safetree

Thinning for Value

Best Practice Guidelines

Foreword

Thinning has always played an important, if underrated role in maximising the value of a forest.

This Best Practice Guide has been prepared to provide a comprehensive and detailed guide to Thinning safely and well. In an era where forestry is evolving, having a foundation of best practices with the latest technical understanding is paramount. The content has been curated to ensure clarity, accuracy, and relevance, drawing from the expertise of seasoned practitioners. We thank everyone who took the time to bring this document together.

Your feedback and insights are invaluable as we strive to refine and enhance this resource for future editions.

Joe Akari

CEO Forest Industry Safety Council

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Disclaimer

The Thinning for Value Best Practice Guidelines are only a guide and do not supersede legislation or individual forest manager's thinning requirements unless endorsed.

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Contents

Duty of care

The Thinning for Value Best Practice Guide aims to improve workplace safety.

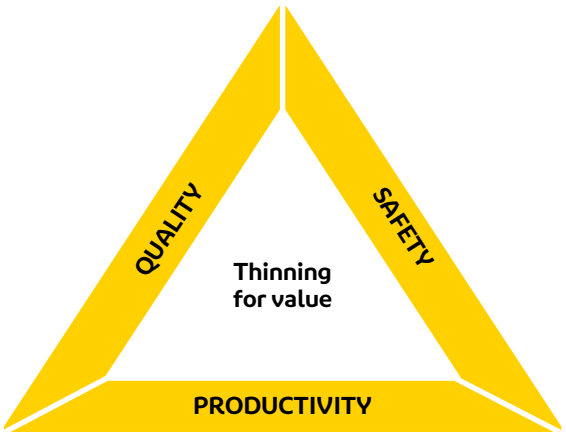
It helps meet the duty of care requirements within the H&S at Work Act 2015 on Persons Conducting a Business or Undertaking (PCBU). These obligations require PCBUs to ensure a safe work environment, provide safe equipment, and establish safe work systems. Everyone has a role to play.

Introduction

The purpose of the Thinning for Value Best Practice Guide (BPG) is to create consistency of standards to assist thinners, contractors, forest managers, regulators and training providers:

- ✓ Establish what is best practice.
- ✓ Recognise the specialised skills and techniques needed for thinning compared to clear-felling.
- ✓ Improve and maintain high standards of safety, quality and productivity.
- ✓ Improve understanding of thinning for value.
- ✓ Increase the value of forests through best practice selection and thinning.
- ✓ Help forest managers, assessors, and regulators with management and compliance.

The guide aims to balance the three main objectives of thinning for value. A problem with any one of them likely impacts the others. For example, if a thinner struggles to reach target, safety and quality may be compromised for production.



This guide is for chainsaw thinning radiata pine. Different species may have other thinning techniques.

The guide does not cover chemical or machine thinning. However, tree selection in Chapter 4 is relevant to other methods.

The guide also does not cover specific operational requirements. These are decisions made by forest managers. Examples include decisions about target stocking, timing of thinning operations, production targets and rates. Forest managers often incorporate these into thinning contracts, prescriptions, or other operational documents.

Why the move from 'thinning to waste' to 'thinning for value'?

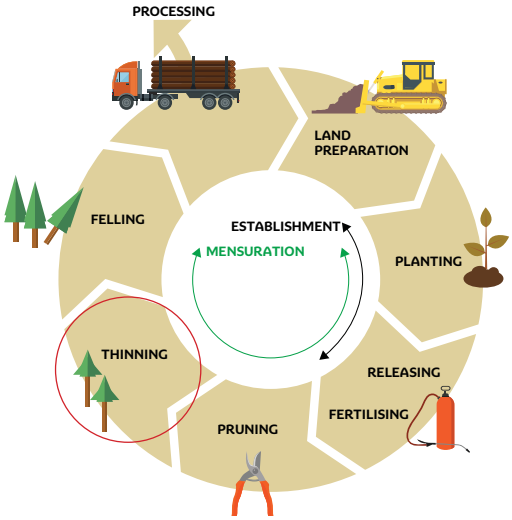
'Thinning to waste' has been used for over 50 years, so why change it now? The reason is the purpose of thinning has changed over time. Back in the day, most forests were pruned. Thinning was about keeping pruned trees and 'wasting' or removing unpruned trees unless the stands were planned for 'production thinning' and the cull trees were processed into logs.

Over the decades, especially after the end of the NZ Forest Service in the late 1980s, the pruned area has significantly reduced as a percentage of the total area planted. This shift means thinners increasingly decide the final crop trees for framing or structural stands.

Deciding what trees stay and what goes is about adding value. 'Thinning for value' shifts the focus from what to cull (waste) to what to keep (value).

What is thinning for value?

Thinning is an important part of the forestry cycle. Thinning sets up the forest for harvesting because thinning leaves the final crop trees that grow and create value.



Thinning is one of the main ways to add value to a forest. More trees are planted than are needed as some will die or not grow as well as others. The purpose of thinning is to remove the inferior trees so the best ones can grow and add value. Thinning for value is about selecting the right trees. Great selection and thinning will significantly improve the financial returns to the forest owner because the best trees are kept.

A skilled thinner will ask themselves, 'Will this tree be worth more at harvesting than that one?' or 'Is it worth more money to keep a poorly formed tree than leaving a gap that makes no money?'

Symbols used in the guide

Warnings

Warnings specify hazards associated with a task, location, or equipment.

Experienced thinners' advice:

Experienced thinners have emphasised important information.

Examples of good and poor practice:

Correct personal protective equipment (PPE) and a top-of-the-bar back cut.

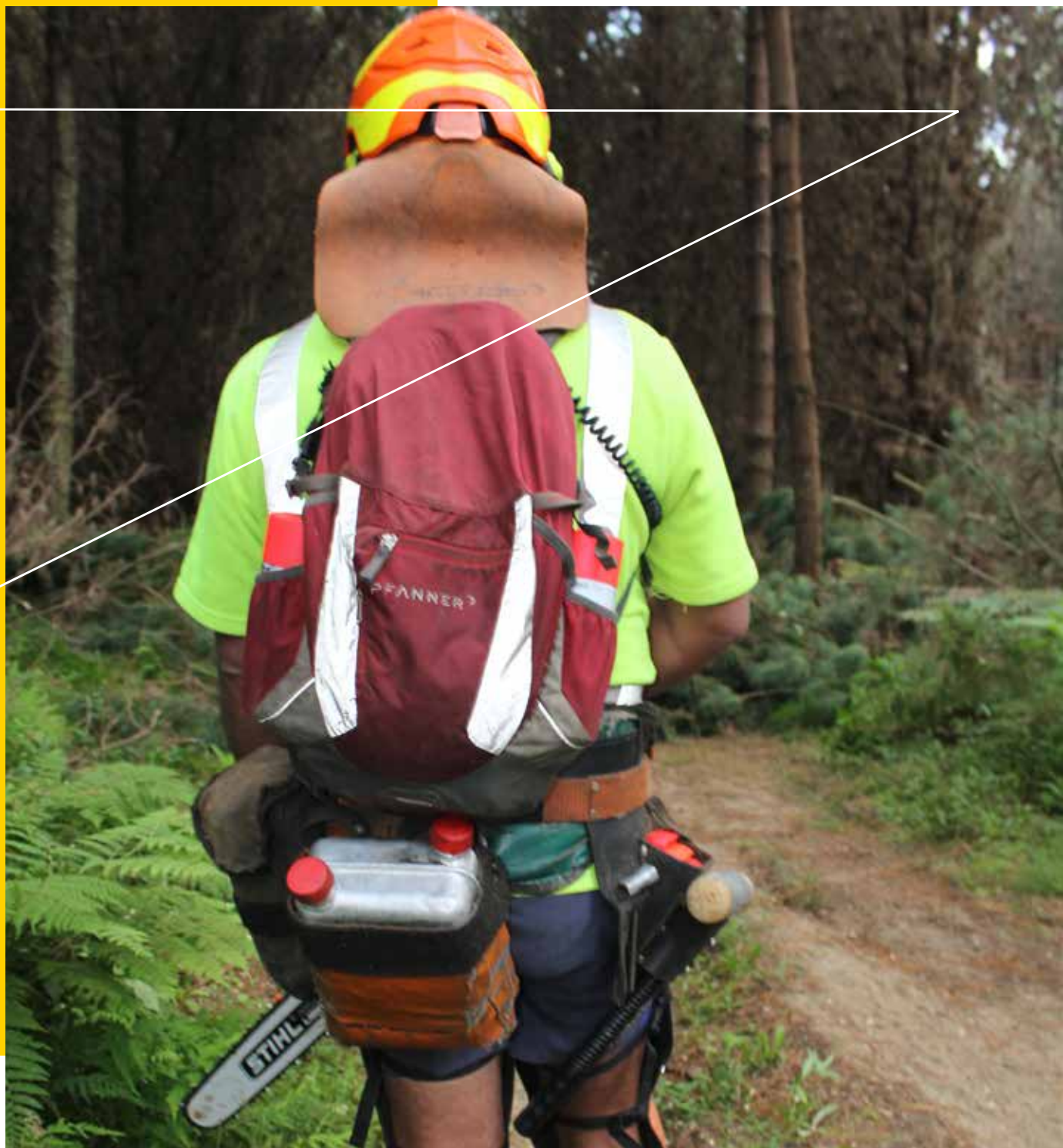
A hang-up was left in an otherwise nicely thinned stand.

Part A

Setting up the Job for Success

Chapter 1

Thinners and their Tools



In this chapter, you will learn about:

- ✓ The training required to become a skilled thinner.
- ✓ Things that can affect the quality and safety of your work.
- ✓ Personal protective equipment (PPE) for thinners.
- ✓ Essential equipment to work safely and effectively.
- ✓ How to prepare for the workday ahead.
- ✓ Work demands, including self-care, fatigue management, and working alone.
- ✓ Knowing when to stop or seek assistance, e.g. when an observer is necessary.

- **Best practice thinning is a continuous cycle of training, application, monitoring, and feedback.**
- **Each aspect must meet industry best practice.**

Training

A competent thinner has the qualifications and the experience. They have proven competence by consistently demonstrating the skill and knowledge. Appropriate qualifications are deemed as New Zealand Certificate in Forestry Operations (Level 3) Thin to Waste Strand.

When training, thinners must work under the supervision of a competent person. The employer must keep records of supervision and training to demonstrate competency.

All inexperienced workers should have a documented training programme in place. They should not be allowed to work unsupervised until they consistently demonstrate competency. Competency measures a person's ability to demonstrate the skills required to perform a task.

Thinners should be monitored to ensure they are maintaining competency. Monitoring should also be documented.

Thinning for value can be a seasonal operation. Thinners often do other forestry work like planting and release spraying. When thinning operations restart, a competent person must reassess and monitor to ensure thinners maintain competency.

- **Work on improving your tree selection and felling.**
- **The forest's future quality is in your hands.**

Thinner safety

Safety is critical in thinning operations. This BPG explains ways to protect thinners from harm.

These include:

- Assessing and managing hazards and risks, e.g. terrain, weather conditions, and the natural lean of the trees.
- Meeting training and on-the-job standards.
- Understanding PPE, on-site communication, and the felling equipment and its use.
- Ensuring you have all the required equipment and it is up to standard.
- Knowing the worksite.
- Preparing adequately for the day.
- Maintaining health and safety.
- Managing fatigue.
- Using correct tree thinning processes and techniques.
- Using observers.

Trees outside your thinning skill set

An essential skill is recognising and walking away from a situation beyond a thinner's ability. For example, thinning may be too risky if trees are heavy leaners, windblown, multi-leaders, too big, have broken tops, or are dangerously hung up.

