate that the mean growth rate of the residual trees increases following a thinning intervention. However, that research did not compare the individual growth-rate responses of dominant, sub-dominant and suppressed trees. The forest manager will often need to decide on whether vigour or form should be given priority when selecting tōtara trees to prune. Spreading the risk may be wise at this stage.

Specific defects that should preclude a tree from selection are covered in Section: 7 - General Specifications and Frequently Asked Questions.

### Consider each tree individually and within its immediate and future context.

Pruning should be considered part of comprehensive silviculture applied at a micro-spatial level. Every visit to a tree is an opportunity to address both obvious problems and to avert foreseeable issues. The tree's form will have a direct relationship to its immediate context. For example, in some cases, pruning of the surrounding vegetation may also be useful to create an overhead light-gap or to free the tree from branches or fronds from neighbouring trees or ferns that are rubbing against the stem and/or damaging the growing leader (often a cause of forking). Or localised weed control or releasing from competition may be a timely additional task for hand, loppers and pruning saw - while the pruner is there.

**"Tree form has a relationship to its immediate surroundings – present and future".**

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### Flexibility rather than rigid prescriptions.

Following on from the point above, the most appropriate pruning intervention may vary from tree to tree. In contrast to pine plantations, it is unlikely that basic pruning prescriptions such as pruning to a specified height above ground or up to a minimum diameter of the trunk, will result in the best outcome. Spacing in natural stands will also be uneven. Therefore, the pruner of tōtara needs to be aware of a range pruning strategies and options and have the flexibility to make the decisions on what approaches to apply and to what extent, on an individual tree basis.

In many instances a variously weighted mix of approaches (such as the 'top-down, bottom-up, and tweak in-between' approach) will be appropriate. But in more homogenous natural pole-stands or dense plantations, more of a conventional bottom-up lift approach may be more applicable. And in sparsely stocked areas, severe corrective tree surgery may be necessary to salvage some merchantable sawlog potential from a poor tree where no other candidates are present.

**"The pruner needs to assess each tree individually and apply a flexible mix of approaches and actions".**



## Prune with a realistic programme in mind.

Pruning is hard work, time consuming, and a significant early cost. Financial and/or time restraints may affect pruning actions. Also, the opportunities to usefully prune a tree or forest, are limited by parameters such as trunk diameter, branch size and tree form. Furthermore, there may be practical limitations such as access difficulties due to weeds such as blackberry or gorse. Then there are difficult decisions to make, such as how much to prune off at one time? Moreover, only completing a partial pruning (e.g., not achieving a useful clear bole length, or not maintaining a tight DOS) may mean previous pruning efforts are wasted. These matters highlight the need for pruning to be part a realistic silvicultural programme or plan.



In contrast, if more frequent periodic visits are anticipated, then a more restrained, staged, and strategic manipulation of the tree form, to develop a tall and clear-pruned bole could be applied.

Pruning every 3-5 years is ideal.

**“It is easy to underestimate the time and effort involved with intensive pruning and to overestimate the likely enthusiasm for it when the time comes”.**

## Strategic match to site and resources

The form-quality and total area of the forest, its accessibility, and the forest owner's capacity and resources to either do the work themselves or pay for a contractor, are all significant factors that will affect pruning operations. With severely limited time or resources pruning efforts should be directed to the best existing trees spread over the most accessible areas of the forest. If greater investment is possible, then intensive silviculture that aims to develop a forest that is fully stocked with potential harvest trees, even with potential for production-thinning, could be considered. However, the reality is that there is almost no limit to the amount of silvicultural effort that could be applied to a developing forest. Therefore, it is useful to have some framework or plan that helps limit the work and decide how many trees to prune and how severely to prune them.

## Know when you likely to return

For many native forest owners, pruning may be done in their spare-time on an opportunistic basis – e.g., when the time is available, and the mood takes them. However, even on that basis, it is useful to have an idea on when a return visit to that tree or part of the forest is realistic. Such a rough programme of intent will help make critical decisions such as how much to take off in one go. For instance, if the expectation is that a repeat visit is unlikely within the next 10 years, then it may be wise to choose between form-pruning to create a tall bole, or alternatively, at least securing a shorter clearwood butt log in a single pruning action.

## Predict diameter growth to manage DOS

Managing the maximum target DOS is usually the key driver for any pruning programme. To assist with this, knowing, or predicting, the growth rates of your vigorous trees can be a useful guide. In northern regions, on good growing sites, the diameter of the trunks of the vigorous tōtara may be growing around 6mm to 10mm diameter each year.

This can be used as guide on when a return visit will be necessary. For example, if the target maximum DOS is 15cm, but monitoring shows a mean unpruned trunk diameter of 10cm, then a pruning operation should be planned within 5 years, before the stem diameter gets too close to 15cm. But if a 20cm maximum DOS is targeted, then the next prune should be scheduled within 10years.

Monitoring the growth rate of your forest will help guide pruning to manage DOS.



### 3. Suggested pruning schedule for tōtara plantations

Ideally pruning is started early and done 'little and often' and as much as necessary. DOS is the critical driver of pruning programmes. However, many people will want guidance on what the minimum requirements might be. Of course, that will depend on the site and many other factors. Nevertheless, the following is an example of a practical pruning schedule based on good growth rates and targeting 400 pruned trees with a 50cm target harvest diameter.

#### First Prune

- When: Approx. age 5-8 years, mean DBH 3-5cm, height around 1.5 - 2.5m.
- What: Leader-training and basic form-pruning only.
- Amount: Up to 600 stems/ha (4metres average spacing).

