PART E

Mobile plant and harvesting

IN THIS PART:

TERM OR SYMBOL	MEANING IN THIS DOCUMENT
Must	A mandatory legal requirement under HSWA or regulations.
Other wording including 'check', 'make sure', 'design', 'do not'	How WorkSafe expects certain health and safety risks to be managed. This is not mandatory to follow – you may adopt other practices, as long as these practices provide a level of health and safety as good as or better than the standard in this code.
You/your	Refers to the PCBU involved in forestry and harvesting operations.

18.0
Introduction to Part E

IN THIS SECTION:

18.1 What does this Part cover?

18.1.1 This Part covers managing the risks of:

- mobile plant
- mechanised harvesting including winch-assisted harvesting
- manual felling including machine-assisted felling
- cable logging including manual breaking out.

18.2 What are the common health and safety risks faced by workers?

18.2.1 Table 15 gives examples of how workers can be harmed.

18.2.2 There may be hazards that are not identified in this table. You will need to identify and assess health and safety risks arising from your own work.

WHAT COULD GO WRONG?	POSSIBLE CAUSES
Workers being hit by falling objects	– broken branches sitting in the canopy – trees during felling including rebounding butts – dead trees.
Workers being struck by stems, dislodged material or rigging, including while breaking out	– being hit by loose objects, rocks, stems, branches and pieces of wood in the cut over – being hit by rolling or sliding stems while working on steep slopes below the landing.
Workers being struck by ropes, chains or cables	– being struck by equipment, ropes, rigging which fails – wire rope sprags.
Workers being struck by mobile plant	– see Section 19.
Mobile plant tipping, rolling or losing control	– see Section 19.
Impaired or distracted workers making mistakes resulting in injuries	– fatigue from long work hours, working at night or long travel times to worksite – dehydration – being under the influence of drugs or alcohol – distracted by cellphones, work pressures, home pressures.
Workers harmed during repairs or maintenance activities	– plant not being de-powered/no energy isolation.
Workers being harmed by poor or extreme weather conditions	– sun/UV exposure – hot or cold temperature extremes – heavy rain, flooding – strong winds.
Workers being injured carrying out manual tasks	– repetitive physical actions – operating mobile plant controls.
Workers being exposed to harmful fumes, excessive noise or vibration, cutting edges for example, while using plant	– excessive noise from machines – chainsaw hazards such as kickback.
Workers being injured in slips, trips and falls	– difficult terrain (for example, steep slopes, waterways) – falls when working at height.

TABLE 15: Examples of what could go wrong – harvesting

18.2.3 The following guidance provides good practice on how to manage these risks. To manage the health risks, see Section 3.5.

18.2.4 Guidance that is common to activities (for example, on requirements for worker training) has been placed in Part B.

18.2.5 See Appendix 6 for an approach to manage health and safety risks.

19.0
Mobile plant

IN THIS SECTION:

19.1 Introduction to mobile plant

19.1.1 Mobile plant is an essential part of the forestry industry. Examples include:

- wheeled and tracked skidders
- forwarders
- excavator-based machines
- haulers
- mechanised harvesters and processors
- wheeled loaders
- bulldozers
- other vehicles like light utility vehicles (LUVs) or quad bikes to move people or things.

19.1.2 In this document, 'mobile plant' does not include log trucks, utes or crew vans.

19.1.3 Each machine has its own characteristics and requirements and will have its own risks to be managed.

19.1.4 This section looks at the general risks of mobile plant and how to manage them. Some of this guidance applies only to certain mobile plant. For industry guidance, see Resources webpage

19.1.5 Table 13 describes how workers can be harmed.

19.1.6 There may be hazards that are not identified in this table. You will need to identify and assess health and safety risks arising from your own work.

WHAT COULD GO WRONG?	POSSIBLE CAUSES
Ground workers being struck by mobile plant or being hit by object while working close to mobile plant	– poorly managed mobile plant/ground worker separation – hit by object struck by mobile plant (for example, stems) – mechanised processor chain breaking (chain shot).
Operators injured while using mobile plant	– mobile plant tips or rolls – intrusion of object into the cab (for example, stems) – poorly maintained or defective safety equipment and structures – hydraulic equipment fails.
Workers are harmed during servicing and maintenance	– lockout-tagout system not used – machine not de-energised – incorrect maintenance procedures.

TABLE 16: Examples of what could go wrong - mobile plant

19.2 PPE

19.2.1 It is industry best practice for the following PPE to be used:

- high-vis shirt, vest or jacket with day-night for added visibility
- high-vis helmet
- hearing protection (Grade 5)
- safety footwear (make sure machine operators do not wear spiked footwear)
- gloves – leather or thick cotton (when dealing with wire ropes or chains)
- protective eyewear.

19.2.2 Section 10 explains the requirements you **must** meet if you are using PPE to minimise risks.

19.2.3 Appendix 7 contains relevant standards for PPE. Look for the mark/stamp on the PPE to check it is compliant with the relevant standard.

19.3 Safe machine

19.3.1 A PCBU who manages or controls plant at a workplace **must**, so far as is reasonably practicable, ensure that the plant is without risks to the health and safety of any person.

19.3.2 PCBUs **must** ensure, so far as is reasonably practicable, the provision and maintenance of safe plant and the safe use, handling, and storage of plant.

Safety and protective structures

19.3.3 Make sure any mobile plant brought into the forest is safe and compliant for its planned use.

19.3.4 Make sure mobile plant has appropriate protective structures and equipment that:

- are certified by the manufacturer or a Chartered Professional Engineer
- are suitable for their planned use
- meet or exceed industry or equivalent standards (Appendix 7).

19.3.5 Table 17 shows examples of protective structures and equipment. In some cases, and particularly with more modern machines, these different protective structures could be the same structure.

MACHINE, LOCATION AND TASK	HAVE THE FOLLOWING PROTECTIVE STRUCTURES AND EQUIPMENT
Machines working in or near standing trees	– falling object protective structures (FOPS)
Machines working where there is risk of objects entering the cab	– operator protective structures (OPS) – approved chain shot guards – polycarbonate protective windshields appropriate for the proposed use and risk (for example, 32mm on the front shield of a harvester or processor)
Machines (not including hydraulic excavators) working on sloping or rough terrain that may cause instability	– rollover protective structures (ROPS) – an approved seatbelt system or other safety restraint (Appendix 7)
Hydraulic excavators working on sloping or rough terrain that may cause instability	– cabin operator protective structures (COPS) or tip-over protective structures (TOPS) – an appropriate seatbelt system or other safety restraint (Appendix 7)
Machines working at night	– lights capable of illuminating the area being worked
Machines with structures that may come into contact with overhead power lines	– appropriate warning displayed in the cab – consider use of proximity alarms or warning devices
Machines with exposed drumlines and rotating flywheels	– guarding in place and secure.
Machines with hydraulic systems involved in lifting, for example, lifting trailers	– hose burst protection.

TABLE 17: Protective structures and equipment for mobile plant

19.3.6 For more information, see Resources webpage

Emergency exits

19.3.7 Make sure all machines and processors have emergency exits that can be activated internally and externally.

19.3.8 For the emergency exits, make sure:

- there are at least two (2) emergency entry/exits that can be manually opened
- emergency exits are not blocked or hindered by protective structures
- all emergency exits are accessible and usable by the operator – the operator will be able to exit quickly in the event of an emergency
- tools required to activate emergency exits (for example, hammers for glass) are kept in the machine
- where the machine has doors with latches, the latches function properly. Make sure doors are kept closed and latched when the machine is in use
- there is a process in place to get operators out if all emergency exits are blocked or cannot open.

19.3.9 Make sure training for machine operators includes checking their knowledge and use of emergency exits in the machine they will be operating and their ability to easily use those exits.