The following provides options as to what to do next. Regardless of the option you decide, communication is important. Options include:

- **Leave it.** If possible, mark it with flagging tape. Communicate this to the crew foreman or forest manager as soon as possible.
- **Seek help from a more experienced crew member.** The benefit is two sets of eyes are better than one and an opportunity to learn from a more experienced thinner.
- **Come back on the next run back.** Carry on thinning past the issue, provided you aren't putting yourself or others at risk. On the way back, you'll see it from a different angle, and it may be more manageable than first thought. If the hazard is left, tell the foreman.
- **Mark on a mapping app.** Use Avenza or a similar app, or mark with tape if it is safe to do so.

Work within your training and experience. Be prepared for the day!

Things that affect a thinner's safety, quality and productivity

The following things affect the safety, quality and productivity of your work. If you are prepared, then you:

- Avoid distractions, rushing, and complacency.
- Discuss concerns that impact your work with the foreman and crew, e.g. production pressures.
- Listen to directions and follow plans and maps.
- Communicate clearly.
- Have the necessary experience and skills for the job.
- Think ahead and adapt to change.
- Know and respect hazards.
- Operate well-maintained and approved equipment.
- Maintain your fitness.
- Can deal with the unexpected.

Chainsaw thinning fatigue management plan

Chainsaw thinning is demanding, especially on steep ground and in heavy undergrowth. Develop a fatigue management plan, so you know what to look for and how to manage it. A fatigue plan helps you manage your work health, e.g. eating and drinking, and be 'fit for work'.

- **Don't work unsafely.**
- **Look after yourself.**
- **Take breaks and stop working if you've lost concentration.**
- **Don't let your decisions be affected by production pressures.**

Safetree Fatigue Management Guidance

www.safetree.nz/resources/fatigued-or-fit-for-work

Personal protective equipment

Personal Protective Equipment (PPE) must meet required standards and be worn correctly. The Approved Code of Practice for Safety and Health in Forest Operations (ACOP) outlines the required PPE including approved standards.

A Hi-vis helmet

B Hearing protection (class 5)

C Eye protection (visor or glasses)

D Protective legwear (chainsaw chaps or trousers)

E Forestry-approved safety footwear.

F Hi viz top

G Backpack with hi viz cover

H Gloves

Wear the approved footwear as 25% of a thinner's injuries are slips, trips, and falls.

Other equipment

Having the right gear in proper working condition (to the manufacturer's standards) is essential. Again, the ACOP is the document that lays out rules for your felling gear. Make sure you have the following at a minimum:

A Fuel and oil in approved containers

B First aid kit (with two wound dressings)

C Fire extinguisher - fully charged (300 g minimum)

D Wedge hammer (mallet) and a minimum of 3 wedges

E Spares kit, e.g. files and bar spanner

F Radio

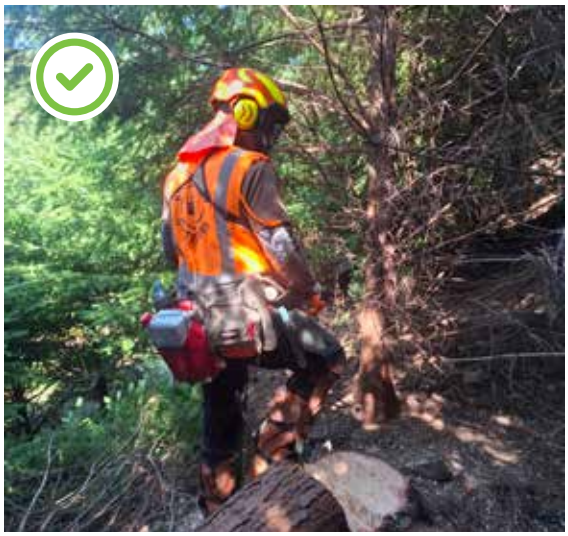
G Drink bottle

H Backpack (hi viz preferable, hi viz backpack covers are available)

Always take all your gear.

Right: The chaps have a saw cut through the outer fabric and into the protective inner.

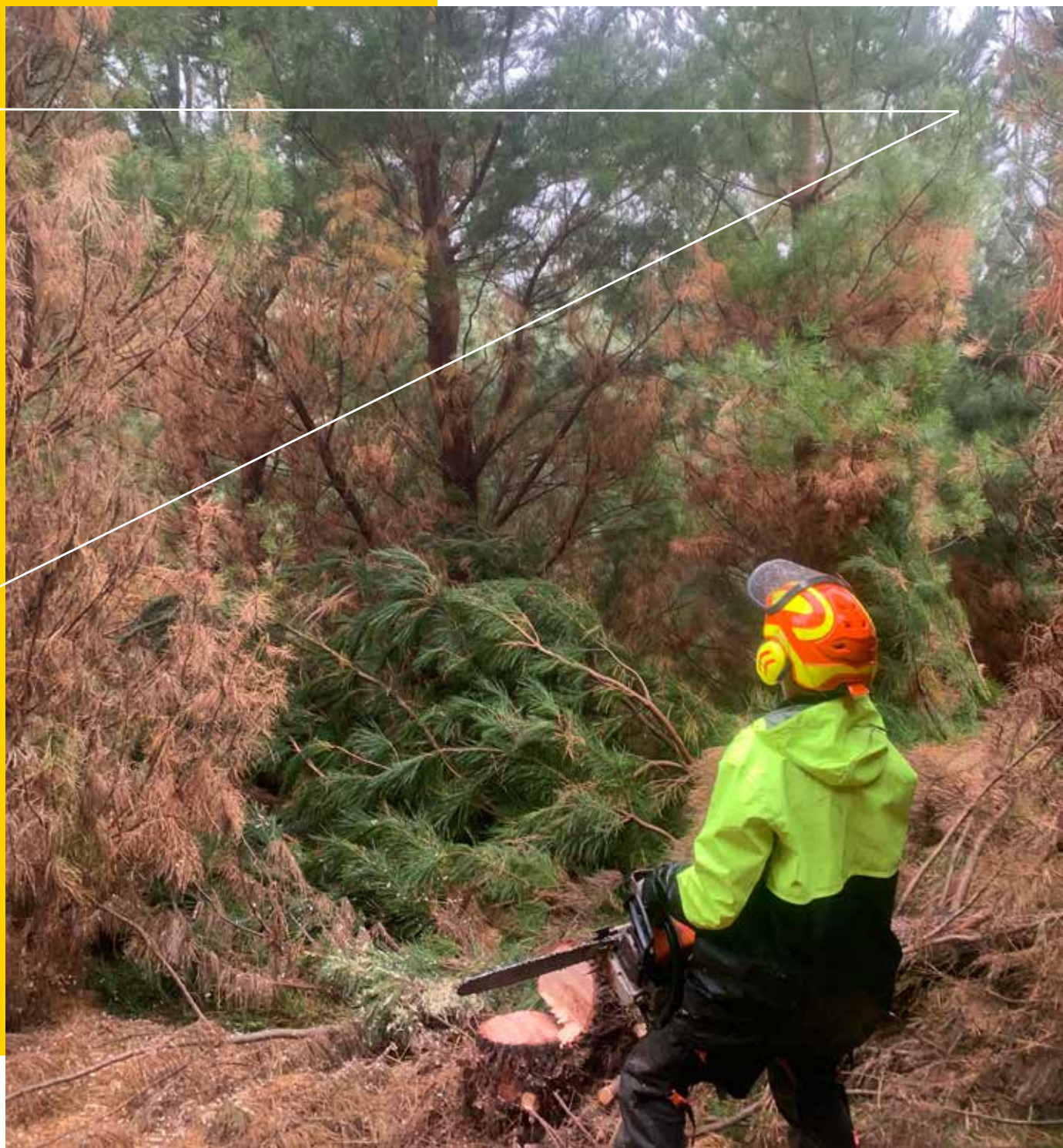
Right: The mitt has lost a rivet (yellow arrow).



Right: The thinner has covered over their hi viz shirt.

Chapter 2

The Work Site



In this chapter, you will learn about:

- ✓ Pre-site inspections
- ✓ On-site communication and the different methods used.
- ✓ Signage required for thinning operations.
- ✓ The importance of identifying and managing hazards and their risks.
- ✓ Critical rules that must be followed.

Pre-site inspections

The purpose of the pre-site inspection is to clearly understand the block and the required work methods.

The contractor or foreman should have a pre-site inspection with the forest owner or manager so they can agree on the following:

- Emergency procedures, including communications and evacuation points with GPS coordinates or rapid numbers.
- Block boundary and access points.
- Known hazards and risks and the way they will be managed.
- Traffic management plan (road controls), if required.
- Job requirements, e.g. confirm the final stocking, tree selection, and the approach to thinning the block.
- The general condition of the stand, like stocking, form, and gaps.
- Potential hazards like gullies, bluffs, undergrowth, roads, powerlines fences, other forestry operations or people nearby.
- Restricted and sensitive areas, e.g. archaeological sites, wahi tapu, native bush, waterways, and endangered species.

On-site Communications

Good on-site communication and knowing the crew's check-in procedures are essential. Regularly checking in helps to make the job safer.

Common ways to be in contact with other crew members include:

- **RT** (radiotelephone) is generally the most reliable way to communicate. Some models also have man-down systems. RTs can be line-of-sight or linked to wider communication networks through repeater stations.
- **Cell phones** can be reliable, but reception is not always good, e.g. the signal can be lost

in gullies or other 'blind spots'.

- **Man-down devices** send an automatic alarm to the contact person if the thinner has not moved for a set time.
- **PLBs** (Personal locator beacon), when activated, sends an emergency signal to tell Search and Rescue you are in distress. Some can send text messages.

Ensure all communications are in working order, including checking the RT or cell phone is charged.

Emergency procedures

Emergency procedures must be on site.

All crew members must know:

- The emergency procedures and where to find a copy.
- When and how to raise an alarm.
- Which crew members have communications that can call emergency services from the work site. If possible, at least one person should be able to call.
- All vehicles must be parked facing the forest exit. If the vehicle is locked, know where the keys are located.

- **Remember to charge the RT or cell phone overnight.**
- **Have spare batteries on site.**

No one can work remotely (away from the rest of the crew) unless there are effective ways to get help from others in the crew.

Signage and road control

Signage and road control are needed whenever work is within two tree lengths of a road, forestry track, or where the public or non-operational people could access.

The signage must meet the company or forest manager's standards. All temporary traffic control should comply with the Best Practice Guidelines for Temporary Traffic Control (August 2007). One person on site must hold the current temporary traffic control unit standard.

The type of road controls include:

- External roads, e.g. council roads: Managed by a traffic management company.
- Major access roads within the forest: Generally managed by road control banners across the road, which could be manned. They warn of felling and require proceeding only when instructed by the thinning crew.
- Low-volume roads and access tracks: Roads are often closed off with a banner and contact details. Access is typically pre-arranged, and the banners are unlikely to be manned.

An example of signage on a low-volume access track.

Managing hazards and risks

A hazard is something that can cause harm. Trees become a hazard if they can harm people, property, or the environment.

A risk is the chance that someone or something will be harmed by the hazard and the likely consequences if this happens.

Managing hazards and risks through a risk assessment process must be part of managing the worksite and preparing for the workday:

A risk assessment will help decide:

- How severe the harm may be.
- How likely the harm is to occur.
- Whether existing control measures are effective.
- What additional action needs to be taken.
- How urgently it needs doing.

Risk changes under varying conditions. Always identify the hazards and assess the risks.

- A = multi-leader tree
- B = working too close to others (within 2 tree lengths)
- C = working under a hung-up tree

Safetree Reference: How to... manage forestry risks

safetree.nz/wp-content/uploads/2017/03/Managing-risk-in-forestry_March-2017.pdf

General rules

- A minimum of two people are required on-site. However, three are recommended so that if an accident occurs, one person can stay with the patient while the other gets help.
- At least two people need to hold a current first aid certificate.
- Thinners must have a reliable communication method.
- Check the communication system before starting work and check it again where you are working.
- Thinners must check in regularly with a contact person.
- No thinner must work remotely from the rest of the crew unless there are effective ways to get help from other crew members.
- Thinners must call up before and after undertaking a hazardous task, e.g. tree drive.