#### Second Prune

- When: Approx. age 12-15years, mean DBH\* 9-12cm, height around 4-5m.
- What: Leader-training and form-pruning, and clear-prune from ground-up only where stem dia. exceeds 12cm. Target max. DOS 16.5cm\*\*.
- Amount: Up to 550 stems/ha (around 4.2m average spacing between pruned trees).

#### Third Prune (3-5 years later)

- When: Approx. age 15-25, mean DBH\* 13-15cm, height around 5-8m.
- What: Form-pruning to secure a straight trunk (targeting a 4.5-6.5m potential butt log) and clear-prune only where stem dia. exceeds 12cm. Target max. DOS 16.5cm\*\*.
- Amount: Up to a maximum of 400 stems/ha.

#### Fourth Prune (final)

- When: Approx. age 20-35, mean DBH\* <20cm, height around 9-12m.
- What: Clear prune to secure a clearwood butt log (target 4.5-6.5m pruned height). Max. DOS 16.5cm\*\*.
- Amount: Up to a maximum of 400 stems/ha if the max. DOS is kept below 16.5cm. Otherwise, refer to Table: 1 (page: 27) for recommended maximum final stocking of pruned trees according to maximum DOS values.

\*Mean DBH of vigorous/dominant potential future harvest trees only – ignore the suppressed trees.

\*\*Target max. DOS of 16.5cm is for a target harvest diameter of 50cm DBH. If it is impractical to keep max. DOS below 16.5cm, record the max DOS value in the silvicultural records. Note - It will change the target harvest diameter and the recommended final stocking of pruned trees (See Table: 1 page: 27).





## 4. Equipment

This section lists an array of equipment and tools useful for pruning tōtara. The list varies slightly from the standard equipment used in plantation forestry. The main differences are that pruning ladders need to be of a type that does not damage/bruise the bark of the tree. Additional 'steps' (e.g., Timbersaws' Unistep) are not recommended due to the risk of bark damage. Jack saws (e.g., Timbersaws' Bushmate) are not as practical or versatile as arborist-style pruning saws (e.g., Silky Saws) due to the bulkiness of their frames. Epicormic knives are not necessary because epicormic shoots are not so often encountered that a dedicated tool is warranted when a saw or loppers will make do.



### Health and safety

All tools and equipment should be bought from a reputable forestry supplier and all products should be intended and certified for commercial forestry use. The use and maintenance of all tools and equipment should follow the current best practice Safety and Health standards or advice for silviculture as is set out in relevant industry guidelines: (e.g., [here](#)), and Approved Codes of Practice documents (e.g., [here](#)). The matters of health and safety are not covered thoroughly in this manual – the reader shall be responsible to inform themselves on the most up-to-date advice.



Pruning ladders should be of a type that does not damage the bark of the tree with the 'V' shape structure at the working platform.



A webbing belt can keep the hard metal of the 'V' from contacting the bark.





## Minimum pruning tools and equipment

Personal preferences and, for plantations, the stage and height of forest growth, will affect the range of tools required. But for mixed-age, mixed-size, natural regeneration and continuous cover forestry, the following list is a suggested minimum range of tools.

### Minimum Tools:

- ☐ **Pruning loppers**  
e.g., Timbersaws Prun-off Lopper, plus holster
- ☐ **Pruning saw - arborist style**  
e.g., Silky Saw, model: Gomtaro, with sheath
- ☐ **Eye protection**  
either safety glasses or mesh goggles
- ☐ **Pruning ladder 2.2 – 2.4m**  
enables pruning up to around 4.3- 4.5m (i.e., a 4.2m log)
- ☐ **Pruning ladder 4.0 -4.2m**  
if high pruning is intended (4.3 – 6.5m)
- ☐ **Forestry pruning harness**  
fall Prevention Device, if high pruning - (e.g., Timbersaws Body-belt 1.1m chain lanyard)
- ☐ **Diameter tape**  
to apply/check/record DOS

In some situations, a chainsaw is also useful.

## Comments on using specific tools

General safety, user instructions, Approved Codes of Practice, and standard maintenance etc. is not covered here. Rather a selection of comments relevant to the use of specific tools for the pruning of tōtara are offered below.

### Loppers

- Loppers are quick and energy efficient pruning tools.
- They are designed to be used with only one side of the lopper (the side with the flat head of the bolt between the opposing jaws) positioned against the trunk. Do not use loppers with the nut side against the trunk as this will damage the bark at the collar of the branch stub.
- If a branch is too large for the lopper's jaws to easily grab, then use the pruning saw instead.
- Shortening a heavy branch before the final pruning cut can help ensure a smoother cut face results.
- Loppers do not leave as smooth a stub cut as a saw.







### Pruning saws

- Pruning saws are slower than loppers, but can leave a smoother pruned stub face with may have health advantages for the tree.
- Arborists' pruning saws usually enable more accurate cutting (i.e., close to the branch collar) without leaving 'coat-hanger' branch stubs.
- Undercutting of the bark around the root collar of ALL live branches is essential to avoid tearing of the bark down the stem as the cut branch drops – which has serious health implications for tree. **Tōtara branches are prone to bark tearing! Always generously undercut all branches!**
- It is important to shorten heavy branches to avoid 'pull-wood' holes in the pruned stub face. Use a three-step cutting process; undercut at branch collar, shorten the branch, final pruning cut. When shortening, leave a 250-450mm branch stub and use an offset double-cut to avoid tearing the bark back to the trunk. (See demonstration in video)
- Sawdust in the eyes can be a problem when sawing branches above shoulder level. Eye protection should be used to alleviate this nuisance.