Working near water

19.3.10 Make sure there is a process to manage the risk of water entering the cab if the mobile plant enters the water. Consider the suitability of emergency exits (can they be manually opened?), escape tools, and a supplementary breathing system.

Braking standards

19.3.11 Make sure:

- all machines have a braking mechanism capable of holding itself and its load on any slope which it is operating on
- where winch-assist is being used, the winch braking system is capable of holding the machine if traction or stability is lost. (see Section 20.5).

Fire extinguishers and fire suppression systems

19.3.12 Make sure the type and number of fire extinguishers are appropriate for the size of the machine and they are serviced as recommended.

19.3.13 Make sure fire extinguishers are secured, easily identified, and easily accessible.

19.3.14 Make sure plant has a fire suppression system in the engine bay, so far as is reasonably practicable. If you do not have a system, you need another method to adequately manage the risk of fire in the engine bay.

19.3.15 Machinery used in the forest needs to be turbo-charged or needs to be fitted with efficient spark arrestors.

Seating, seatbelts and seat restraints

19.3.16 Have ergonomically designed seating and controls to minimise risk to the operator. Have seating with pneumatic or other suspension-type vibration mechanisms.

19.3.17 Have seating and controls that can be adjusted to suit the operator.

19.3.18 Make sure all mobile plant is fitted with seatbelts that meet relevant industry standards (Appendix 7). For mobile plant working on slopes with a gradient greater than 8 degrees, fit the plant with multi-point harnesses which provide shoulder restraint.

19.3.19 Make sure seatbelts and harnesses are always worn when the machine is in operation.

Emergency stop

19.3.20 Make sure mobile plant operated on steep slopes have an emergency stop button that immediately brakes the machine or winch (if relevant).

19.3.21 If the plant is used as a winch-assist anchor, have a monitoring system to detect machine movement (see Section 20.5).

Objects secured in cab

19.3.22 Secure all loose objects in the cab so they do not interfere with the operator or the safe operation of the mobile plant.

19.4 Safe practice

Machine operation

19.4.1 Operate all mobile plant to the manufacturer's specifications and limits (if supplied) or as modified by a suitable competent person.

19.4.2 Develop and put in place a specific hazard management plan if there is any risk of instability of the mobile plant because of slope, terrain or ground conditions.

19.4.3 Make sure the operators are familiar with:

- where the operator's manuals are kept
- the daily pre-start checklist
- what safety devices are fitted, how they operate and how they are to be maintained
- the lockout procedures for the machine
- how to de-energise the plant.

19.4.4 Do not allow workers to get on or off a moving plant.

19.4.5 Do not allow workers to ride in mobile plant unless it has proper seating and seat restraints for that person – this applies particularly to carrying passengers.

19.4.6 Make sure that if the mobile plant is left unattended with the engine running or shut down:

- the brakes are applied
- any blades, attachments or accessories are rested on the ground.

DAILY PRE-START CHECKS

19.4.7 Make sure all mobile plant has a pre-start check in accordance with manufacturer's recommendations, as well as worksite procedures. This is both for the mechanical safety of the mobile plant and the safety of the operator.

19.4.8 Check (as relevant):

- the fluid levels
- the cooling system (including coolant levels)
- the hydraulic hose condition
- the tyre and track condition
- the condition and security of machine guarding, access ladders and handrails
- the operator protective structures
- the fire suppression system
- for debris in the engine compartment
- the appropriate equipment is in operator's cab.

19.4.9 Make sure the operator checks daily:

- the mobile plant's controls and safety devices
- that all objects in the cab are secured
- that any repairs or due maintenance are noted and reported.

Safe procedures for maintaining and repairing mobile plant

19.4.10 Service and maintain all mobile plant in keeping with the manufacturer's recommendations. This includes daily pre-start checks and regular audits.

19.4.11 Note and repair all machine faults.

19.4.12 Remove the mobile plant from use if the fault puts the safety of the mobile plant and operator at risk. Do not use the mobile plant until it is repaired.

19.4.13 Make sure tagout or lockout tag is attached.

19.4.14 Make sure your procedures for maintaining plant in the field are followed.

19.4.15 If you engage a service provider:

- make sure they have knowledge and experience in repairing or maintaining the plant type
- complete a handover of the plant including the current lockout, de-energisation state and any other lockout points required
- inform the service provider of risks (this includes for any felling heads)
- agree on how the risks are managed at the site.

19.4.16 This is an example of how you might manage the risks while maintaining and repairing mobile plant:

1. Think about what could go wrong.
2. Have a plan and make sure that everyone knows what is going on and who will be doing what.
3. Have a designated area for repairs (if possible):
   - Cone the area off.
   - Make sure that everybody knows that any machine in there is not to be operated.
4. Before starting repairs or maintenance make sure all attachments are on the ground.
5. Isolate the plant. Engine off, take the keys out of the ignition, isolator on (if it has one).
6. Turn the computer off.
7. Put in any locking pins for booms, heads and anything else that requires them.
8. Remove residual hydraulic pressure in the operating lines. As an extra precaution, if working on hydraulic hoses, 'crack' the hose by a turn, stand back and give the hose a wiggle just in case there is residual pressure.
9. Put 'Do not operate' tags on the machine. Make sure that they are large and easily seen. Put them in critical places such as the cab door and inside where the operator's controls are.
10. If working on fuel lines, get expert advice. Do not touch them unless the engine has been switched off for at least 10 minutes.
11. If putting the machine on blocks, do not allow any body part between the top of the block and the frame of the machine.
12. Chock wheels to prevent any vehicle movement.
13. At every step, always think 'What if?'

19.5 Safe site

Managing worker/mobile plant separation

19.5.1 Make sure mobile plant operators are aware of who is in their work site, and where they are.

19.5.2 Stop work if there is any risk that a worker is in the vicinity of plant, and any worker who is not accounted for, or cannot be seen by the operator. Do not restart work until the operator knows where that worker is.

19.5.3 Make sure no workers approach mobile plant without:

- contacting the operator saying that they want to approach
- receiving clear approval to approach from the operator
- the machine being in the at-rest position.

19.5.4 More information about the separation distances for specific activities can be found in the relevant sections.

19.6 Using LUVs and quad bikes to move people or things

19.6.1 Other vehicles like LUVs and quad bikes are used in many forestry operations, particularly silviculture. While small compared with most forestry mobile plant, they still pose considerable risk, particularly from rollover.

19.6.2 Choose the right vehicle for the job – take into account the work, the terrain, the capability of the vehicle and its safety features.

19.6.3 If such vehicles are used, make sure:

- the vehicle has appropriate operator protection against the risk of rollover or tipping
- that operators have a communication system
- passengers are not carried unless the vehicle has been designed for carrying passengers
- equipment carried in vehicles or on attached trailers is safely secured
- appropriate helmets are provided and kept with the vehicle for the number of people it is permitted to carry
- the operator and any passengers wear the seatbelts and helmets provided.

20.0 Managing the risks – mechanised felling

IN THIS SECTION:

20.1 Introduction

20.1.1 Mechanised harvesting is where machines are used for felling and delimbing.

20.1.2 For further information on safe working practices, look at industry guidance, see Resources webpage

20.2 PPE and other equipment

Personal protective equipment (PPE)

20.2.1 It is industry best practice for the following PPE to be used:

- high-vis shirt, vest or jacket with day-night for added visibility
- high-vis helmet, when working outside a protected cab
- safety footwear
- hearing protection
- gloves (when working with wire ropes and chains).

20.2.2 Other useful equipment includes a small personal first aid kit.

20.2.3 Section 10 explains the requirements you **must** meet if you are using PPE to minimise risks.

20.2.4 Appendix 7 contains relevant standards for PPE. Look for the mark/stamp on the PPE to check it is compliant with the relevant standard.