Critical rules

Critical rules must not be broken. Breaking a critical rule can put you and other workers at serious risk of harm. Most forest managers have critical rules that all staff, contractors, and their workers must follow.

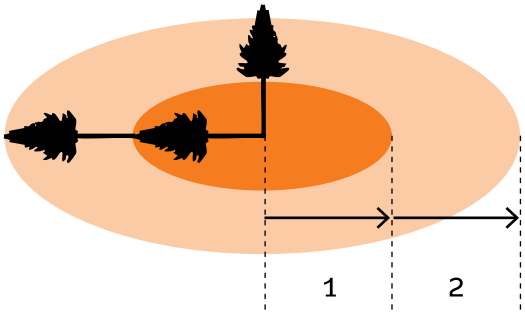
Competency

All thinners must be competent to thin, under training, or be directly supervised by a competent person. Refer to the training section.

Two tree lengths

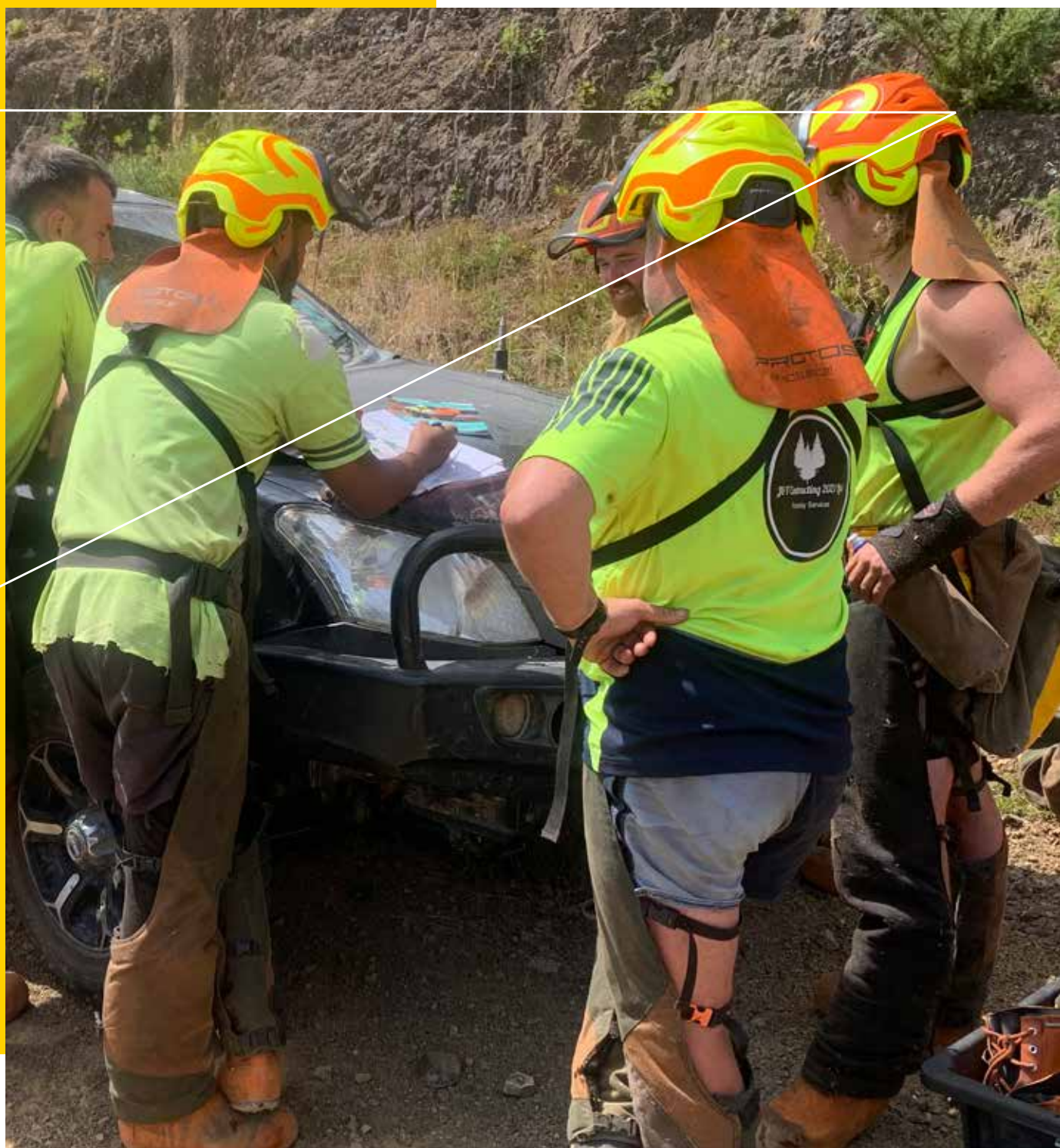
The two-tree length rule applies to all thinning operations. Anything within two tree lengths of the tree being thinned is in the danger zone because of the chance that a falling tree may bring down another standing tree. The specifics of the rule include:

- The crew owner/foreman is responsible for ensuring the operation's two-tree-length distance is calculated, recorded and understood.
- It is each operator's responsibility to manage a two-tree-length distance from other thinners, roads, safe zones, and adjacent operations.
- Avoid working below thinning. If you are downhill of a thinner and outside the two tree lengths, this may still be unsafe.
- Trainers, trainees, supervisors, auditors, or observers can be within two tree lengths provided it is managed.



Chapter 3

Preparing for the Day



In this chapter, you will learn about:

- ✓ Why tailgate meetings are important.
- ✓ Whether you are prepared for the day's work.
- ✓ What is involved with chainsaw maintenance.
- ✓ How to refuel and start a chainsaw.

Tailgate meetings

The tailgate meeting is an important start to the workday. The short daily meeting covers the critical things that make your work site safer and a better place to work. Tailgate meetings are also called toolbox meetings.

Every thinning crew must have a daily tailgate meeting, which everyone on-site must attend. Also, they must be documented and signed off by all workers.

It is best to follow a meeting structure so things aren't accidentally forgotten. Here's a list of topics important for thinners to discuss:

- The daily work plan.
- Any changes from yesterday's plan.
- The day's details on individual members and crew work zones.
- The worksite's known hazards.
- Procedures for the daily check-in.
- Critical rules, e.g. two tree lengths.
- How is everyone doing (well-being check).
- Emergency plans.

The tailgate meeting also allows you to discuss many things that help you and the crew work together. Safetree has many tailgate resources on its website.

Tailgate meeting resources to support good discussions:

www.safetree.nz/resources/tailgate-resources

End of the day debrief

An end-of-the-day debrief is an important way to finish the day. It helps prepare for the next day's work, including addressing any new issues identified onsite or raising things that need to be done in the morning.

Are you prepared for the day?

A day of thinning is physically and mentally demanding. You must be job-fit, and you need to eat the right food and drink.

Here are six questions that will help you decide if you are on your game:

1. Do you have the skills to feel confident felling all parts of the block?
2. Is your equipment up for the task, and do you have all of it?
3. Have you got good food and plenty to drink?
4. Are you in the right headspace? Can you focus on just the job?
5. How is your attitude? Will it affect your work or your workmates?
6. Will tiredness, low energy, or an addiction affect your work?

Only thin if you are prepared for the day.

No one feels 100% every day. If you've been down for a while, getting help is OK.

A great website if you need a little headspace help:
mentalhealth.org.nz

Good practical stuff for people working on the land:
farmstrong.co.nz

Chainsaw maintenance

Your chainsaw is your workhorse. It needs to be in top condition. If you look after your saw, it will look after you. Everyone knows this, so there are rules and guidance for maintaining chainsaws.

If you do maintenance at the end of each day:

- Your equipment is ready to start the next day's work.
- It is much easier when you have time to find or organise getting replacement parts or fixing something.

Doing maintenance in the morning before starting the job can lead to problems with equipment not up to standard for the day's work. Instead, by doing maintenance at the end of the day, all that is required the next morning is a once-over to check that you did the right things with the end-of-day maintenance

It is essential to check and maintain the **nine** safety features daily:

1. **Rear hand guard -** guards the right hand from a broken or thrown chain.
2. **Throttle lockout** - locks the throttle out and prevents unwanted revs.
3. **On-off switch** – turns the saw off.
4. **Safety mitt** - keeps the left hand on the saw and helps place the thumb under the top handle to improve grip.
5. **Chain brake** - stops the chain from turning. It is activated manually by the lever or automatically through inertia from the saw moving rapidly backwards.
6. **Muffler** - quietens the saw and channels fumes away.
7. **Spark arrestor** - catches hot embers before they exit the muffler or exhaust.
8. **Chain catcher peg -** catches a broken or thrown chain before it heads towards the operator's right hand or leg.
9. **Anti-vibration mounts** – reduce and absorb chainsaw vibrations.

Also check or maintain:

- **Bar** – Clean the groove and rotate the bar daily, file the bar weekly, and check the sprocket for free rotation and firmness daily.
- **Drive sprocket.** Including general wear and tear. Generally these are replaced every two chains used.
- **Chain** - tension, sharpness, and depth gauge setting. Clean the chain daily.
- **Air filter** – clean daily.
- **Bucking spikes** – check that the bolts are tight daily.
- **Loose bolts, nuts or screws** - check the saw daily.
- **Nothing is missing or damaged with the saw**

Left: Check the chain's condition and sharpness. Sharpen or replace. Using a round file guide improves maintaining optimum sharpness. **Right:** Check the air filter and clean it.

Once maintenance is done, top up chain oil and refuel, and start the saw to check that:

- Nothing is loose or feels different.
- The saw is idling correctly.
- The saw's chain remains stationary when the motor is idling.

Maintenance shortcuts increase risk!

Taking shortcuts in maintenance can create highly unsafe practices.

Left: Saw without a chain capture peg. **Right:** Mitt with a cable tie (yellow arrow) and chain too loose (grey arrow).

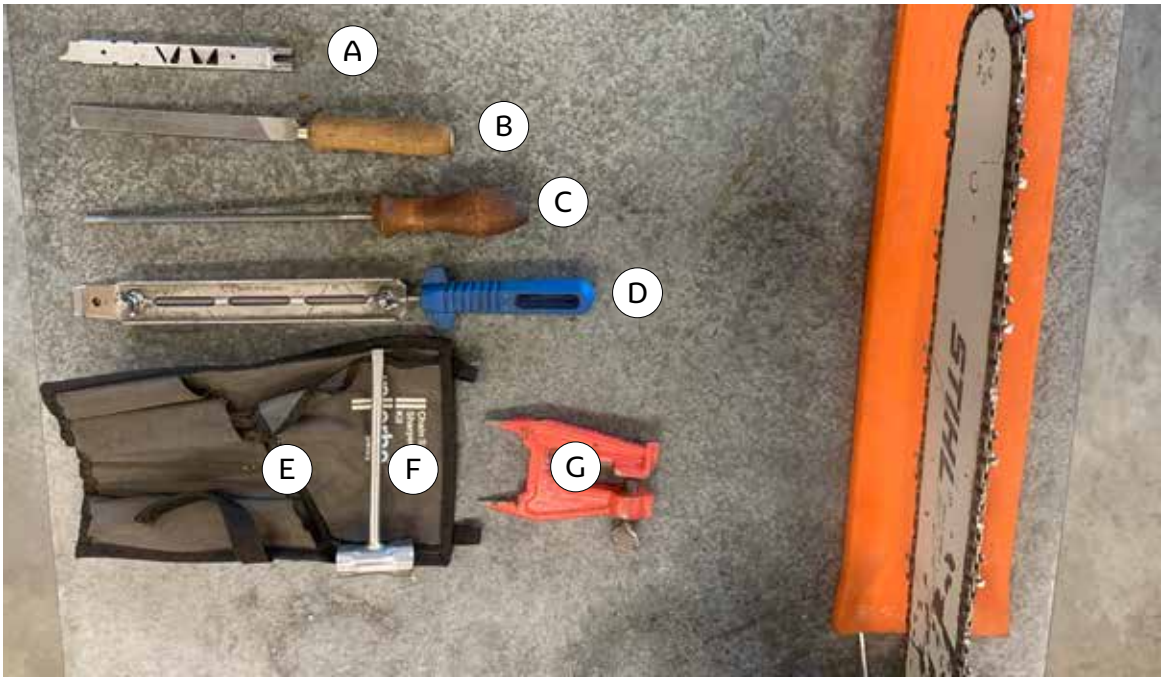
Sharpening the chain

Sharpening a chain is an important way to help maintain a saw's optimum performance. A correctly sharpened saw eliminates 'fighting' the saw as it cuts, improving thinning techniques.