### Pole-pruners (non-motorised)

- Pole-pruners may avoid the need for ladders or enable higher pruned heights from ground level.
- However, pole-pruners have less cutting accuracy than handsaws or loppers and it may be more difficult to execute the bark-tear prevention cuts well (i.e., undercutting).
- If using a pole-pruner the same advice as with handsaws applies concerning the need for undercutting and the shortening of heavy branches to prevent bark-tears and pull-wood.
- Motorised pole-pruners present a high risk of leaving long branch stubs ('coat hangers') or damaging the bark at the root collar or at the tree trunk.

### Chainsaws

- Chainsaws are useful for severe corrective tree surgery such as removing large forks and for releasing tōtara from the adverse effects of adjacent trees and branches (e.g., branches that are interfering with the crown or rubbing against the main stem etc.).
- As with non-motorised handsaw procedures, preparatory undercuts should be made to reduce risk of bark tearing and felling cuts should all be executed further out or above where the final cut will be made (i.e., to leave a short stub that can be removed with a final tidy-up pruning cut).
- If pruning off the ground, top-handled chainsaws must be fitted with a bar guard (e.g., Timbersaws chainsaw pruning guard). N.B. - top-handled chainsaws should not be used from the ground.
- Chainsaw pruning presents a higher risk of damaging the bark of the tree around the branch collar, than non-motorised pruning tools.
- For the removal of large double leaders, a standard chainsaw without a bar guard may be necessary and to avoid damaging the residual stem, the back cut, or felling cut, may need to be angled down steeply, just off vertical, to create the hinge.
- To encourage the unwanted fork or stem to fall cleanly, a Vee scarf or a Humboldt scarf may have advantages over a standard scarf.
- The finished cut faces of the pruned stub should be angled steeply to shed water.
- Final pruning cut faces should be done with a push-stroke (i.e., using the top of chainsaw bar), because that enables good vision and control and leaves a smoother finished cut surface.
- Chainsaws can easily damage the bark collar or bark of trees and should not be used for pruning branches that can be easily done with a handsaw.
- **If a tree requires pruning with a chainsaw, it questionable whether it should be pruned at all!**



bark tearing



'pull-wood' hole



## 5. Pruning basics

This section illustrates basic technical details relevant to pruning cuts on tōtara trees.



Loppers are quick and efficient and suitable for small branches, but the cut faces of pruning stubs from loppers are never quite as smooth as can be achieved using hand saws.



Clean pruning stubs done with a hand saw, near vertical cut faces, close to the trunk, but outside the branch collar. Under-cutting, and then shortening the branch to take the weight off before the final cut, has avoided any pull-wood or bark tears.



Large pruning wounds need to have smooth, clean cut faces, and be steeply angled to shed water and minimise chances of disease entry or rot before they seal over.



'Pull-wood' on the pruned stub face is caused by breakage as the branch falls. This increases the risk of pathogens entering the pruning wound. Shortening the branch first - but only after undercutting at the branch collar - relieves the weight and avoids this defect. This makes pruning with a saw a 3-step process (i.e., undercut, shorten, final pruning cut).





Tōtara are prone to bark tears when pruning branches with a saw. ALWAYS generously undercut the bark, and shorten heavy branches, to prevent tearing the bark and or breakages, or pulling wood out of the pruning stub face.



Tōtara can heal over large pruning wounds (e.g., left above in 2010 and right above is the same tree in 2021). However, the advantages of removing large forks and large branches need to be weighed against the risk of creating internal defects (See next two pages).





An 11cm diameter pruning stub in 2010 (left above), had been completely occluded within the trunk by 2021 (right above). However, excessive DOS, discolouration and a pocket of unsound wood have resulted at this part of the log on the side that sustained the pruning wound (see right).

A small pocket of slightly spongy wood is present on part of the pruned stub face (beneath the dark area of encased bark), and a brown discolouration of the otherwise physically sound wood beneath the pruned stub is apparent. Some discolouration of the pith of the remaining stem has also occurred. This has created a wood defect at this part of the log. Any long-term health effects on the tree or on timber quality, from such pruning wounds are unknown.



This pole-sized tōtara tree growing in open conditions (left above) had had some form-pruning in the past, but then could be pruned up to 4.5m in a conventional bottom-up lift, before the DOS became too large (right above: tree in centre view, midground, - is same tree but different viewing angle).





A pocket of rot in the pruned stub where a large fork was removed has resulted in brown discoloured wood within the residual trunk. It is not known whether this would have been successfully contained and 'compartmentalised' by the tree's defences, or whether it would have spread significantly further up and within the crop stem (see below).



A long section ripped through the stump reveals rot and discolouration resulting from the removal of a large fork. In contrast, on the right-hand side of the tree, a pruned stub from a small branch has been occluded over without causing any apparent ill effects (see below).



Tōtara trunks can easily grow right over the stubs of large forks that have been removed.

However, early indications are that rot in large, pruning wounds may sometimes result in defects at the base of the remaining trunk (See above right).

Small pruning stubs appear to heal over without causing any significant ill-health to the tree.



## 6. Pruning implementation – A checklist guide



A checklist style 'quick guide' for pruning is set out below.

### Planning and preparation:

- ☐ Have a plan or idea when you will likely make a return visit (e.g., 3yrs, 5yrs, 10yrs), to guide how much to prune each tree at this visit. (N.B. – 3-5 yrs. is ideal)
- ☐ Have a final pruned stocking rate in mind (i.e., how many trees to prune per hectare – so you don't prune too many) – N.B. – this will depend on stand stocking, silvicultural system and target harvest diameters – See Table: 1, page: 27). It will range up to 400 stems/ha for plantations and tōtara dominant stands, but should be much less for mixed species, natural stands.
- ☐ Convert the target stocking rate to average spacing (distance between pruned trees), as a guide for practical application (this will vary according to mean tree size and stand development and likely be at least 5.0m between pruned trees – See Table: 1, page: X).
- ☐ Have a target maximum DOS in mind (based on an expected minimum harvest diameter (- e.g., 16.5cm max. DOS for 50cm min target harvest diameter, or 20cm max. DOS for 60cm target harvest diameter). And take a diameter tape measure with you when pruning!