20.3 Safe site

Managing worker/machine separation

20.3.1 Before planning any mechanised felling operation, think about:

- where the operation is taking place
- what other activities are happening nearby
- who else may be in the area.

20.3.2 Once you have this information, determine the hazard zone(s) considering the following.

MAKE SURE WORKERS ON FOOT DO NOT ENTER WITHIN TWO TREE-LENGTHS OF A WORKING FELLING MACHINE

20.3.3 This is the minimum zone to protect workers from sailers or breakage from the felled or nearby trees (Figure 17). There may be circumstances when a larger zone is needed.

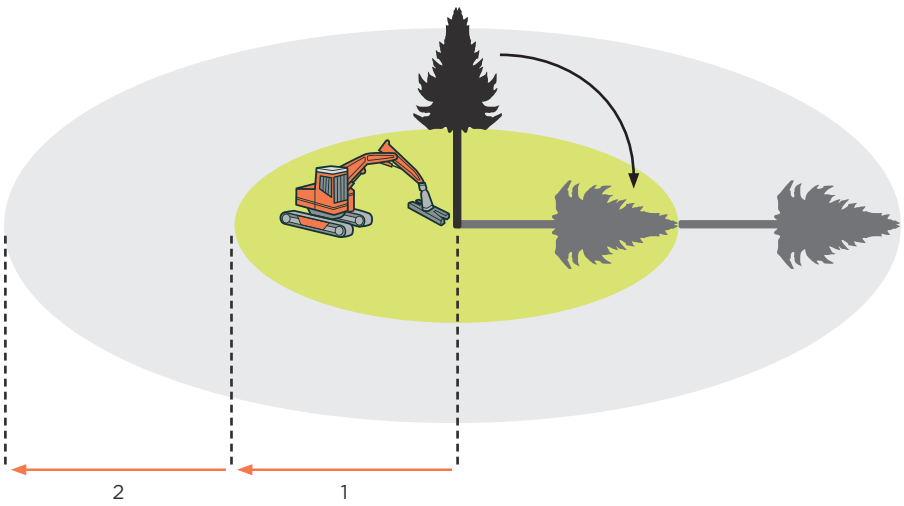


FIGURE 17: Danger zone for workers around working felling machines

MAKE SURE WORKERS STAY OUT OF AREAS WHERE STEM MOVEMENT COULD OCCUR AFTER FELLING, PARTICULARLY IF FELLING DOWNSLOPE OF THE MACHINE

20.3.4 Figure 18 shows the danger zone.

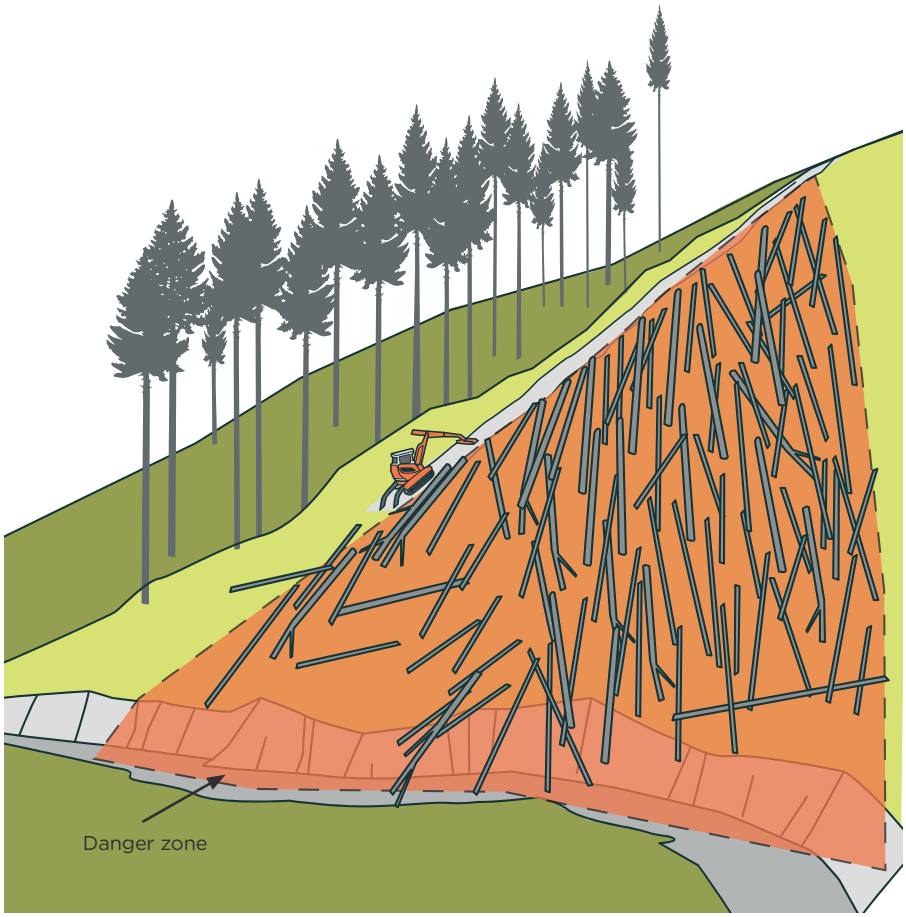


FIGURE 18:
Danger zone from stem movement downslope

MACHINE SEPARATION

20.3.5 Make sure other machines maintain a safe distance unless the risk is well managed.

WORKERS APPROACHING A MACHINE

20.3.6 Make sure workers on foot:

- do not approach a machine without first contacting the machine operator and letting them know their intentions
- only approach when they have permission.

20.3.7 Before machine operators give permission to workers to approach (or get out of the cab), make sure the operator:

- stops the task they are doing
- lowers any raised implements
- locks out the hydraulic system
- applies the brakes.

CHAIN SHOT

20.3.8 Make sure workers are at least 70m away from the cutting direction of the saw chain. This is due to the risk of chain shot from the chain breaking (Figure 19).

20.3.9 If there is a natural or man-made barrier between the saw chain and workers, this distance could be reduced once a risk assessment is carried out.

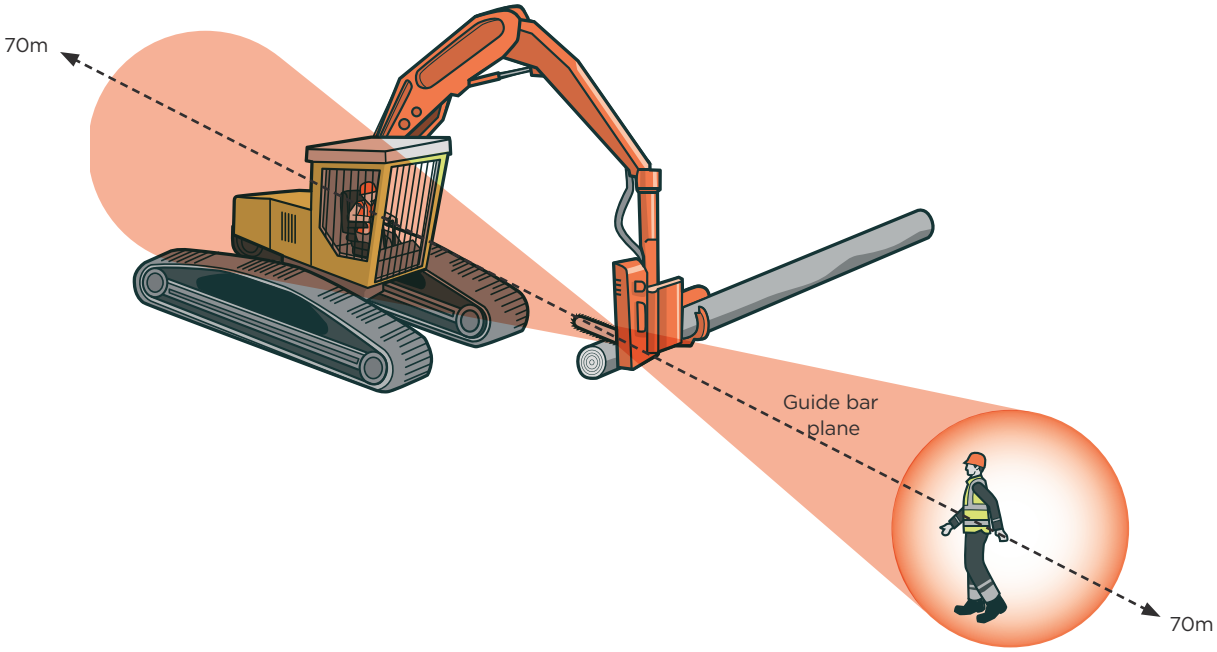


FIGURE 19: Minimum 70m exclusion zone to protect against chain shot injury[3]

20.3.10 Have a sign warning about entering a chain shot zone at the entrance to all working skid sites with processing machines working.