Sharpen the cutters and file down the depth gauges as close as possible to the manufacturer's specifications. Use the manufacturer's file guides and tools specifically designed to help maintain optimum sharpness and cutting.

A correctly sharpened chain is much more efficient than one with aggressive cutters and depth gauges. Aggressive sharpening increases thinner fatigue, saw maintenance, and the risk of kickback.

Having the chainsaw in a stump vice or a sharpening block gives the thinner a better opportunity to sharpen correctly.



A Depth gauge setting tool

B Flat file

C Round file

D Round file guide

E File kit

F Combi spanner

G Stump vice

Using a file guide improves consistency when you sharpen your chain.

Right: Aggressive chain sharpening of depth gauge and cutters leads to a much higher risk of kickback, feller fatigue, and more saw maintenance.

Holding the chainsaw

The default way to hold a chainsaw is in the 'number one' position. In this position, the bar is horizontal and points right to left across the body.

The left hand is in the mitt, on top of the handle, with the thumb wrapped around it. The right hand is on the rear throttle handle. The fuel tank is resting on the right thigh.

Chainsaw refuelling procedure

A chainsaw needs fuel for the engine and oil for the bar. Saws need regular refuelling because their tanks are small to reduce their weight.

Fuel must be in an approved container, labelled, and with a cap that seals.

When refuelling:

- Find an area where the saw can lay level at least 3m from the work area.
- Keep outside of the 2 tree lengths rule.
- Keep visible to other workers if they are nearby.
- Turn off the saw.
- Fill the bar lube first.
- Fill the petrol.
- Wipe up spills.
- Move 3m from the fuelling zone before re-starting the saw.

Think fire!

- **Turn off the saw.**
- **Clear an area.**
- **No smoking.**
- **Move 3m away before restarting.**

Chainsaw starting procedure

Cold starting

There's only one way to start a saw when it's cold, and that's with it on the ground. The thinner has to have three points of contact with the ground too.

Manufacturers recommend having the chain brake on when cold starting. However, when the chainsaw does start the saw will be revving higher than normal because the throttle lock is also on. First pull the trigger to get the saw back to normal revs. Releasing the chain brake with the throttle lock on can cause the saw to jump.

Fuel-injected chainsaws or those with technology that does NOT have a rotating chain at cold start can use the warm start method.

A Chainsaw is on the ground.

B Mitt hand in the mitt with a straight arm.

C Right heel on the rear handguard.

D Left knee on the ground against pull start side cover.

E Pull the starter cord.

Warm starting

There are two approved methods:

- Starting as for a cold start.
- Step over method.

The step-over method

A Mitt hand in the mitt with a straight arm.

B Position chainsaw on left thigh, and pointing left.

C Step over the rear handle and secure the chainsaw behind the bent right knee.

D Both feet are flat on the ground (where possible).

E Pull the starter cord.

If the chainsaw does not start after several pulls, revert to the cold start method.

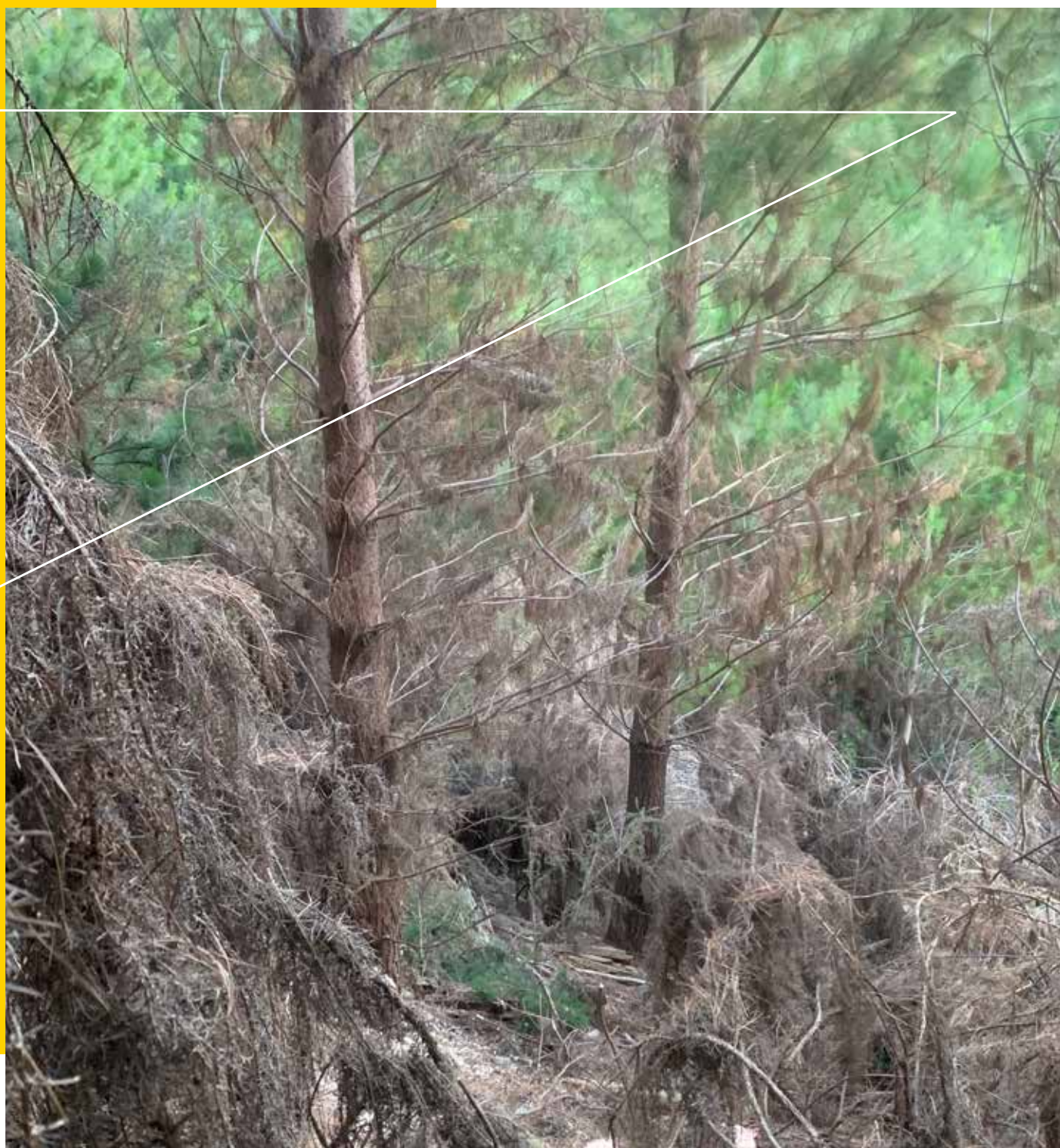
Never drop start a saw! It can swing on the starting cord and cause serious injury.

Part B

Thinning for Value

Chapter 4

Tree Selection



In this chapter, you will learn about:

- ✓ Thinning is one of the most important jobs in creating value for a forest owner.
- ✓ The importance of selecting for tree dominance.
- ✓ How to assess for tree form.
- ✓ Why spacing is important.

The importance of tree selection

Quality thinning will significantly improve the financial returns to the forest owner because the best trees are left. The best trees are those that are bigger and have better shape than their neighbours. Great thinning increases timber volume and improves timber quality.

Harvesting crews get cutting instructions from the forest manager. The cutting instructions contain details about the maximum size or number of defects allowed for a log grade. If these are exceeded for the highest quality grade, the log gets assessed for a less valuable grade until the log is in specification.

- **Bigger logs get a higher price.**
- **Smaller branches get a higher price.**
- **Wobble and sweep can lower a log's grade.**

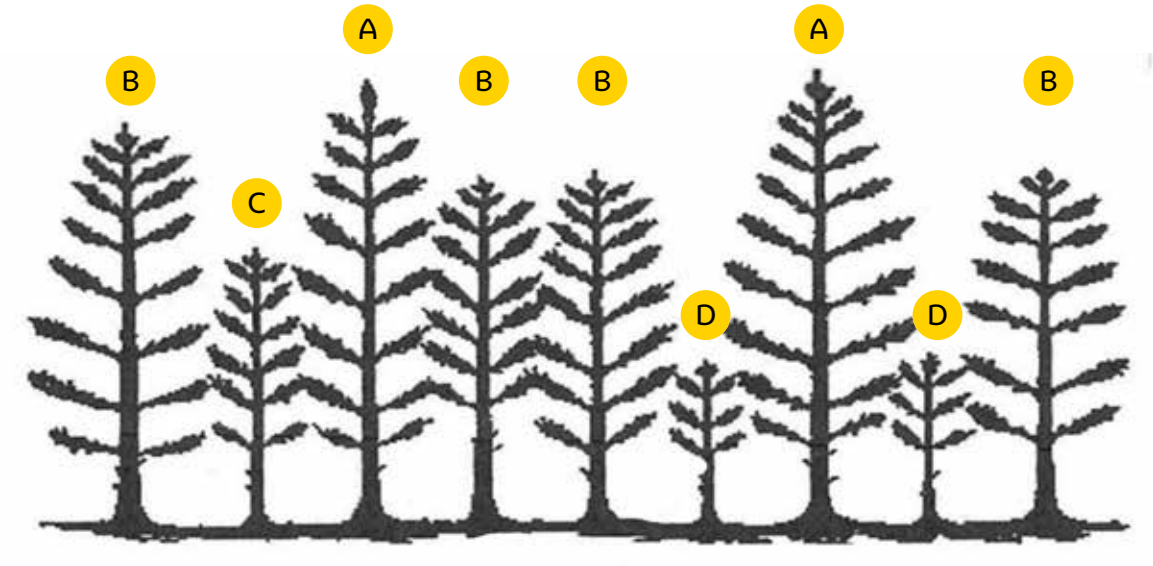
Selecting the right trees

Tree selection is about choosing the right trees. It is about keeping the biggest trees, especially those with great form, and not leaving gaps. The following diagram shows the order in which a thinner chooses the best trees.

Select carefully. Choosing correctly is one of the most important jobs in forestry. You help create the final forest value.

Consideration #1: select for dominance.

Dominant trees are the bigger trees with more vigorous growth. They give more volume as they have larger stem diameters. Dominant trees stay dominant throughout their growth. They get the best sunlight and have better roots for water and nutrients. Forest owners get more money with increased volume at harvest.