### Assessing the tree:

- ☐ Select a potential crop tree, confirming that the tree has the following:
  - ☐ Good potential form, health, and vigour, and no defects (e.g., spiral grain etc.)
  - ☐ Its immediate surroundings are suitable to maintain good future growth – or can be managed to ensure continued vigour and crown development.
  - ☐ Its diameter is less than the intended maximum DOS.
  - ☐ There are no better trees in the immediate vicinity.

- ☐ Prioritise the branches to prune according to the following guide:
  - ☐ Identify and plan leader-training and form-pruning to maximise the height of a single stem starting from the top of the tree, or as high as is safe and practical to reach, and removing any forks and competing leaders, and working down the stem to remove (or tip) the steeply-angled and large-diameter branches.
  - ☐ Remove all lower branches as a bottom-up 'clear lift' where the diameter of the tree trunk is close to (within 3-4cm of) maximum DOS.
  - ☐ Estimate the future growth of the tree until the next likely visit (using a rate of 6-10mm annual diameter increase of the trunk) and remove branches where the trunk growth might exceed the specified maximum DOS in that time, and either remove or tip (shorten) heavy branches that are likely to exceed 45mm in diameter before the next pruning visit.
  - ☐ Remove the minimum amount of foliage to achieve the above. Do not remove more than two-thirds of the tree's foliage in one pruning. (N.B. – ideally limit removal to one third of the tree's foliage if possible).

- ☐ Assess and plan any actions needed around the tree such as:
  - ☐ Thinning or pruning of adjacent trees or interfering branches to ensure an overhead light gap and room for canopy development (to maintain vigour and growth rates) but also maintain some side shade (to encourage good form development).
  - ☐ Weed control around the tree– especially control of climbing vines (including the native *Muehlenbeckia australis*), both on the ground and in the surrounding trees.



## Pruning practice

- ☐ Apply best practice pruning techniques, including:
  - ☐ **Ensure** the 'V' of the ladder does not damage the bark of the tree.
  - ☐ **ALWAYS** prune close to the stem, but outside of, and without damaging, the branch collar (i.e., where the bark wrinkles at base of the branch), and without leaving protruding branch stubs ('Coat hangers').
  - ☐ **NEVER** place loppers with the locking nut side against the tree.
  - ☐ **ALWAYS** generously undercut branches when using a pruning saw, to avoid bark tears.
  - ☐ **ALWAYS** shorten heavy branches before final pruning cut to avoid pull-wood (i.e., a 3 step process – undercut, shorten, prune).
  - ☐ **Minimise or avoid** pruning branches >45mm in diameter.
  - ☐ When pruning forks and large branches always leave steeply-angled final pruning cuts that shed water.
  - ☐ **DO NOT** prune trees that will have an excessive DOS.
  - ☐ Remove all epicormic shoots

## Record keeping

- ☐ If practical, record silvicultural activities (e.g., map areas, note dates, max. DOS, mean pruned height, pruned tree numbers (stocking rate), etc.)
- ☐ Schedule the next pruning visit in 3-5 yrs.
- ☐ Consider surveying for Pruned Stand Certification (for large commercial timber plantations).



# 7. General pruning specifications for tōtara – and matters of choice

## Frequently Asked Questions

The following section discusses some the common parameters relating to pruning choices and decisions to make.

### Q- Is there a minimum pruned log length?

The short answer is no. But 2.7m is suggested as a practical minimum length.

While longer pruned butt logs (4.2m+) are likely to have greater market demand – because they have more possible end use applications and are more efficient to process, shorter pruned logs still have useful clearwood timber volume. Technology, such as end-matching for tongue and groove profiles, glue-laminating and finger-jointing etc. may help enable short timber lengths to be effectively used. Who can predict the future technological, processing, and market requirements concerning a minimum log length? Carvers may also find short log lengths suitable for some applications. So how short is too short? That is only answered by what we consider is practical and economic now or in the future.

John Wardle in his Woodside forest applies a minimum of 3.3m log length for his black beech. That length suits the characteristics of the forest, practical extraction, and the processing equipment he uses. If the logs are to be transported to a mill, then the trucking company may stipulate a minimum log length to fit safely between the bolsters. This may be 3.1m, otherwise short logs need to be cradled between longer log lengths. However, the use of on-site portable sawmills would remove any such transport restraints.

In the context of continuous cover forestry and silviculture that includes production thinning, it may be useful to recover a short log from a poor tree that would otherwise only be thinned to waste. It adds to the forest's productivity. If the tree has a big green crown, then short butt logs often put-on log diameter faster and reach targeted minimum harvest diameters more quickly. They

also have high timber volume recovery rates due to lessened effect of natural log taper over the length.

Potential merchantable log length will be affected by the characteristics of the forest, such as stocking rate, topography, growth-rates and individual tree locations. For example, it may be unrealistic to expect to prune a long log section from a tree growing on an exposed ridge, or in open conditions.

But if we have to offer a figure, then currently, around 2.7 metres is probably a minimum pruned height. It allows for the generous docking and processing of finished timber to furnish 2.4m minimum lengths. However, for most tōtara forests, a target pruned height of 4.5m+ above the ground is a practical goal. This length strikes a nice balance between limiting the negative effects of log taper on sawn-timber recovery percentages and yet providing a common industry standard for medium length finished products at 4.2m long. Nevertheless, if a pruned height of 4.5m cannot be attained then a shorter merchantable log may still be 100% better than no merchantable log.