Managing terrain

20.3.11 Each machine make has its own unique features that will determine the exact slope limits for the machine.

20.3.12 When planning the work activity, carry out a risk assessment considering:

- the machine(s) to be used. Are they designed to be used on slopes? Will you use a winch?
- surface condition including slope and soil type, and soil moisture content
- operator experience
- any changes expected during the day.

20.3.13 To assess those limits, Safetree's Steep Slope Risk Assessment tool may be useful.

[3] Adapted from OSHA Oregon's Hazard alert Chain Shot Logging Hazard

20.4 Safe practice

20.4.1 A PCBU who manages or controls plant at a workplace **must**, so far as is reasonably practicable, ensure that the plant is without risks to the health and safety of any person.

20.4.2 PCBUs **must** ensure, so far as is reasonably practicable, the provision and maintenance of safe plant and the safe use, handling, and storage of plant.

20.4.3 Table 18 shows examples of sources of harm from mechanised felling and possible control measures to consider when managing risk.

20.4.4 There may be hazards that are not identified in this table. You will need to identify and assess health and safety risks arising from your own work.

SOURCE OF HARM	POSSIBLE CONTROL MEASURES
Unexpected tree movement	– Make sure the machine has appropriate protective structures. – Do not exceed machine/operator capabilities. – Make sure operators: - assess tree characteristics and fall direction - use proper felling cuts - keep cab door closed - fell uphill (unless on a winch-assist or tether) making sure the swath width is matched to the slope.
Working too closely to ground workers	– Make sure operators: - keep workers beyond two tree-lengths - make sure felling is stopped if distances are breached.
Unplanned machine or component movement	– Make sure operators: - position machine stably - stay within machine/slope capabilities - control slew speed to suit load size.
Working too closely to other machines	– Make sure operators: - avoid close proximity to other machines unless planned and the risk is managed (for example, used to avoid using a manual faller). - maintain communication with the other machine.
Machine instability resulting in machines overturning	– Make sure operators: - stay within slope capabilities for the ground conditions - keep weight of machine and boom over front of machine on slopes (unless on winch-assist or tether) - choose travel paths that avoid side slopes, slumps and soft ground - wear a seatbelt or harness when operating the machine - use caution when slewing downhill.
Broken saw chain resulting in chain shot	– Make sure: - unprotected workers are kept at least 70m away - machines have the appropriate protective structures and glass.
Difficult terrain and micro-slope conditions resulting in machines overturning	– Identify hazards beforehand. – Make sure operators: - stay within machine capabilities - choose safe travel paths - fell uphill when possible - wear a seatbelt or harness when operating the machine.
Overhead hazards (trees, sailors, broken heads) falling on workers	– Make sure operators: - check harvest plan for known hazards and risks - check for overhead hazards before exiting cab - wear PPE (helmet and high-vis) outside cab - check for ropes/guylines in cable logging operations.

SOURCE OF HARM	POSSIBLE CONTROL MEASURES
Contacting overhead power lines – electric shock	– Make sure operators follow procedures for work near power lines including having the appropriate permits. – Add signs to warn of powerlines. – Have a planned and marked area to cross underneath powerlines.
Slipping when exiting the main cab	– Make sure operators: - check surroundings before exit - climb off machine – do not jump - wear the correct PPE (for example, non-slip footwear) - maintain 3-point contact when descending steps.
Poorly maintained or defective safety equipment	– Maintain protective structures to required standards. – Make sure operators do not operate defective equipment until the problem has been fixed. – Have qualified engineers assess any damage.
Hydraulic equipment failing	– Make sure operators: - never work under raised equipment. Make sure equipment is lowered to the ground and chocked and stable before entering danger zone - wear full PPE (gloves, protective clothing, approved eye protection) for work on live or pressurised systems - turn off machine and reduce hydraulic pressure before work.
Harm during maintenance of the felling head	– Make sure operators: - use a lockout-tagout system when repairing, maintaining and servicing any mobile plant - turn off and de-energise machines before starting any maintenance on the head - lower all equipment to level ground - do not move, modify or remove any safety devices - use a locking pin to secure the head - follow proper lifting procedures when removing any heavy components - wrap sharp items for protection - use hydraulic lock-out to immobilise the machine - turn off the computer.

TABLE 18: Sources of harm from mechanised felling and possible control measures

20.5 Winch-assisted harvesting systems

20.5.1 Winch-assisted harvesting is a system that uses wire rope(s) attached to a harvester that is safely anchored uphill allowing operation on steep slopes.

20.5.2 These machines are used to provide winch assistance for a range of uses including:

- harvesters felling trees
- knuckle boom loaders/excavators engaged in shovel-logging stems
- skidders or bulldozers used for stem extraction
- standard excavators for land preparation
- forwarders moving up and down slopes
- assisting mobile plant to relocate.

20.5.3 For industry guidance, see Resources webpage

Winch-assist anchoring systems

20.5.4 The PCBU operating the plant needs to make sure:

- the winch braking system is designed and tested to ensure the machine holds if traction or stability is lost on the slope the machine is operating on
- it has Original Equipment Manufacturer (OEM) certification or a Chartered Professional Engineer (CPEng) has certified the winch-assisted steep slope harvesting system as designed, tested and demonstrated to be safe. This includes an assessment of:
  - fail-to-safe design features
  - safe operating procedures
  - inspection and maintenance schedules
  - a list of all rigging components and their breaking loads
- if a machine is significantly modified after the manufacturer's original certification, a CPEng has certified the modification is safe (for example, an excavator being re-purposed by attaching a winch for steep slopes)
- the tension on the wire rope is not greater than 33% of its breaking load at all times
- the maximum operating weight of the mobile plant does not exceed the rated breaking load of the wire rope. This applies to all rigging components. The maximum operating weight is the weight when fully loaded
- an emergency back-up system is incorporated into the operation to ensure the stability of the mobile plant if the winch, wire rope or anchor fails.

20.5.5 Make sure all winch-assist operations and mobile tailholds have a movement alarm to warn if the anchor moves and immediately alert the winch-assist machine operator.

Winch-assist systems safe practice

20.5.6 Carry out regular reviews to make sure new risks are identified and existing control measures are working effectively.

20.5.7 Include the following in the documented safe work practice as a minimum:

- hazard identification and risk management
- machine and wire rope inspection and maintenance routines (see Section 20.5.4), and who is competent to carry these out
- operator fatigue plans
- working alone procedures
- an emergency plan
- a map indicating slope and terrain features and areas of exclusion
- slope/soil condition operating guidance
- safe operating procedures
- training requirements
- daily prestart checks
- competency standards for operators and those responsible for safety checks and maintenance.