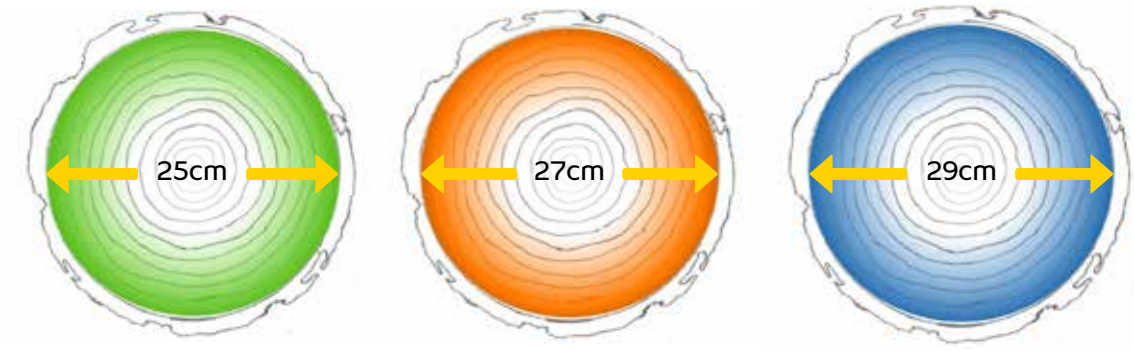
A Dominant. Select these for final crop trees unless they have poor form. Select dominant trees even when they are next to each other.

B Co-dominant. Can also select these also as final crop trees.

C Subdominant trees are much smaller than most others. Only select these if canopy gaps need filling and there are no other alternatives.

D Suppressed trees do not grow into valuable trees. They always stay small. Only select these if there are no other alternatives to fill in a canopy gap. Otherwise, cull.

The following diagram shows the importance of the biggest trees on stand volume. Thinners need to keep big trees. The diagram explains that if a thinner regularly keeps 25cm trees and fells larger ones, the forest owner rapidly loses an extra tree's volume without changing the final thinned stocking.



Diameter	Diameter increase (from a 25 cm tree)	Volume increase (from a 25 cm tree)
27 cm	2 cm	17%
30 cm	5 cm	44%

Select bigger trees as a small increase in diameter makes a huge increase in tree volume. The reason for the large change in a tree's volume, even with a small change in diameter, is due to the following:

- Larger diameter trees are taller, so they have more wood.
- The difference in diameter is across the whole tree, not just at eye height.

Without altering the stocking:

One tree's volume is lost if FIVE 27cm trees are felled instead of 25cm ones

One tree's volume is lost if TWO 30cm trees are felled instead of 25cm ones

Adding value is removing trees with the most defects, but not at the cost of dominance and spacing!

If you are unsure what to keep, remove definite cull trees to help improve your view.

Consideration #2: select for form.

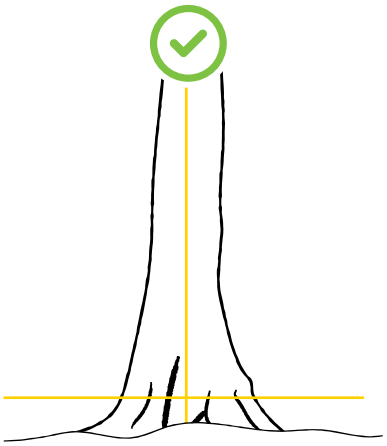
The tree's form is how it looks. After tree size, choose on tree form unless any features would make it a cull. Defects will reduce the value of the tree at harvest. The form comprises of:

- Straightness, e.g. lean, sweep, butt sweep, wobbles, kinks, and number of leaders.
- Branching, e.g. number and size of branches.
- Tree health, e.g. insect or disease damage and nutrient deficiencies (colour and leader wobble).

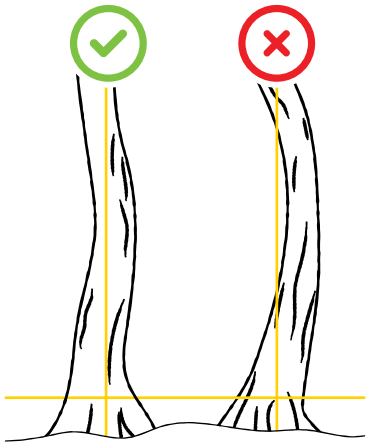
The following guide will help you decide how to choose trees for value.

Straightness

Choosing straighter trees is the second most important form feature. A tree, or part of a tree that is not straight, is sold for a lower price. Many trees have defects or features that don't make them straight. Keep or cull trees with the following straightness:



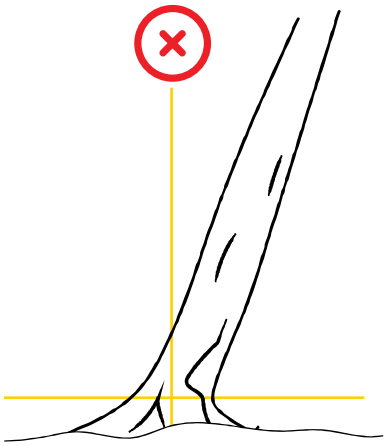
Straight



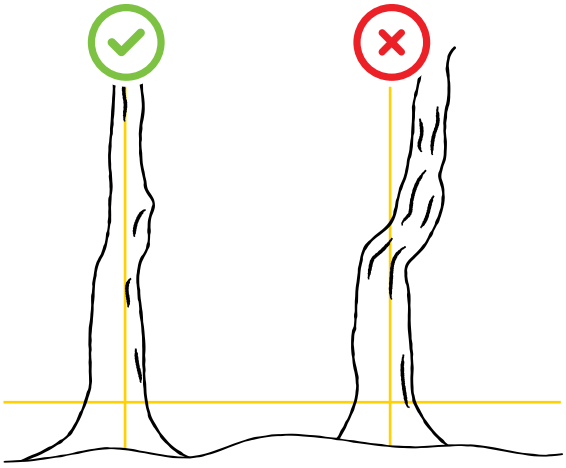
Sweep needs to be within the stem.

A gradual sweep over the tree is OK.

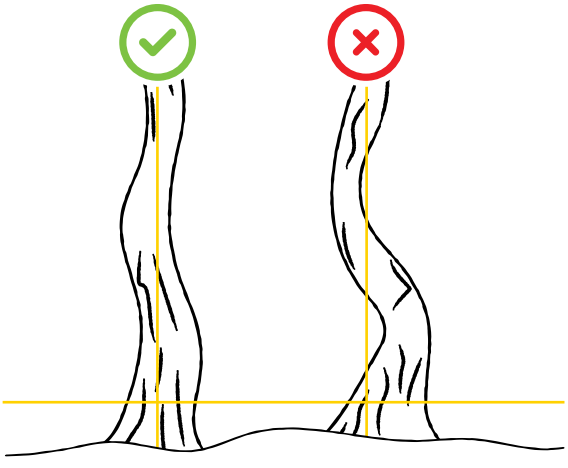
Butt sweep not to exceed one metre high.



Leaning trees need culling

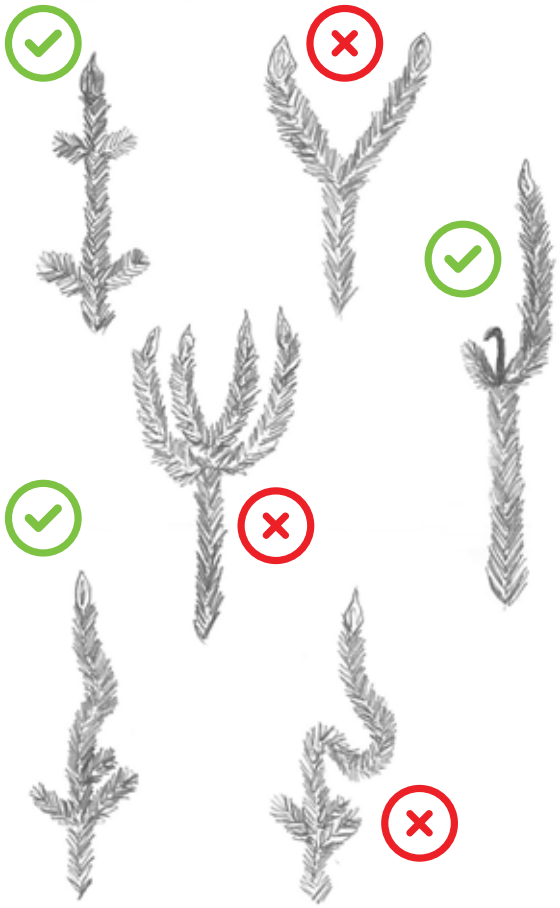


Kinks (often caused by leader dying)



Wobble is OK within the stem

Based on diagrams provided by Rayonier Matariki Forests



Double and multiple leaders are major defects and need culling unless the tree fills a gap.

Branching

The third most important form feature is branching. After tree health and tree straightness, select trees based on the size of their branches.

In pruned stands, always select a pruned tree before an unpruned tree, except if the pruned tree is suppressed or has other features that make it a cull, e.g., a broken top, or a major lean.

Trees with big branches are less valuable than those with smaller branches. Big branches growing up rather than sideways reduce a log's value the most because they create the biggest knots, known as spike knots or ramicorns. Even one of them reduces a tree's value.

Select trees with branches that are:

- Smaller than their neighbours
- Have branches that come out horizontally rather than steeply angled up.
- Wider spacing between branches and whorls.

Light and flat branching

Heavy branching (basket whorl)

Heavy and steep branches

Good quality wood

Low-quality boards

Poorest timber

Tree health

Choose healthy trees over ones that are less healthy.

Consideration #3: spacing, including canopy gaps

Select for spacing after dominance and form.

Trees need sunlight, nutrients, and water. The area each tree has influences its growth. Growth reduces if trees are too close. The number of trees in an area is called the stocking. Stocking is measured in stems or trees per hectare. Therefore, the stocking gives an indication of the spacing between trees. This is why work prescriptions have a final stocking requirement to help make sure each tree has the right space to grow.

Evenly distributed final crop trees can produce more consistent wood quality. However, do not focus on spacing at the expense of volume. Keep dominant trees even if they are close together.

Canopy gaps are where there are no trees. Gaps occur for many reasons, including poor planting, areas that couldn't be established like slips, and areas affected by wind damage, animal browse, or weed infestations. Canopy gaps allow the trees around the edge to grow bigger branches which reduces a tree's value. Canopy gaps can lead to increased stand windthrow because gaps can create wind funnels.

To help improve stocking consistency and spacing and the quality of the trees next to the gap, keep trees you would otherwise cull, even though these trees have lower value,

Leaving a tree to fill a gap helps good crop trees stay high value rather than growing big branches.

Gap trees provide some value at harvesting, whereas a gap provides no value.

Stocking and prescriptions

The prescription provides the thinning details required by the forest manager for each thinning area.

The block needs to be thinned to the approved final stocking within the prescription. If the stocking is higher than allowed, the block needs to be reworked. It is critical not to remove too many trees.

- Pruned target final crop stocking varies but is usually between 300 – 350 stems per hectare.
- The final crop stocking target for structural or framing regimes is generally between 450 and 600 stems per hectare for radiata and 600 to 800 stems per hectare for Douglas fir.

A quick and easy way for a thinner to check their approximate stocking is doing an 'eyeometer' half plot. This is not the exact number of stems per hectare, but it is a quick and effective way to check to help you decide whether more trees need to be kept or removed:

- Pick a spot along the thinned edge.
- Look left of where you are standing and work out roughly where 11 meters away is.
- While standing in one spot, follow that distance around the thinned area counting any tree within the 11 meters.
- Stop when you are directly opposite where the half-plot started.
- Work out the stocking. Each tree counted in the half plot equals 50 trees per hectare. Therefore 10 trees counted in the half plot means an approximate stocking of 500 stems per hectare.
- If there are more than 10 trees, the thinner may decide to remove extras. If there are fewer than 10 trees, the thinner can leave the unthinned area outside the plot slightly heavier stocked to help keep the overall stocking at the right level.

Some common mistakes around tree selection and stocking.

- **Taking out every second tree.** This method becomes a "default mode" for some thinners, and while it might get the stocking close to correct, it won't maximise the volume the stand could produce.
- **Thinning to spacing ahead of dominance and form.** Again, the final crop stocking may be close to correct, but the overall volume will most likely be less than it should be.