**“For most tōtara forests, a target pruned height of 4.5m+ above the ground is a practical goal.”**





## Q- How high to prune?

As high as you can and the tree's form permits! But generally, a good target pruning height above the ground is to accept a flexible range between 4.5 and 6.5m, determined by the tree's form attributes.

Often there is a point where such severe form-pruning would be required to continue increasing the pruned height that it is better to just accept the practical length that the tree itself determines.

Tōtara are capable of growing very tall and developing tall boles often with 8-14m of total combined length of sawlogs. In some situations, pole-sized trees in highly stocked stands will naturally have good form and be shedding their shaded lower branches. Sometimes the opportunity to prune to 8m or more will exist. However, in most cases influencing the quality of the logs above 6.5m is more about managing the forest's structure (e.g., stand stocking and timing of thinning etc.) than by ultra-high pruning. Even if the tree forks or branches heavily above a short, pruned butt log, often merchantable top logs can form in the stem sections above such defects.

Ultimately, the pruner should aim to maximise the potential pruned log length. However, in continuous cover forestry contexts this should also be thought of in relation to a harvest being used as a production thinning opportunity. The shorter-boled trees are likely to be harvested first, often leaving thinner but taller-boled adjacent trees as the residual forest or creating gaps for new regeneration that can be managed to have better form. In this way, over time, and through selective harvests, the overall canopy height and mean bole-length of the developing forest could be increased. It is difficult to develop trees with tall clear boles, from a young developing forest by pruning efforts alone.



In some natural pole stands a 4.5 – 6.5+m clear pruned height can be done in one single pruning lift. Some trees would have the potential to chase a 9m pruned height.



### Q- How much to take off?

Recommendations vary from not more than one-third, to not more than half of the green foliage or crown – although vigorous trees will survive having two-thirds to three-quarters of their foliage removed.

The practical answer depends on several variables, such as what form-pruning is required, and when you expect to be able to return to prune again, and how the DOS values will be effectively managed. Pruning at not more than three-to-five-year intervals is recommended. But if a timely return visit is doubtful, then it may be wise to prune to best effect assuming a one-off intervention.

Experience shows that tōtara survive severe pruning – even ‘lion’s tailing’ – where only a tuft of foliage is left on a tall, clear-pruned stem. But that can reduce their rate of growth for several years. This is logical since the foliage is where their energy is produced, and so it is reasonable to assume that a drastic reduction in foliage is likely to reduce a tree’s vigour and possibly also slow the healing of pruning wounds and reduce its resistance to pathogens. However, the latter assumptions are supposition in relation tōtara, but such effects have been observed in other tree species. And severe pruning encourages epicormic growths from the trunk.

### Q- What is the maximum DOS?

Ideally the DOS should be kept as low as possible (e.g., <15cm). But for plantation tōtara forests an ideal target maximum DOS is below 16.5cm. However, a maximum DOS of up to 20cm may be more realistic in many forests - especially in naturally regenerated forests.

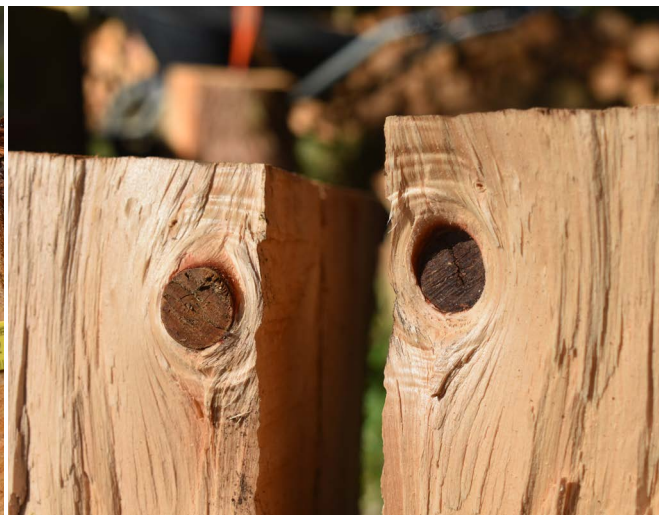
There is an important relationship between the target harvest diameter of a tree and its maximum DOS. The DOS should not be more than one third of the target harvest diameter. For example, if the target harvest diameter is 45cm, then the DOS should be kept less than 15cm. That means the tree stem should be well less than 15cm thick at the time of pruning. Another way of looking at it is to realise that if the tree has a DOS of 20cm at breast height, then the target harvest diameter of that tree will then need to be >60cm DBH. But if that 20cm DOS was high up on the tree’s stem near the top of the log length, i.e., at the small end diameter (SED) of the log, then the SED of the log should be around 60cm before that tree is harvested. That may require the tree having a DBH of >70+cm.

Earlier harvest opportunities dramatically affect the financial economics of forestry. This incentivises management to minimise DOS and thin the stands to quickly reach harvest size.



A cross-sectional view of a tōtara log showing a pruned branch stub (lower left) at recommended maximum DOS relative to the harvested diameter (i.e., in this case, a DOS of around 15cm and log diameter around 45cm.

N.B. – a Pin knot has formed (upper right) in what should have been Clears Grade timber. This is probably the result of an epicormic shoot developing on the stem. Such Pin Knots are acceptable in Premium Grade timber (under NZS 3631:1988), but not in Clears Grade. This highlights the importance of a return visit to remove epicormic shoots.



Pruned branch stubs are sealed when the tree grows (occludes) over them. However, a structural defect in the timber remains between the face of the pruned branch stub (left) and the sealing occlusion material (right). Pruned stubs are not wanted in sawn timber products and need to be restricted to the defect core. It is better not to prune branches when the stem diameter exceeds the target maximum DOS.