Safe winch systems

A COMPETENT PERSON SETS UP AND CHECKS WINCH SYSTEMS

20.5.8 Make sure a competent person sets up the winch system.

20.5.9 Make sure anchors and their locations are:

- selected and constructed by a competent person
- checked daily.

20.5.10 Make sure independent winch systems are positioned and anchored securely by a competent person.

TAKE CARE WITH WIRE ROPES

20.5.11 Do not use joining splices to join broken or damaged winch ropes.

20.5.12 Visually inspect wire ropes regularly.

20.5.13 Check rigging daily.

20.5.14 Keep a record of inspections with the plant.

20.5.15 Do not re-use wire ropes used for winch-assisted harvesting for other purposes.

MAKE SURE WINCH SYSTEMS HAVE APPROPRIATE INSPECTIONS

20.5.16 Make sure mobile plant and winch systems have engineering and mechanical inspections appropriate to their age and use (see Section 20.5.4).

20.5.17 Make sure second-hand plant has a full engineering and mechanical inspection before it is deployed (see Section 20.5.4).

20.5.18 Make sure inspections are carried out by a competent person.

20.5.19 Keep a record of inspections with the plant.

21.0 Managing the risks – manual tree felling

IN THIS SECTION:

21.1 Introduction

21.1.1 This section of the guidance looks at how to best manage the risks of manual felling.

21.1.2 Manual felling is one of the most hazardous tasks in forest harvesting. You **must** eliminate risks from manual felling so far as is reasonably practicable (for example, by using another harvesting method like mechanised felling). If you cannot eliminate the risks, you must minimise them so far as is reasonably practicable.

21.1.3 Fell all dangerous or wind-affected/damaged trees by machine where practicable.

21.2 Safe system

21.2.1 Before manual felling is carried out, the harvest contractor:

- establishes and documents the reason for using manual felling. This may include carrying out manual felling in a specified area to maintain a faller's competency.
- works with the felling crew to identify and assess significant hazards and risks and develop a management plan for each risk, including the need for an observer.
- checks that the manual felling plan meets the requirements of the documented health and safety system. This includes making sure that:
  - the faller has the appropriate qualifications, training and experience (see Section 21.3)
  - there is a system to audit competence on a regular basis
  - there is a designated, competent observer on site
  - there is a documented process to deal with a hung-up tree
  - there is a documented process to deal with tree driving
  - there is a documented process to deal with an unsuccessful tree drive, including stopping the work until an observer is available
  - there is a documented process to stop tree felling due to high winds or other extremes of weather
  - there is a documented process to establish the two tree-length zone and communicate the boundaries of the zone to all affected parties
  - these processes are known to and followed by the faller and any observer
  - buddy cutting (two fallers cutting within two tree-lengths) is not carried out
  - the faller has the high level of fitness required for the job
  - for remote or isolated work (see Section 3.4), PCBUs **must** provide a system of work that includes effective communication with the worker.

21.3 Qualifications and training

Training and qualifications

21.3.1 Make sure fallers hold the appropriate skill/unit standard (Appendix 7) and have been deemed competent.

21.3.2 Consider industry-recognised certification (for example, Safetree).

21.3.3 However, if a faller does not hold that skill/unit standard, make sure they are working towards achieving it. If they do not have adequate knowledge and experience, they **must** be supervised by someone with that knowledge and experience.

21.3.4 Make sure fallers are physically capable to do the work and keep their skills up to date.

21.4 PPE and other equipment

Personal protective equipment (PPE)

21.4.1 It is industry best practice for the following PPE to be used:

- high-vis shirt, vest or coat with day-night for added visibility
- high-vis helmet that meets recognised industry standards
- hearing protection with RT capability
- protective legwear, chainsaw chaps or trousers
- eye protection
- safety footwear that provides ankle support and good grip
- lone worker (man-down) device or digital radio equivalent.

21.4.2 Section 10 explains the requirements you **must** meet if you are using PPE to minimise risks.

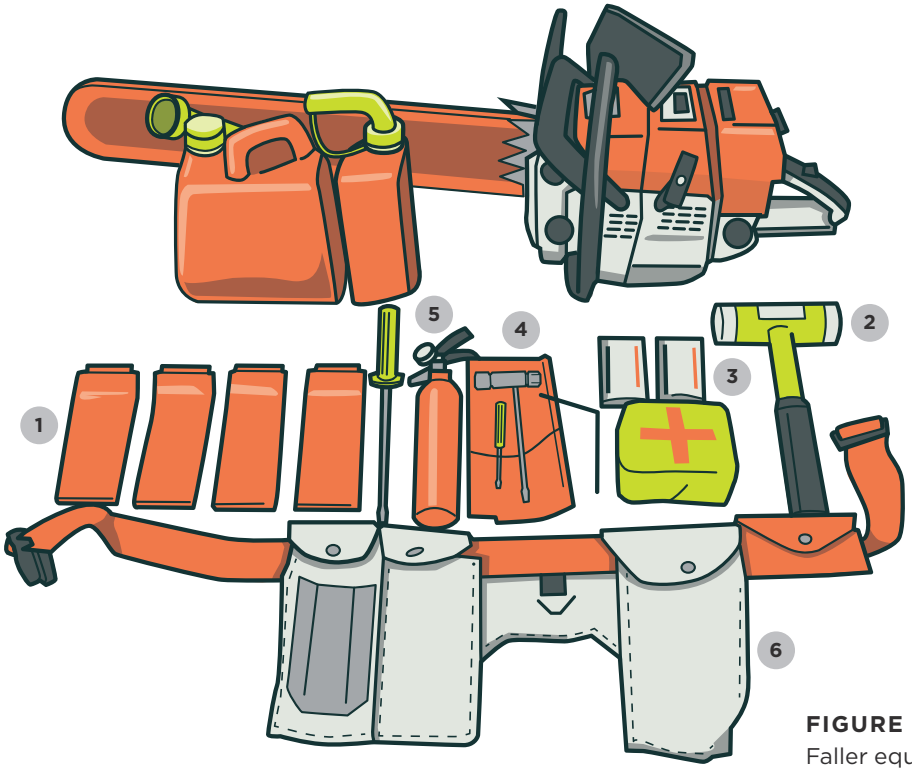
21.4.3 Appendix 7 contains relevant standards for PPE. Look for the mark/stamp on the PPE to check it is compliant with the relevant standard.

21.4.4 Figure 20 shows the PPE fallers carry or are equipped with.

FIGURE 20: Faller wearing PPE and equipment

Equipment essentials

21.4.5 Make sure fallers have the right equipment for the job, including the minimum number of wedges to be carried (Figure 21).



1. Wedges (at least 4)
2. Driving tool
3. First aid kit with (at least) 2 large sterile wound dressings
4. Files and maintenance tools
5. Fire extinguisher
6. Equipment belt

FIGURE 21:
Faller equipment[4]

Chainsaws

21.4.6 Make sure chainsaws are in safe working order and include safety features such as:

- a safety mitt
- an inertia chain brake
- a chain catcher
- a rear handguard
- anti-vibration mounts
- a throttle lock-out
- an on-off switch
- a muffler and spark arrestor.

Communication

21.4.7 It is industry best practice that all fallers and any observers carry RT.

21.4.8 Have RT-enabled hearing protection or hearing protection that can fit earpieces for immediate and direct communication.

21.4.9 Make sure fallers and any observers check-in regularly (for example, every 30 minutes or after tank refuelling).

[4] Adapted from Safe Work Australia's guidance: Forestry: Guide to managing risks of timber harvesting operations (2014)

21.5 Observers

21.5.1 Observers work with the fallers to provide advice or decide when it is too risky to fell the tree. Particular attention should be given to windthrow or trees leaning into the hill.