A Prescription is the information the forest manager gives the thinning crew so they know as much as possible about the stand of trees they are about to thin. It outlines the rules the crew must follow when doing the work.

It is critical that you follow the prescription rules, as these are the basis for all work-related decisions.

If any of the prescription details are unclear or not fully understood, then that needs to be addressed prior to starting any work related to the prescription.

A good thinning prescription should include:

- The forest/compartment/stand details, e.g. stocking, stocking range, mean top height.
- Location, including road names.
- Detailed map and aerial imagery.
- Health and safety hazards and controls and environmental requirements.
- Communication and emergency details, e.g. site GPS coordinates, access points, helicopter emergency skid location.
- Setback requirements, e.g. along roads, waterways, or sensitive areas.
- Quality standards for the work.
- Selection and spacing criteria, e.g. the minimum spacing, the maximum spacing target stocking.
- Other operations nearby.
- Rework requirements and costs.

Working the block

Selecting for dominance, form, and spacing can be complicated, and thinners need to constantly decide which tree is more valuable than another. Also, in many stands, it is hard to see each tree and its neighbours clearly because of slope and heavy scrub.

Find a system that helps you work more efficiently and effectively. Thinners need to work quickly to meet production targets, so having a good system ensures the selection process isn't rushed. Depending on the block or even parts of the block, you may need to change how you approach the selection process. For example, you may thin a contour-planted stand differently from one planted up and down the slope. A thinner will be making hundreds of decisions daily, so all the above steps will happen quickly.

Thinners may have a process like the following. They:

- Work across and uphill. Looking from above and across often gives the best view of the trees.
- Check out the next 2-5 trees, depending on how good the view is. If needed, shift your position to improve your view.

- Decide what you are going to do with each tree. Use your selection training and knowledge to decide whether to keep or cull. If you are unsure, fell the ones that need to come out and then re-assess.
- Work your way to each cull tree. Find a safe and efficient way to reach them.
- Check that the stocking is within the required stocking range.
- Constantly reassess the current plan. For example, you may find an easier way to get to one tree which could change the felling sequence, or you may see a defect in a crop tree that you were going to leave but now should remove.
- Start the selection process again.

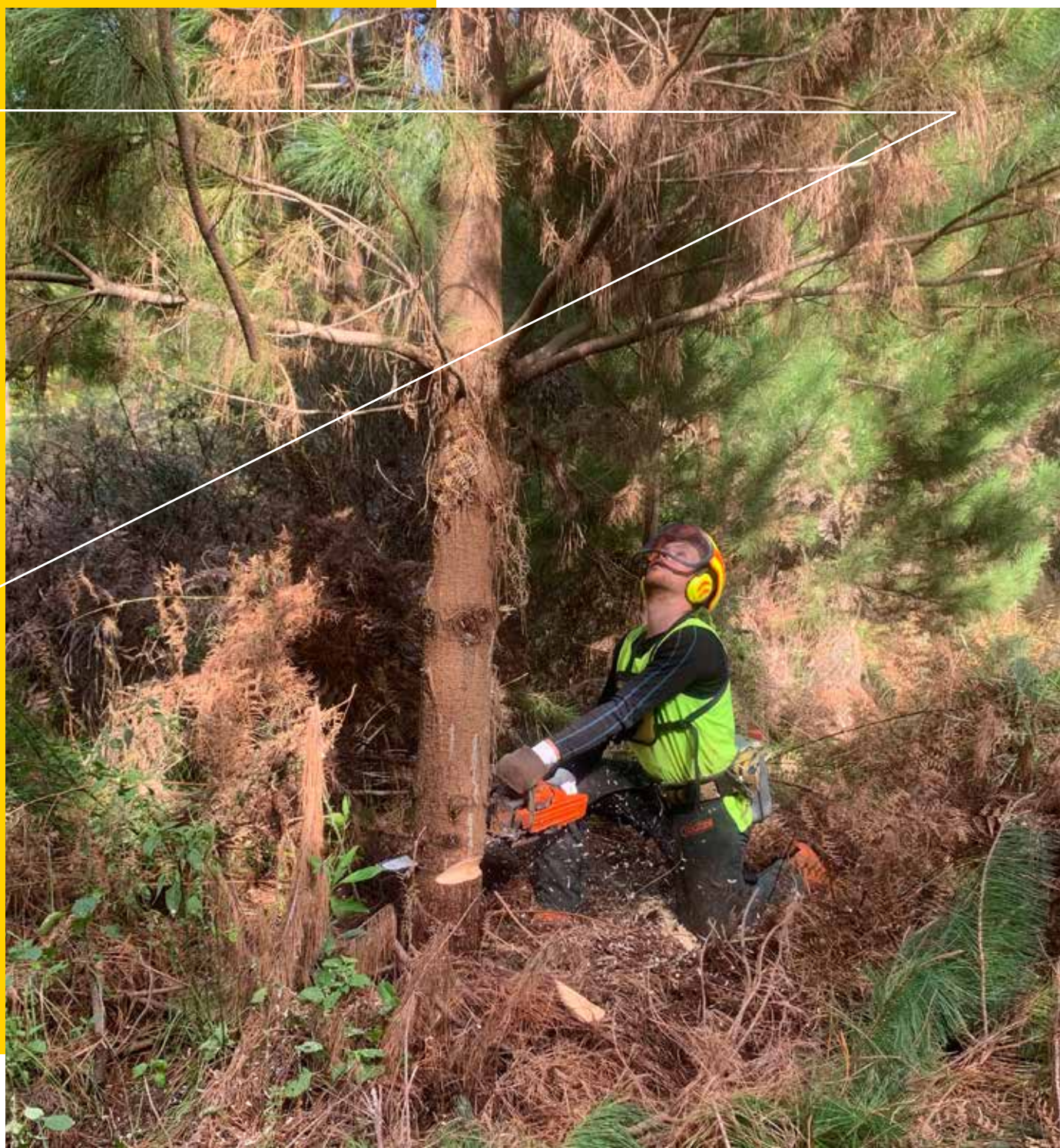
A dominant tree with a dead top, surrounded by co-dominant trees. It should be culled.

A dominant tree with an acceptable wobble is likely a crop tree.

Right: Pruned versus dominance. The pruned tree is suppressed, and the pruning scars haven't healed. It is likely best to cull the pruned tree and keep the dominant unpruned one because the pruned one is unlikely to produce a pruned log.

Chapter 5

The Felling Process



In this chapter, you will learn about:

- ✓ What are the five critical steps to fell a tree.
- ✓ The different techniques to fall a tree.
- ✓ How to manage hangups.
- ✓ Understand what can cause stem movement, rebound and butt swing.

Moving between trees

Managing how you move between trees is an important part of thinning. Thinners need to often cut scrub between trees. Always do the following:

- Cut scrub only when you are not moving. Have both feet on the ground when the chain is rotating.
- Use the saw below shoulder height
- Cut within your reach. Do not over-reach.

The five-step felling process

If you don't have a consistent felling routine, there's more chance for something to go wrong. It doesn't matter which of the different felling methods are chosen; all thinners must follow the five-step felling process. This process has been used for decades and has been proven to minimise the risk of injury to thinners:

Step 1: Assess the site for hazards

- Approach the tree to be felled and assess the surrounding area within two tree lengths for hazards to help you decide how you will thin the surrounding work area.

Step 2: Assess the next tree to fell for hazards

- Carefully check out the tree. Look for multi-leaders, decay, heavy lean, broken branches or top, or anything else that may affect how you fell it.
- Decide how you will fell the tree if it is safe to fell.
- Plan where to put the felling cuts.
- Figure out which side of the tree is the safest for the escape route. The last cut needs to be made from this side.

Step 3: Clear the base of the tree and the escape route, then trim

A Clear vegetation and obstacles from around the base of the tree

B Clear an escape route:

- It must be about 45 degrees from the opposite direction of the fall and as far back until you are safe.
- The exact direction and distance will vary depending on the terrain and the undergrowth conditions.
- It must be on the side of the tree where the last felling cut is made.
- It can be the track used to get to the tree, providing it is safe and in the right direction.

C Trim the tree so you can do the felling cuts and where possible see the top of the tree:

- Trim to the right (anti-clockwise). Sometimes, it is safer and more effective to initially trim to the left to open up the tree before changing to trimming to the right.
- When moving the saw from left to the right the chain should be stationary to minimise the risk of kickback.
- Cut branches flush with the stem to reduce kickback risk.
- Use controlled downstrokes. Avoid lunging or stabbing at branches.
- Avoid using the tip to reduce the risk of kickback!
- Trim enough branches, front and back, to make safe and accurate felling cuts.

A Trim to the left to open up the tree.

B Trim to the right (anticlockwise) to finish the tree.

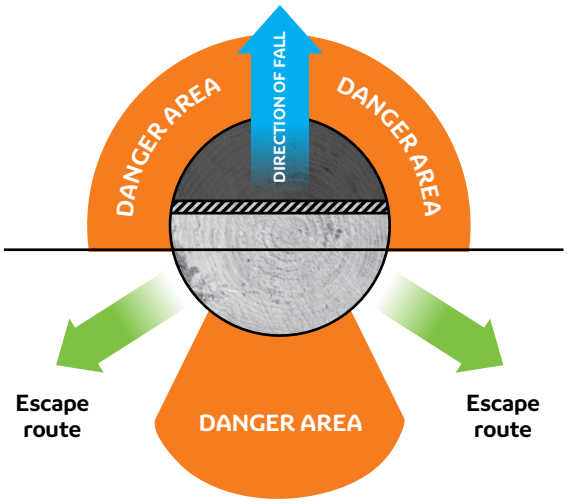
Step 4: Fell the tree

- Good felling technique helps get safe, accurate, and consistent results. Also, good technique helps minimise damage to crop trees.
- Felling techniques are described later in the chapter.

Keeping the left-hand side of the bar in your vision means you're out of the way should the saw suddenly kick back.

Step 5: Retreat and observe

- Finish the felling cut on the safe side of the tree. Use the escape route as the tree begins to fall.
- Watch for falling material and be aware that the tree can kick back or bounce when it hits the ground.
- Make sure it is safe before returning to gather wedges and any other gear.



A Back cut.

B Retreat and observe

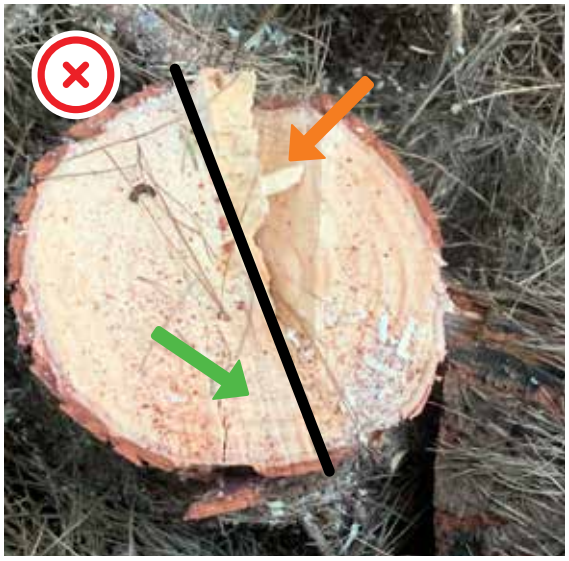
Stumps display the quality of your felling

Stumps show how you felled the tree and whether you did a good job.

- Scarf cuts are the correct size.
- Back cut is stepped above the front cuts.
- Tree has fallen in line with the scarf.

- The scarf is too small and the wrong shape.
- There is no holding wood.

- Back cut is parallel to the scarf cut.
- Holding wood is not overcut.
- Scarf cuts are about 1/3 of the tree.



- Scarf cuts do not match up and create overcut (orange arrow).
- The back cut is not parallel to the scarf cut (black line).
- Holding wood is not even and is cut all the way through (green arrow).