## Record keeping & Pruned Stand Certification

In even-aged tōtara plantations it is very important that the mean maximum DOS is measured and recorded, because the DOS value has such significant implications for log value and harvesting decisions. Certified forest inventories that confirm the DOS values following pruning operations will give any potential log purchasers confidence in the clearwood volume of the forest. This reduces their risk and should result in higher prices being obtained for the logs. It also helps the forest owner better estimate the timber values of the forest.

For large commercial tōtara plantations, owners should consider Pruned Stand Certification, by an independent forester to verify the pruning work. (See NZFFA website: [here](#))

When pruning an uneven-aged naturally regenerating forest, detailed record keeping is complicated and may be less meaningful. The pruner will need to assess the individual trees, and make a judgement call in the field on whether to prune or not. Simply identifying the pruned trees (as future harvest trees) and recording a maximum DOS that was applied across the block (e.g., 20cm), is a practical approach.

## Exceptions to every rule

A 60cm target harvest diameter is certainly not unreasonable for tōtara. Many farm-tōtara will exceed that diameter within 80 to 100 years. And there will always be odd situations where trees may be expected to be kept to much larger diameters, e.g., trees holding up tracks and stream banks. The DBH of such trees might eventually exceed 90cm, so arguably, if the DOS of those trees were 30cm, there would still be plenty of recoverable clearwood timber – should they come down in storm or be harvested for any reason in the very distant future.

Once the pruning wounds have occluded over, the DOS will become a hidden secret within each stem – maybe to the saw miller's pleasure or dismay.

## Q- Which trees to prune? And how many?

Pruning a tree is to select it as a potential future harvest tree. Only the right stocking of well-formed and well-spaced, vigorous trees, should be pruned. Trees with serious defects, in terms of sawlog quality, should not be pruned. However, where no better tree exists, form-pruning may be used to address some defects to create a potential sawlog where otherwise no merchantable sawlog would develop.

## Defects

Standard forestry tree defects include multiple leaders, heavy branching, sweep, lean, wobble, kinks, out of round, spiral grain, bark damage, rot, and lack of vigour etc. Some trees may only have these faults to a minor degree. Acceptable limits to some of these parameters are set out in forestry publications. Some trees are not worth pruning.

Knowledge of tōtara specific log-grade categories, would help a pruner decide when a defect should preclude a tree from being pruned. However, a tōtara specific log grading system has not yet been developed.

## Select for vigour or form?

In young developing tōtara forests, especially in natural stands, often the dominant trees will have poor form and/or large branches. In contrast, the slower growing sub-dominant and suppressed trees often have excellent form and lower potential DOS values. It can be hard to choose between more vigorous but branchy trees, and sub-dominant but better-formed saplings and poles.

There are risks either way. Vigorous trees may have a larger DOS and larger pruning wounds which may create possible long-term tree health risks. But then vigorous trees certainly heal over pruning wounds much quicker than suppressed trees do. Well-formed tōtara poles often require very little pruning, but it is unknown to what extent slower growing sub-dominant or suppressed trees with small crowns, will pick-up vitality even if released from competition.

Unfortunately, we do not have tōtara specific research guidance on this matter. Spreading the risk is probably a wise approach.

**Table 1. A guide on maximum final number of pruned trees, relative to maximum DOS and target harvest diameters for tōtara plantations.**

Maximum DOS (cm)	Target DBH* (cm) at harvest	Recommended maximum final number of pruned trees (stems/ha)	Average spacing between pruned trees (m)
16.5	50	400	5.0
18.0	55	350	5.3
20.0	60	300	5.8

### Stocking and spacing

Deciding how many trees to prune is a critical step. For plantations, or for evenly sized and well-stocked pole-stands in naturally regenerated forests, Table: 1 may help guide such decisions. For practical application, the average spacings between pruned trees are also indicated in the table.

Thinning is an important complementary action to pruning. And although both pruning and thinning relate to a common final stocking rate, they are not necessarily carried out at the same time or to the same degree. Unpruned trees may be left between pruned trees and remove in staged operations as the stand develops. The details of thinning are covered in another chapter. So, it should be noted that the suggested stocking of pruned trees in Table: 1, does not infer that all non-pruned trees are to be thinned immediately following pruning.

It may be useful to form-prune up to 550 stems/ha in the sapling and early pole-stand development phase (<15cm DBH), but the final number of fully pruned trees should not exceed the maximum recommended figures.

### Lower-stocked natural forests

Table: 1 may be a useful guide for well-stocked plantations and naturally regenerating pole-sized stands. However, owners of naturally regenerated forests with relatively low stocking rates of well-formed trees may be heartened to know that in many European forests it is common to only identify 40-150 potential final crop trees per hectare. These 'future trees' are pruned and managed to become large-diameter, tall-boled, large-crowned, premium-quality, and extremely valuable timber trees. Such trees are often around 8-14metres apart to give them sufficient space to develop large green crowns. So, even pruning only a few dozen trees per hectare is not a ridiculous forest management option if that is what suits your forest.

If any additional trees between them are pruned for possible production-thinning, then it is essential that they have a low DOS, and sufficient diameter at harvest time to have made the pruning worthwhile.



A naturally regenerated stand of farm tōtara pruned and thinned. A circular sample plot (centre peg visible in image above), indicated an initial stand stocking of nearly 3,400 stems/ha and a mean DBH of 14.3cm. The stand stocking was reduced to 1200 stems/ha and most residual trees pruned in single lift, up to between 4m and 6.5m high. However, not all of those trees should have been pruned because many will be thinned to further reduce the stocking of the stand over time (see Table: 1.)

N.B. – two forked trees in the image (centre and lower right) have been ring-barked rather than felled to waste. This should reduce the chance of wind damage, and also reduce the incidence of epicormic shoots developing on the residual stems due to a sudden increase in exposure to light.