21.5.2 Make sure observers are skilled in recognising and managing risk.

21.5.3 Make sure an observer is available on site and used when a faller is uncertain or in a higher risk situation.

21.5.4 Consider the use of observers when planning how the work is going to be carried out.

21.5.5 Make sure observers have an effective means of communicating with the faller. It is industry best practice to have a two-way RT with an earpiece in the earmuffs.

21.6 Seven key causes of harm

21.6.1 There are seven key causes of harm in manual tree felling that need to be planned for:

- fallers working too close to other people or plant
- incorrect or poor felling technique
- broken tree limbs or top hitting the faller
- hung-up trees left standing, or not felled using correct methods
- stem movement/rebound and butt swing
- felling dead trees or spars
- the faller being struck from behind by an object or tree.

21.6.2 The five-step tree felling plan is discussed next. Further guidance on managing the risks from the seven key causes of harm are discussed from Section 21.8 onwards.

21.7 The five-step tree felling plan

21.7.1 Make sure all fallers, and any observers, follow this five-step tree felling plan:

- Step 1: Site assessment
- Step 2: Individual tree assessment
- Step 3: Preparation of the work area and escape route
- Step 4: Fell the tree using safe felling techniques
- Step 5: Retreat and observe

21.7.2 These steps are explained below.

21.7.3 Before starting, make sure each faller is physically and mentally prepared for the task.

21.7.4 **Step 1: Site assessment:**

- Assess the stand for hazards relating to the trees, terrain, other operations, and power lines.
- Assess the strength and direction of the wind and whether it will affect safety.

21.7.5 **Step 2: Individual tree assessment:**

- Look for tree defects, decay, heavy lean, or any other characteristics of the tree that may affect the felling plan.
- Note the ground condition and soil moisture.
- Check the surrounding trees for interlocked branches, dead tops or branches that may fall into the work area.
- Determine if the tree can be safely felled and plan the felling cuts.
- Decide on the felling direction. This will help determine which side of the tree will be the safest for the escape route.
- Decide on retreat distance based on the assessment.

21.7.6 **Step 3: Preparation of the work area and escape route:**

- Clear vegetation and obstacles from around the base of the tree.
- Always think about the escape route before starting any felling cuts. Where possible, make sure the escape route is at a 45-degree angle opposite the felling direction (Figure 22).

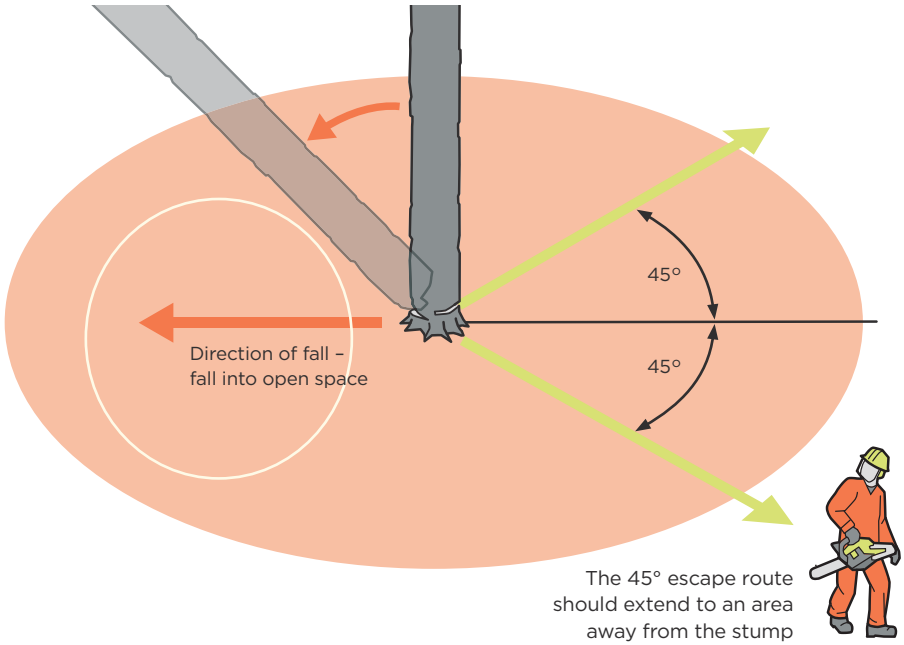


FIGURE 22: Escape route positioning[5]

- Be sure the escape route is clear of obstacles or hazards before beginning.

21.7.7 **Step 4: Fell the tree using safe felling techniques:**

- Good felling technique is critical to safe, accurate, and consistent results.
- Fell trees over 200mm at the stump using a scarf and back cut.
- The degree of forward, back or side lean and the weight distribution will determine the type of back cut used and whether wedges, tree felling jacks or machine assistance will be required.

[5] Adapted from Safe Work Australia's guidance: Forestry: Guide to managing risks of timber harvesting operations (2014)

21.7.8 **Step 5: Retreat and observe:**

- Finish the felling cut on the safe side of the tree. Use the escape route as soon as the tree begins to fall.
- Watch for falling material and be far enough from the base of the tree to avoid a kick back, butt swing, or bounce.
- Avoid walking directly behind the tree.

21.7.9 Managing the risks from the seven key causes of harm are discussed next.

21.8 Managing the risks of fallers working too close to other people or plant

21.8.1 The danger zone of a felled tree is a circle from the stump that stretches out twice the height of the felled tree (Figure 23).

21.8.2 This danger zone allows for the chance that the falling tree may bring down another standing tree. If working on slopes, a greater distance may be required.

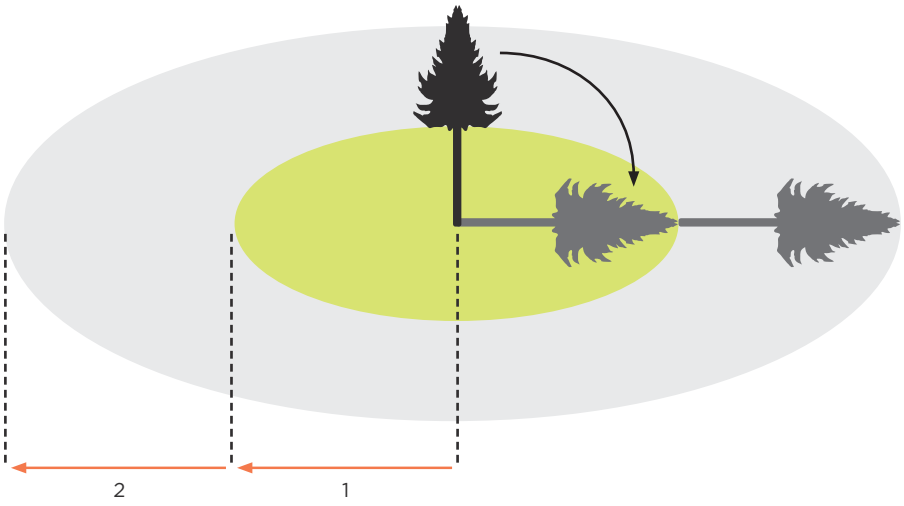


FIGURE 23:
The two tree length danger zone

21.8.3 Make sure the only people present within those two tree-lengths are:

- the faller and any observer assisting the faller
- anybody being trained and the person supervising them
- an auditor or supervisor.

21.8.4 Anyone who is within two tree-lengths of a tree being felled is under the direct control of the faller. Make sure people within two tree-lengths of a tree being felled:

- can communicate with the faller, using clear, prearranged procedures, techniques, and signals using RT, earpiece, or other established method
- let the faller know when they are coming and when they arrive
- are positioned up the escape route in full view of the faller (Figure 22)
- can see the top of the tree being felled from a safe position.

21.8.5 For guidance on working near machines, see Section 20.

21.9 Managing the risks of broken limbs or tree top hitting the faller

21.9.1 Assessing a tree and its surroundings is the first step in felling. At this time the faller may be able to identify broken limbs or top.