Chainsaw kickback, traction, and recoil

Kickback

Kickback is the chainsaw's violent, uncontrolled upward and backward motion towards the operator. It is one of the leading causes of severe injuries to chainsaw operators. Injuries are usually to the face, head, or left shoulder. Kickback is a constant risk for chainsaw thinners, but a good understanding of kickback's causes and controls means you can work safely.

The two main causes are:

- **Cutting with the bar tip.** Kickback can occur when the chain's cutters move around the top of the bar tip and are exposed to more wood than they can cut at an angle not designed for cutting. Instead of cutting through the wood, the chain's energy is violently forced up and backward towards the operator.
- **Getting a chain or bar pinch near the bar tip**—The bar kicks back for the same reason as above. The pinch slows the saw, and the chain's energy is violently directed up and backward.

Left: The yellow arrows show where the saw has kicked back. **Right:** The kickback danger zone is within the orange square.

Beware kickback!
Keep the bar tip away from direct contact with the tree's stem.

There are many other reasons for kickback. They can be split between chainsaw maintenance and operator causes. The following are other reasons why kickback occurs:

Chainsaw maintenance

- Filing the depth gauges too low – too much cutter is exposed.
- Inconsistent sharpening – changes in cutter angles and length.
- Using a chainsaw with a loose chain – increases the angle of the cutter.
- Using a chainsaw with a blunt chain – the chain has more resistance to cutting, so more energy is needed to cut.

Operator

- The tip catching an unseen or unplanned object such as a branch or stub.
- The tip catching the stem of the tree when trimming.
- The chainsaw does not have the correct revs when cutting.
- Overreaching when cutting.
- Misreading compression and tension wood.
- Walking and cutting at the same time.
- Rushing and "stabbing" the saw forward.
- Cutting smaller wood under tension, e.g. regen, gorse or broom, and native scrub.

How to control and or minimise the effect of kickback:

- Use the correct cutting techniques.
- Have a balanced body position with left foot forward, where possible.
- Have two hands on the chainsaw when cutting with the left hand on the front handle and the right hand on the rear handle.
- Keep the left hand in the mitt with the thumb wrapped around the handle.
- Keep the left arm straight when cutting wherever possible.
- Maintain your view of the left side of the bar when cutting, where possible.
- Only cut when stationary, so no walking and cutting.
- Don't rush, plan your cuts.
- Use down strokes, where possible
- Identify compression and tension wood.
- Regularly check and maintain your chainsaw's nine safety features.

- Sharpen correctly to manufacturer specifications, including setting of depth gauges.
- Set chain tension correctly.
- Don't overreach with the saw.
- Don't use a saw above shoulder height.

Traction

Traction is when the saw pulls away when you are cutting with the bottom of the bar. It is created by the force of the cutters biting into the wood.

A good way to manage traction is to have a slower chain speed when starting a downward cut.

Recoil

Recoil is the pushing back motion created when using the top of the bar to cut.

A good way to manage recoil is to have a straight left arm and the side of the fuel tank resting on the top of your right thigh or hip, where possible.

Felling techniques

Thinners fell hundreds of trees a day and thousands of trees a month. Having a mix of felling techniques prepares you for all felling situations. It is important to get it right every time.

Felling trees up to 10 cm

A 10cm tree is about the diameter of a spray can. There are two options:

1. Fell with a single cut from the back of the tree. Start cutting, and as the tree begins to fall, complete the cut.
2. Cut from the front to the back of the tree on a slight downward angle. Make sure you are on the side of the tree. The angled cut makes the butt slide backwards, giving the tree lean in the intended direction of fall. Remove the angled cut on the stump so a "sharpened spear" stump isn't left behind.

For either method, you can use the top or bottom of the bar but never the top part of the tip.

Stump height should not be more than 20 cm.

Thinner doing a front cut. **Centre:** Regen cut high on an angle creates a hazard in an escape route or when walking between trees. **Right:** Cut off the spear after felling.

Felling trees 10 to 20cm

Once trees are over 10cm fell with a front and back cut. It makes thinning easier and safer.

- Make the first cut in the direction where you intend the tree to fall. Cut to a depth of between ¼ to ⅓ of the diameter. Make it level.
- Place the back cut in the tree. Make it about 2cm above the height of the first cut. Stop cutting with about 2cm left between front and back cuts. Make sure the cut is level and parallel with the front cut. This creates the hinge wood. The hinge is designed to both steer the tree in the intended direction of fall and to help prevent the tree from falling backwards.
- A variation is to place two front cuts 2cm apart instead of one. Place the back cut as described above. Two cuts generally make the tree fall easier.

Stump height should not be more than 20 cm. Once felled, make sure the stem has been completely severed.

Left: Putting in the first cut. **Middle:** completed two cuts. **Right:** Doing the felling cut.

Trees over 20cm – Standard method

Felling a tree over 20cm requires the thinner to use a scarf and back cut with hinge wood. The method is:

Step 1: Make a scarf

- Place a 45-degree cut downwards into the tree. Cut on the side of the tree where you want it to fall. Cut to a depth of between ¼ to ⅓ of the diameter. Make the bottom level. For a 20cm tree, as soon as the top or bottom of the bar has disappeared into the bark, you are deep enough. On a 30cm tree, the bar only needs to be 2-3 cm deeper into the tree to be good.
- Make a level cut to meet the 45-degree cut and remove the wood wedge.
- Check to see that the two cuts meet neatly. If there is an overcut, tidy it up so there isn't. This is crucial for the safe felling of the tree.

Step 2: Do a back cut

- Before you start, have another look up the tree for safety.
- From the opposite side from the scarf, put in a level cut about 10% higher than the bottom of the scarf. For a 20cm tree make it 2cm higher and for a 30cm tree, 3cm. The step prevents the falling tree from sliding backwards off the stump.
- Stop cutting the back cut at 10% of the diameter before where it would meet the scarf. Make it square (parallel) to the scarf cut to make sure there is the same width across it. The remaining wood, the hinge wood, steers the tree's direction and stops the tree from falling backwards off the stump.

Step 3: Check the tree is completely cut off the stump

- Once the tree is safely on the ground you may need to go back to the stump and make sure the remaining hinge is completely severed.
- The stump should usually be about 15 – 20cm high. Adjust your felling if your stumps are getting high.

Use the chainsaw balance points to give greater accuracy with felling cuts and less muscle fatigue.

Cutting with the back knee on the ground is better for you back, helps keep cuts level, and may improve seeing the top of the tree.

The following images show the two variations of the standard method. Either way is effective, but the second method gives better vision, so less exposure to unseen hazards:

- Felling the tree using a scarf made with the **bottom** of the chainsaw bar. This is the method many thinners use which means putting the scarf on the right side of the tree, as facing the thinner. The back of the bar is used for the back cut.
- Felling the tree using a scarf made with the **top** of the chainsaw bar. The scarf is cut on the left side of the tree with the top of the bar used for cutting. The back cut is made with the bottom of the bar.

Conventional scarf (bottom of the bar)

A 45-degree top cut of the scarf, using the bottom of the bar.

B Level bottom cut of the scarf, using the bottom of the bar.

C Back cut, 10% diameter above the top of the scarf, using the top of the chainsaw bar.

Alternative scarf (top of the bar and trees to 30cm with bar tip clear of tree)

A 45-degree top cut of the scarf, using the top of the bar. 20% of the bar is beyond the end of the cut.

B Level bottom cut of the scarf, using the top of the bar.

C Back cut, 10% diameter above the top of the scarf, using the bottom of the chainsaw bar.

Using the top of the bar to apply the 45-degree cut has advantages:

- Approaching the tree from the left-hand side (facing downhill), the thinner doesn't have to walk or trim all the way around to the right-hand side.
- If kickback occurs, it will drive into the tree.
- It is ergonomically easier to get the saw in the correct position to do the scarf flat cut.
- Better grip on the saw as there is more room for the left hand to hold the top handle.

Looking down the 45-degree cut makes it easier to line up the bottom scarf cut.

Keep your body in balance for safer and easier felling.

DO NOT use the top of the bar method on:

- **Trees over 30 cm**
- **Where the bar tip is NOT clearly seen throughout the 45-degree cut.**
- **When the bar tip is NOT well clear of the cutting zone.**

Trees over 20 cm – Split level back cut method - one wedge

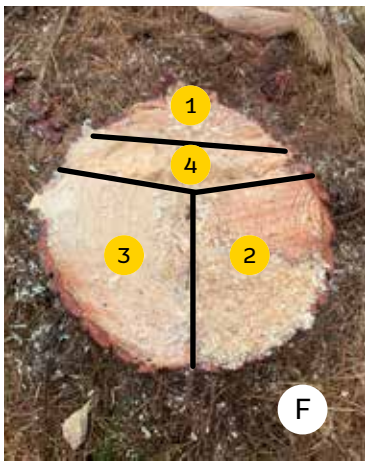
This technique can be used on back-leaning trees. Most back-leaning trees need wedging to fall them. The split-level quarter-cut method enables using wedges without the risk of cutting into the wedge with the chain.

Using wedges enables trees to be directionally felled. This is useful when felling away from restricted areas, such as the edges of roads, waterways, native areas, or archaeological sites.

A Cut a smaller scarf than normal.

B Cut half of the back cut, the side away from the escape route. Make sure it is level and has the correct hinge.

C Place wedge with barbs down in the cut. If the tree has a heavy lean one way, place the wedge so that it counters that lean. Otherwise, place the wedge close to the centre of the back cut.



D Cut the second half of the backcut about 1 – 2 cm below the first cut but still 10% of the tree's diameter above the scarf. Angle the saw up so that when finished, it is at the same height as the first cut through to the hinge wood.

E After completing the second cut, the tree may start to fall. If not, hit the wedge until it starts to fall, then move back along the escape route.

F The three cuts. 1 = the scarf, 2 = first half of the back cut, 3 = the final half of the back cut. 4 = Hinge wood.

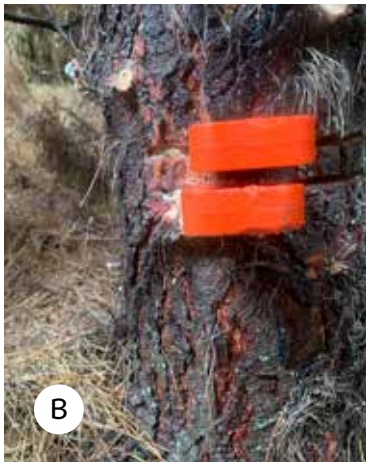
Left: A closer look at the second cut. **Right:** A closer look at the stump shows the two back cuts and the hinge wood.

Hit the wedge in till firm. This will help preload it with energy and hold the back cut open.

Push the saw forward 3-4 cm parallel with the hinge after doing the first half of the back cut. This removes a small triangle of hinge wood that otherwise gets created by the shape of the tip of the bar when the two half cuts meet.

Trees over 20 cm – Split level back cut - two wedges double lift method

The method is like the one-wedge method with an extra wedge. An extra wedge helps directionally fall heavy-leaning trees away from restricted areas.



A Cut first quarter cut. Place the second about 2 cm above the first one.

B Place a wedge with barbs down into both cuts directly above each other. As with the one wedge method, if the tree has a heavy lean one way, place the wedges so that they counter that lean.

C Cut the second half of the back about 1 – 2 cm below the first cut but still 10% of the tree's diameter above the scarf.

D Taken from the escape route side of the tree, the cuts were completed before hitting the wedges to fell the tree.

E The stump and tree clearly show the different cuts and the wedge placements.

Consider using the two-wedge double lift method if:

- There isn't enough room to get a single wedge fully into the cut.
- If the back lean is creating more pressure.
- One wedge won't create enough lift.