### Q- How big a branch can be pruned?

Ideally, branches should be pruned before they exceed 3cm diameter at the branch collar. The smaller the branch diameter the quicker the pruning wound can heal over and seal out potential health threats to the tree. However, larger branches will often be encountered on vigorous tōtara trees that are otherwise excellent trees to prune. A practical threshold to apply is only to prune what can comfortably fit in jaws of the loppers. This may include branches up to approximately 45mm in diameter at the branch collar. However, such large pruning wounds should only be made on vigorous trees and a pruning saw would make a cleaner cut.



Pruning stubs from small branches <30mm occlude (heal and seal) over quickly.

Bigger branches and/or competing leaders and forks need to be sawn-off. While totara appear to heal well – even over quite large pruning wounds (e.g., up to 100mm across), larger pruning wounds, especially where a fork has been removed, will frequently go soft or crumbly with rot before the cambium and bark occludes (grows over) the wound and seals it off. Large pruning wounds/stubs that are close to vertical and drain well, appear to resist rot much better than shallow-angled wounds. The long-term effects of sealing in a pocket of rot within the tree are not known. But small pockets of rot and discolouration of the timber around such wounds have been observed.



Pruning wounds from large branches up to around 45mm diameter appear to heal cleanly on vigorously growing trees but take several years to do so.

Dry, hard, and clean pruning stubs suggest minimal danger of ill health effects on the tree resulting from pruning.



In contrast to the three images above, large pruning scars on suppressed and slow-growing trees can take more than 4-5 years to heal.



A small pocket of rot beneath a 50mm pruned branch stub has been occluded over and sealed within the tree. This branch may have been dead at the time of pruning.

To date, observations of milled timber from natural stands of farm-tōtara indicate that tōtara trees are relatively adept at 'compartmentalising' and limiting the spread of small rot defects caused by cavities from branch-dieback and injuries. However, the average age of the harvested trees was only around 85 years old. Longer term effects on trees exceeding 150 years are unknown.



Perhaps of greater significance is that the Tōtara Industry Pilot project results indicated reasonable timber volume and grade recoveries from knotty tōtara logs. The diameter of branch knots tapers down from the outside of the log to the pith and live branches do not typically have bark inclusion defects. This means that 'green knots' stay sound and intact within tōtara timber, unlike some cypresses where a bark ring around the branch knots often causes them to become loose and fall out. Again, the implications are that tōtara trees do not always need to be pruned to yield valuable timber. Indeed, the compression grain around live knots can make an attractive feature in knotty tōtara timber.

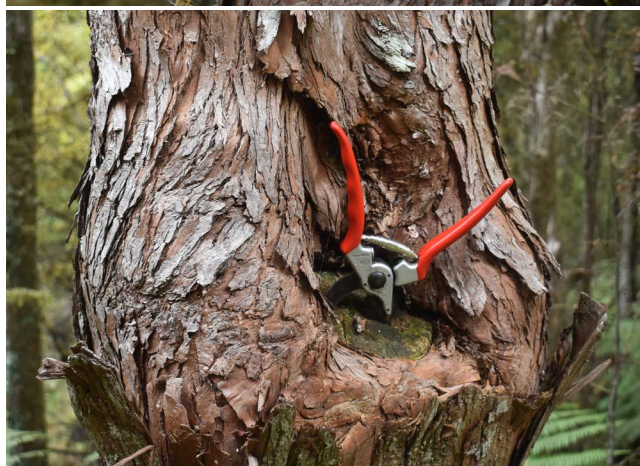
### Rot from large branch removal

Field observations have revealed pockets of rot and/or discolouration of the surrounding timber, from trees where large pruning wounds have been made (See image centre page 20). This is presumed to be the result of a fungal entry via the large pruning wounds. Whether such discolouration would be contained (compartmentalised) or spread within the tree is unknown. Likewise, any long-term effects on tree health are not known.

*Large pruning cuts should only be executed where there are no alternative trees in that location to prune instead, and where such pruning is necessary to create a sawlog where otherwise none would eventuate.*

Similar discolouration was observed at the butt end of many freshly cut logs harvested during the Tōtara Industry Pilot project (See image following page), yet encouragingly, no corresponding defects were noted during the milling and grading of that timber. Those trees had not been pruned, but a fungal attack entering the tree via obvious and sustained damage to their roots from cattle hooves was the presumed cause. However, the discolouration fades and is much less apparent in dry lumber and is possibly mistaken for heartwood.

Although this is a very concerning observation, to date, harvests from farm-tōtara trees have not highlighted this as a serious implication for timber yield or tree health. Nor has pruning or tree wounds been clearly confirmed as the cause. Nevertheless, a precautionary approach in respect to pruning is recommended at this stage. Pruners should understand that large pruning wounds are associated with health risks for the tree and possibly timber defects too.



Tōtara survive severe pruning treatments such as removal of large forks and large branches. However, this is not without some potential effects on timber values and long-term tree health (see image below). Near vertical pruning wounds (e.g., above, bottom image) shed water and resist rot much better than flatter pruning cuts (e.g., above, top image)



A cross-sectional disc taken 30cm above a pocket of rot at the base of a 50cm DBH tree, that had had a large fork removed around 15 years before. Dark brown discolouration of what is otherwise sound timber is apparent. The long-sectional area affected tapers to nothing within the first 1.5m of log length. This discolouration is presumed to be the result of a fungal entry via the large pruning wound. Whether it would have been contained (compartmentalised) or spread further within the tree is unknown. Likewise, any long-term effects on tree health are not known.