21.9.2 If the limbs or top fall while the faller is working at the base, the danger zone is the width of the crown of the tree being felled.

21.9.3 If a felled tree falls into or brushes past another, the danger zone extends some distance behind the felled tree as the top or limb could rebound backwards. This means the recommended escape route (Figure 21) could be in the danger zone.

21.9.4 Use an observer if the faller cannot see the top of the tree.

21.9.5 If the faller is concerned about felling the tree safely, consider:

- using a felling assistant/observer
- using a machine to fell the tree or
- driving the tree (only where necessary).

21.10 Managing the risks of hung-up trees left standing, or not felled using correct methods

21.10.1 A hung-up tree is one that is caught up or lodged against another tree and is prevented from falling. This could be:

- a cut-up tree (where felling cuts have been made but the tree remains standing)
- a wind-affected/damaged tree
- a pushed tree.

21.10.2 Figure 24 shows the danger area when felling a hung-up tree.

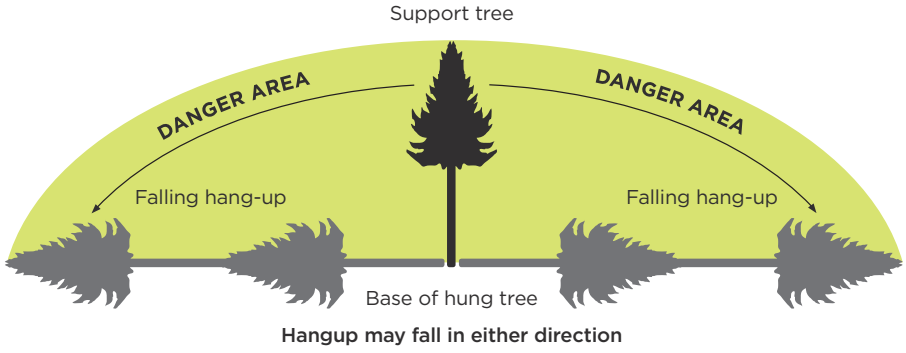


FIGURE 24: Danger area when felling a hung-up tree

21.10.3 Make sure all crew members are warned immediately if a faller creates or identifies a hang-up.

21.10.4 Make sure no one works or is within two tree-lengths of the likely direction of fall.

21.10.5 Then:

- do not allow work under a hang-up
- do not leave hung-up trees unattended
- bring down hung-up trees immediately or isolate the area from other activities and workers
- use a machine to pull down the hang-up if possible.

21.10.6 See Section 21.12 for guidance on using tree driving to bring down hang-ups.

21.11 Managing the risks from stem movement/rebound and butt swing

21.11.1 Stem movement back into the work area after felling can be caused by a number of factors. These include:

- uphill felling
- falling into standing trees
- the tree striking an obstacle as it falls (for example, a rock, another stem, other terrain features).

21.11.2 If a felled tree falls into or brushes against another, the butt of the tree can rebound and strike the faller. Spars are most likely to rebound.

21.11.3 A tree that is felled uphill may also slide back down the hill and strike the faller, so it is important to move further along your escape route.

21.11.4 Tree-to-tree contact can also snap off branches or tops of trees, which ricochet backwards.

21.11.5 Any of these situations may compromise the escape route. Where a hung-up tree kicks back off the stump, the danger zone extends back behind it (Figure 25).

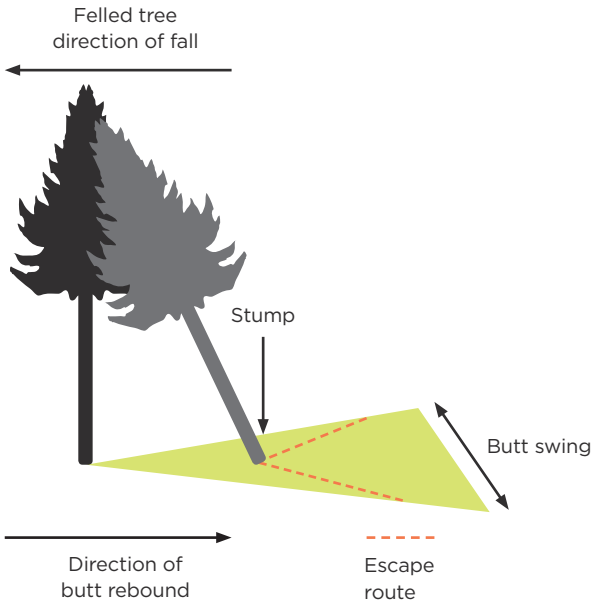


FIGURE 25: Danger zone extending back into the escape route where a felled tree hits another and causes a rebound

21.11.6 To minimise the risk of stem rebound, make sure:

- there is an escape route cleared at a 45-degree angle opposite the felling direction where possible (Figure 22)
- the felling cut is finished on the safest side of the tree
- the faller (and observer if being used) keeps their eyes on the tree as it falls
- the faller moves away from the stump as the tree falls
- trees are not felled uphill where possible.

21.12 Managing the risks of tree driving

21.12.1 Tree driving is where a tree is pushed over by felling another tree onto it.

21.12.2 Tree driving may be used to fell trees:

- to manage risk (for example, remove overhead hazards)
- that are leaning against the intended direction of fall and cannot be safely felled using wedges
- that are hung-up, cut-up or broken
- where conventional felling methods have failed.

21.12.3 Make sure tree driving does not exceed one-onto-two trees.

21.12.4 Make sure tree fallers driving more than one-onto-one hold the appropriate unit standard for tree felling and have demonstrated competence.

Planning the drive

21.12.5 Make sure fallers call up the supervisor (or designated competent person) when a tree drive is to be attempted, and tell them if it is one-onto-one or one-onto-two.

21.12.6 Make sure an observer is called up if there is any doubt about the proposed drive to:

- provide a second opinion
- watch out for falling hazards that could be dislodged as the drive proceeds.

21.12.7 Plan the drive using the five-step felling plan with these additional points:

- the two tree-length zone applies to both the driving tree and the tree being driven
- both trees can sway forward and then back into the felling zone.

21.12.8 When the drive is successfully completed, make sure the supervisor/ competent person is called to let them know of the completion.

21.12.9 For industry guidance, see Resources webpage

21.13 Managing the risks of felling dead trees

21.13.1 Dead trees (includes broken and rotted trees) are particularly hazardous. A dead tree can fall in any direction at any time without warning.

21.13.2 The danger zone associated with a dead tree consists of a circle with the centre at the base of the dead tree and with a radius of two tree-lengths. (Figure 23).

21.13.3 Identify dead trees before the faller begins working in the area, assess the risk they pose and manage appropriately:

- If dead trees are left standing, manage the risk from these to other work.
- If the dead tree is to be felled, consider the escape routes required and the risks of tree breakage and butt rebound.

21.13.4 Machine felling is the best way to fell a dead tree. Always consider this option first. If machine felling is not an option and manual felling is used, driving a dead tree may be the safest option for the faller.

21.13.5 Driving dead trees can also pose dangers as the dead tree may break, with the upper stem falling backwards towards the faller. Make sure the faller carries out a risk assessment appropriate to their situation. For more information, see 21.12 Managing the risks of tree driving.

21.13.6 Make sure the faller carries out their call-out procedure before and after felling the dead tree.

21.14 Managing the risks of windthrow or wind-damaged trees

21.14.1 Machine felling is the best way to fell a wind-damaged tree. Always consider this option first.

21.14.2 Make sure only workers with the appropriate windthrow skill/unit qualifications, experience and competence fell windthrow.