Trees over 20 cm – Bore and release cuts

Use this method to fall difficult trees that could cause the tree to split (barber-chair) when felling. Using a bore cut helps to release the internal tension that can lead to a dangerous barber chair. Examples of situations it can be used are:

- Trees with heavy forward lean
- On windy days when the wind is blowing hard in the felling direction.

A Scarf the tree. If the tree has a heavy lean, place the cuts so they are leaning with the tree, too. The scarf may need to be smaller because the tree could pinch the bar while making the scarf.

B Start boring through the tree from the escape route side. Cut at approximately half the diameter and at the height of a normal back cut. Bore parallel with the front of the hinge.

C Once through the tree:

- First, bring the bore cut forward to establish the back of the hinge wood. Don't cut too much hinge. Otherwise, the tree could move forward and pinch the bar.
- Second, move the saw towards the back of the tree, stopping with about ¼ of the diameter left uncut. Leave even more uncut wood If the tree has a big lean.

D Remove the saw, place a wedge, and start the release cut below the bore cut at a similar height to the scarf.

E The tree should fall without hitting the wedges.

F The stump clearly shows the hinge wood, bore, and back cuts.

When starting the bore cut, use the correct technique with the bar tip.

Managing hang-ups

A tree is 'hung up' if it is caught up in another tree so it is not lying on the ground.

Hangups are also a hazard if they are not removed. Forest managers require removing hang-ups unless it is too risky or outside of your skill set. However, if left, they need to be located on the map and preferably flagged in the field with tape.

There are four methods to remove hang-ups.

The driving method

The following information is based on the tree-driving policy within the FOA Tree Felling Best Practice Guide:

Planning a tree drive must follow the five-step felling plan, with some additional points:

- Thinners must call in before and after a tree drive.
- All trees in the drive must be assessed before any felling cut is made.
- Every tree being driven must be wedged.
- There must be two wedges available for the driver tree.
- Thinners must carry a minimum of three wedges but will need more if driving one-onto-two or more trees.

– An observer is needed if driving more than one-onto-two trees.

Also, the following points apply:

– The two-tree-length rule applies to both the driving tree and the tree being driven.
– The contact person must be advised when a tree drive is planned and again when it's successfully completed.
– A competent person must be available to answer questions about safety issues.

If a one-onto-two drive tree is unsuccessful, the next alternative is to post the tree.

The brushing method

Brushing is when you fall another tree onto the hang-up tree, one that is past the point of no return, to force it down. It may take several trees to brush the hang-up down successfully. The hung-up tree must be on a lean where it can't come back at the thinner when brushed down. The difference between brushing and driving is a driven tree could come back on the thinner if not driven correctly.

Radio call in before and after successfully completing brushing.

A Hung up tree, well beyond 'point of no return'.

B Preparing to fall another tree onto the hung-up one.

C A successful brushing job. Both trees are on the ground.

Brushing is only used if there is no chance of the hang-up coming back towards the thinner.

The posting method

Posting is a way to bring down the hung-up tree in small sections until it is safely on the ground. To post a hung-up tree safely:

- Position yourself away from the direction of fall and have an escape route.
- Never work under a hang-up.
- Watch for stem movement when applying cuts.
- Never post above shoulder height.
- Wherever practicable post from the uphill side of the hangup.
- Keep checking the escape route as the posting position changes.

When cutting:

- Cut the compression side first, which is normally the top.
- Cut the tension side last, which is often the bottom side.
- Keep post lengths no longer than 1.2 meters. Shorter posts give more control of the fall.
- One post at a time.
- Cut at right angles to the stem.
- Don't cut on steep angles as this creates a sharp edge that can cause serious harm if it hits the thinner.
- Where possible, keep the left-hand side of the bar pointing up. If kickback occurs then it will move away from the thinner.
- Be prepared to let the saw go if the saw gets pinched rather than getting dragged into the hangup.

A Top cut into compression wood,

B Bottom cut (tension wood) releases tension to allow the section to fall.

C Repeated until posted tree is fully on the ground.

Cutting the posts too long creates more risk of butt swing.

Cutting the posts at an angle too steep across the grain may cause the tree to drop onto a foot or leg.

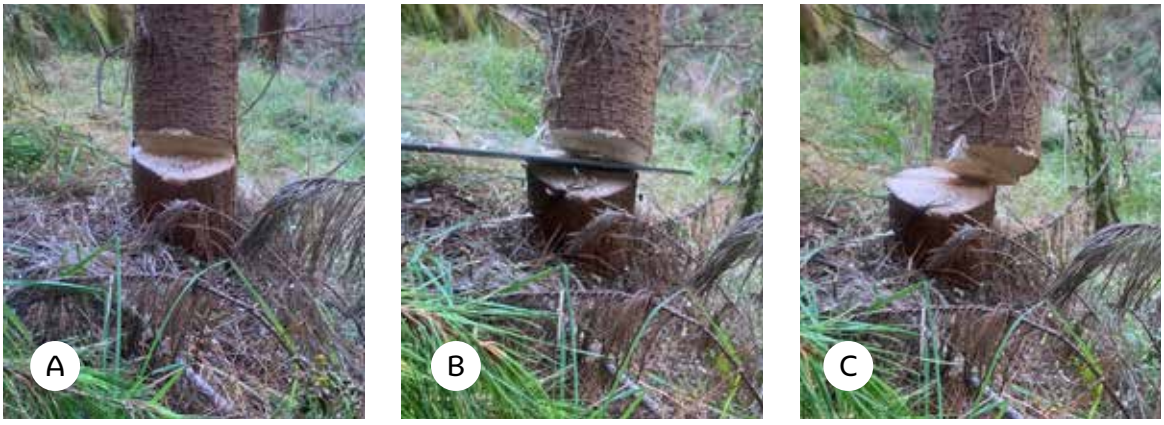
Alphabetical order: compression wood first, tension wood second.

The rolling method

Rolling is used to help a hung-up tree roll off the side of the tree it has landed on.

Rolling is only used if the hinge wood has not been cut all the way through and the tree is unlikely to come back towards the thinner.

Rolling involves removing one side of the hinge to allow the tree to roll down the tree it has hung up on.



A Top cut into compression wood.

B Bottom cut (tension wood) releases tension to allow the section to fall.

C Repeated until posted tree is fully on the ground.

Stand on the opposite side of the tree to the roll direction.

WAIT until the hung-up tree has come to rest before you use the rolling techniques.

Be aware of the risk of the bar tip pinching.

Stem movement, rebound and butt swing

The main causes for a stem to move or rebound towards the thinner after the tree has fallen are if the tree:

- Crosses over a hung-up tree and cantilevers sideways or backwards.
- Is felled uphill, then slides back down the slope.
- Is felled into standing trees and then rebounds off the stump.
- Lands on an obstacle or a terrain feature that makes it rebound.

Follow the 5-step felling plan to minimise the risks from stem movement, rebound and butt swing.

To minimise the hazard of stem rebound, thinners should:

- Have an escape route cleared at an angle to the felling direction.
- Finish the felling cut on the safest side of the tree.
- Watch the tree as it falls.
- Move away from the stump as the tree falls.
- Avoid felling uphill whenever possible.

A The tree has rebound because the scarf was not completed.

B Rebound due to the hinge wood being cut through.

Felling Douglas fir

Thinning for value in Douglas fir stands is different from radiata pine. This section will only describe the differences and not repeat information that is applicable to both radiata pine and Douglas fir.

- Generally, Douglas fir stands have a higher initial stocking than radiata pine. Higher stocking can reduce undergrowth.
- Trees can have a larger lower stem diameter.
- Douglas fir can have heavy bottom branching with a light crown weight. This can make it difficult to get the tree onto the ground through the canopy, especially as upper branching between trees can also intertwine.

Trimming

The bottom branches of Douglas fir are quite often longer, more numerous and harder than radiata and other pines.

This creates more resistance when cutting, increasing the risk of kickback.

When trimming, a good approach is to put the saw in through the branching where there is a clear view of the left side of the bar and apply downstrokes.

Felling Douglas fir

Standard felling practices, as described in the BPG, apply to Douglas fir. However, because it can be harder to get the trees to fall due to branching and tree shape, there are some minor modifications that may help:

- Scarfing trees less than 20cm makes them fall easier.
- Make the scarf deeper so it is larger than with radiata pine.
- Make the back cuts slightly lower.

Increasing the scarf size from 1 /4 to 1/3 of diameter may help felling.

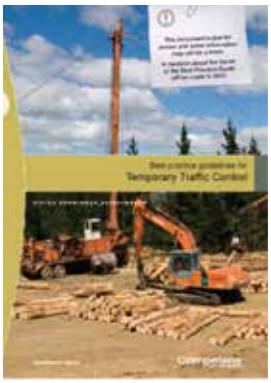
Keep the hinge wood at a minimum of 10%!

Other resources

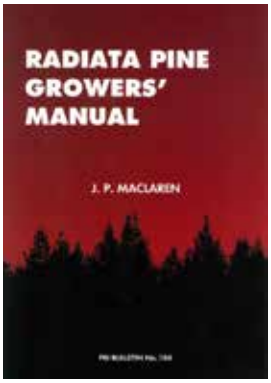
There are other useful thinning resources. These include:

Treefelling Best Practice Guide
An excellent resource to learn more about tree felling.

nzfoa.org.nz/resources/file-libraries-resources/health-safety/628-tfellingbpg/file



Temporary Traffic Control
safetree.nz/resources/traffic-control-on-private-roads-bfg



Radiata Pine Growers' Manual
The 1993 document provides good general information on radiata pine, including thinning.

canopy.govt.nz/forestry-resources/radiata-pine-growers-manual/

Key definitions

Definition	Meaning
5-Step felling process	A process developed to minimise risk during the felling operation
Brushing	This is felling another tree in the direction of a hang-up to brush it down when there is no chance of the hang-up coming back towards the operator. It may take several trees to brush the hang-up down successfully, a common practice with chainsaw thinning.
Competent person (ACOP)	A person who can consistently demonstrate the skill and knowledge derived from experience and/or training for the type of work in which the person is employed and the approved code the person is required to work under.
Cut up tree	Any tree that has had the first felling cut applied.
Driving	Driving is when you fell another tree on to the hang-up tree to in an attempt to bring it down.
Felling Plan	A plan made by the contractor or crew manager outlining how the trees in a block will be felled.
Hung-up tree	A cut tree or uprooted tree that is caught in or lodged against another tree, preventing it from falling to the ground.
Job prescription	Written instructions a contractor receives from the forest owner (or manager), setting out the requirements for the thinning operation.
Kink	A kink is a sudden change or deviation in the main stem of a tree. It is usually caused by the original leader being broken out by wind or snow. A new leader takes over from the break point.

Pith	The pith is the centre of the tree from which it grows. It is usually dark brown and spongy in radiata.
Qualified (ACOP)	A person who holds an industry-recognised NZQA qualification for the type of work in which they are employed.
Small end diameter (SED)	The SED is the diameter of the small end of a log. It is measured under the bark and is used to help classify logs based on size.
Spike knot	A spike knot is created in lumber when a branch exits the tree at an acute or steep angle. Spike knots are less desirable in trees or logs as they create low-grade timber when processed.
Sweep	The gradual curve in a tree or log.
Thinning for value	Thinning trees to maximise the future returns to the forest owner or manager.
Tailgate Meeting	A daily meeting is held in the morning, before the operation starts, to decide the specific needs for that day. The main points discussed must be recorded and understood by everyone involved in the operation.
Tree-length rule	The safety zone applied to tree felling operations. A minimum distance of two tree-lengths must be maintained between the tree felling operation and any other person or operation.
Under training (ACOP)	A person who is not competent or qualified to carry out the task unsupervised and is working toward an industry recognised NZQA qualification under the guidance and training of a competent person.
Whorl	A series of three or more branches in a single plane.
Windthrow	Trees are blown down by the wind or partially uprooted. The stem may have snapped off the root plate or still be attached.
Wobble	This is a sweep in two directions on the same plane.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