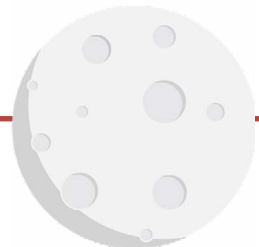
Examples of similar discolouration observed at the butt ends of large unpruned logs freshly harvested as part of the Tōtara Industry Pilot project. Fungal attack entering by sustained damage to the roots by livestock is thought to be a possible cause. Surprisingly, adverse visual or structural effects on the timber quality were not noted during milling or timber grading.

## Q- Is there a correct pruning season?

At this stage, we are not aware of any problems that indicate that pruning of tōtara should be restricted to a particular time of the year.

In European forestry, it is generally recommended that pruning of live branches (except for Douglas fir) is only done between end-winter and mid-spring, or before the main growth flush. The reason is to minimise potential disease issues- especially from fungi. Dead branches can be pruned any time of the year. Presumably, this advice is based on extensive experience and possibly research. However, there are some varying recommendations, and some foresters point out that pruning wounds take an average of 4 to 5 years to heal over and therefore suggest that that makes the time of year of relatively little consequence.

More than one growth flush per year has frequently been observed on tōtara in Northland. And although growth slows during winter, it probably does not cease. Therefore, time of year for pruning may not be as significant for evergreen trees in milder climates, such as tōtara in northern regions of New Zealand. However, we are unaware of any New Zealand based, or tōtara specific research on the matter. Nevertheless, it is suggested that pruning is scheduled before the main growth spurts if practicable.



### Maramataka

Based on the *maramataka* of Ngāti Miro in the Whangaroa area, rongoa practitioner Thomas Hawtin, suggests pruning should be avoided during the waxing moon phase – especially on the full moon. The best time for pruning is *Korekore* to *Tangaroa whakapau* - between the 20th - 26th night after the new moon (i.e., in the last quarter and before the new moon).

## 8. Conclusion

Technical details concerning the pruning of tōtara have been set out and summarised above and demonstrated in the associated video: [here](#).

For foresters who have the privilege of managing a tall mature native forest structure, pruning will be a relatively minor part of silvicultural activities. In contrast, for developing plantations and naturally regenerating forests, the pruning of tōtara could significantly increase the future volume and value of merchantable saw logs within a forest.

However, pruning is a costly intervention and needs to be undertaken at least several decades before any potential harvest or return on the investment. This means pruning needs to be well-targeted, well-executed and well-recorded to have maximum benefit. And it is not without some associated risks. Poor timing, poor tree-selection, and poor practise, all risk it being a wasted effort or even damaging the trees. Furthermore, pruning is only one action within the context of silvicultural management of a tōtara forest. Pruning usually needs to be complemented by thinning, a topic which has not been covered here.

All forests need active management and maintenance, and intensive silviculture is a lot of work. However, tōtara, as a species, is amenable to pruning - and often needs it, if timber production is an objective - although the economic viability of pruning tōtara is untested.

There is a lot of work but also a lot of pleasure to had in tending a developing forest, imagining it in the future, and watching it grow. This can be very rewarding and enjoyable well before harvest time. So, happy pruning. Go out and enjoy it too!

**“Silviculture is a lot of work. But tending a developing forest can be extremely rewarding and enjoyable too.”**

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### Useful links

#### Pruning Totara for Timber – Video

Northland Totara Working Group video, featuring Paul Quinlan, produced by Ian Brennan

<https://vimeo.com/580207222>

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#### DOS

Best Practice Guidelines for Silvicultural Pruning 2005 (pages 8 & 10)

<https://safetree.nz/wp-content/uploads/2015/03/Silvicultural-Pruning.pdf>

#### NZFFA leaflet – No.7 Pruning

[https://www.nzffa.org.nz/farm-forestry-model/resource-centre/information-leaflets/farm-forestry-association-leaflet-series/no-7-pruning/#Defect\\_core\\_size](https://www.nzffa.org.nz/farm-forestry-model/resource-centre/information-leaflets/farm-forestry-association-leaflet-series/no-7-pruning/#Defect_core_size)

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#### Illustrations and advice on form-pruning

Blackwood – a Handbook for growers and users, by Ian Nicholas and Ian Brown, 2002, (pages 50-60).

<https://www.nzffa.org.nz/system/assets/1709/blackwood-a-handbook-for-growers-and-users-.pdf>

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#### Leader-training

NZFFA leaflet - Form-pruning deciduous hardwoods

<https://www.nzffa.org.nz/farm-forestry-model/resource-centre/information-leaflets/farm-forestry-association-leaflet-series/form-pruning-deciduous-hardwoods/>

Pruned Stand Certification – for large commercial tōtara plantations

[https://www.nzffa.org.nz/farm-forestry-model/resource-centre/information-leaflets/farm-forestry-association-leaflet-series/no-9-pruning-and-pruned-stand-certification/#Pruned\\_stand\\_certification](https://www.nzffa.org.nz/farm-forestry-model/resource-centre/information-leaflets/farm-forestry-association-leaflet-series/no-9-pruning-and-pruned-stand-certification/#Pruned_stand_certification) )

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#### Safety and Health

Standards for silviculture

<https://safetree.nz/wp-content/uploads/2015/03/Silvicultural-Pruning.pdf>

Approved Codes of Practice documents

<https://safetree.nz/wp-content/uploads/2015/02/forest-operations1.pdf>

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For more information on managing tōtara, see the Northland Tōtara Working Group pages on the Tane's Tree Trust website:

<https://www.tanestrees.org.nz/about-us/northland-totara-working-group-ntwg/>

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To join the Northland Tōtara Working Group (NTWG) visit (membership is free):

<https://www.tanestrees.org.nz/about-us/northland-totara-working-group-ntwg/join-ntwg/>