21.14.3 For industry guidance, see Resources webpage

21.15 Managing the risks of the faller being struck from behind by an object or tree

21.15.1 Sometimes a tree or limb can fall from a tree behind both the faller and the tree they are felling.

21.15.2 One cause can be intertwined branches or vines connecting the crowns of two trees. Occasionally the vibration from a large tree hitting the ground is enough to fell a dead or unstable tree.

21.15.3 When assessing trees to be felled include assessing the surrounding trees for damage and structural weakness. Look for branches interlocking with vines or branches of other trees.

21.15.4 The danger zone in this hazard extends from the felled tree to the tree behind with a width equal to the width of the tree behind (Figure 26). This hazard is relative to the direction of fall. This emphasises the importance of directional felling techniques and proper use of scarf and back cuts.

21.15.5 Make sure vegetation is cleared around the tree, and the escape route is clear.

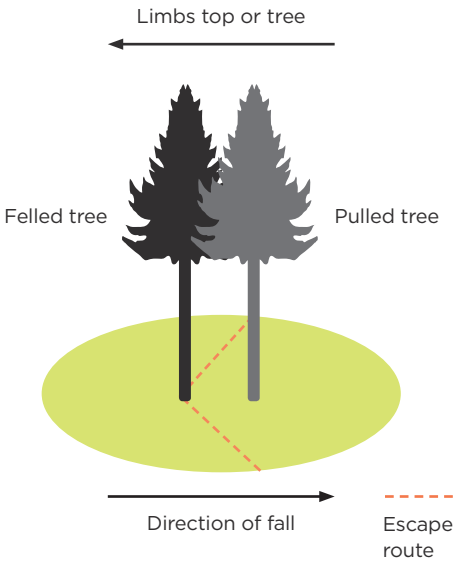


FIGURE 26: Danger area where the felled tree pulls another with it as it falls

21.16 Managing the risks of machine-assisted felling

21.16.1 Machine-assisted felling is used to manage the risks of manual felling. The two most common forms of machine-assisted felling are:

- using a machine to push the tree over
- using the winch on a machine to pull the tree over, or 'back-pulling'.

21.16.2 Whichever system is used, there are some basic principles that need to be followed.

- Make sure the machine is of sufficient size, capacity and traction that it can carry out the job.
- Make sure knuckle-boom loaders have a minimum weight of 20t.
- Make sure a wedge is inserted in the back-cut of any tree to be felled with machine assistance.
- Make sure the faller is in an agreed safe position before signalling for the machine to push or pull the tree over.
- Make sure the faller controls the operation.

Make sure the machine is suitable

21.16.3 A PCBU who manages or controls plant at a workplace **must**, so far as is reasonably practicable, ensure that the plant is without risks to the health and safety of any person.

21.16.4 Before committing to a machine-assisted felling plan, check that it is appropriate for the area to be felled. Some slopes are too steep for machine-assisted felling unless the machine is specifically designed for that terrain and anchored safely.

21.16.5 Other factors to consider in whether machine-assist is appropriate include:

- the size, lean and type of trees in the stand
- the environmental conditions
- the work method that best ensures the safety of the workers.

21.16.6 Make sure machines used to assist felling are:

- of adequate size and engine capacity
- appropriate to the terrain
- fitted with certified protective structures; OPS, ROPS, FOPS, COPS, and side-intrusion guarding.

Develop a risk management plan

21.16.7 Before starting machine-assisted felling, develop a risk management plan to manage the risks associated with this type of felling. Identify and assess the risks and put in place effective control measures to ensure the safety of all workers.

21.16.8 When developing the risk management plan, involve the crew manager, machine operators, and fallers. If the operation is close to roads or powerlines, also involve the powerline owners and road owners if required.

Clear and effective communication is essential. RT communication between faller and machine operator and the use of earpieces is strongly recommended. Do not use or rely on hand signals.

Do not conduct machine-assisted tree felling operations if the communication system is not effective.

21.16.9 In the risk management plan, include:

- plant management, including regular checking and maintenance by competent persons
- worker competency, including training and assessment
- the communication systems to be used
- standard operating procedures, including detailed descriptions of the machines and safe work methods used
- assessment of the area to be felled, including:
  - ground debris and undergrowth around the tree
  - escape routes that can be cleared by the grapple machine or blade
- removal of unstable branches and overhead hazards that can be reached with the grapple
- proximity to powerlines, roads, rail, and walking tracks
- slope and soil conditions, and how they affect the ability of the machine to move and apply force to the trees requiring machine assistance
- stand characteristics, including wind or snow damage, overhead hazards, vines, and undergrowth
- environmental conditions, including prevailing and expected weather such as wind and rain.

21.16.10 Document the risk management plan.

21.16.11 Review the risk management plan's effectiveness daily so long as machine-assisted tree felling is being used.

The faller and machine operator work together to safely fell trees

21.16.12 To plan the order trees will be machine-assist felled, make sure the machine operator and faller assess how each tree is going to be felled. This will minimise falling trees brushing standing trees in front of and to the side of them.

21.16.13 This means assessing each tree's characteristics, including:

- size
- lean
- double or multi leaders
- overhead hazards
- undergrowth.

21.16.14 Make sure the machine operator and faller discuss these factors and agree on:

- the appropriate felling method and direction
- how to position the machine
- the escape route to be used
- the length of the escape route required based on the characteristics of the tree
- how they will communicate.

21.16.15 While the felling approach for each tree is to be decided between the machine operator and the faller, make it clear:

- the faller controls the operation
- the machine operator is responsible for machine stability and control.

Machine assistance to push a tree over

21.16.16 This form of machine-assisted felling uses an excavator to control and push it in the desired direction.

21.16.17 Make sure the implement used to push the tree can stop the tree from sliding sideways.

21.16.18 The most common method of machine assisting is to hold the tree with a grapple.

21.16.19 Make sure the faller controls the operation. The machine operator is responsible for machine stability and control. The instruction to apply force to the tree can only come from the faller and when the faller is in a safe position.

21.16.20 The faller:

- checks that all equipment is fit for use, including personal protective equipment (PPE), first aid kit, chainsaw, wedges, and hammer
- uses the five-step tree felling procedure (see Section 21.7)
- retreats to a safe position clear of the tree while the grapple is being positioned
- completes the back cut
- directs where, when and how much force is applied to the tree
- retreats to the end of the escape route before signalling the machine operator to push the tree over
- directs the machine operator to apply force to fell the tree.

21.16.21 Once the scarf is cut, the faller can move between the tree and the machine to complete the back cutting.

21.16.22 Do not allow the faller to work directly under the raised boom. Back cut or cuts can be made from the side of the tree with the grapple positioned around the tree.

21.16.23 The machine operator:

- conducts prestart checks to ensure the machine is suitable and in a safe condition for use
- follows safe operating practices and procedures
- ensures the safety and stability of the machine
- discusses with the faller on the best machine position
- ensures there is no potential for the grapple to slip off the tree
- ensures effective communication is maintained
- ensures the faller is not positioned directly under the raised boom
- follows direction from the faller
- applies force to the tree only when directed by the faller.

21.16.24 For industry guidance, see Resources webpage

Machine assistance to pull trees over

21.16.25 A skidder, bulldozer or hauler with a winch can be used to back-pull trees. A line is attached to the tree being felled and cuts are placed in the tree by the faller.

21.16.26 The requirements for the machine are covered in Section 21.16.6. Make sure the machine also has a winch rope and a strop strong and long enough to pull the tree over safely.

21.16.27 Make sure the strop is attached as high as possible, which may require a ladder or climbing equipment.

21.16.28 To meet their duties under HSWA, PCBUs **must**, so far as is reasonably practicable, manage the risks of falling from any height. This applies to all work, including pruning from a ladder.

As well as these duties under HSWA, there are also specific requirements under regulations.

21.16.29 Where workers could fall more than 3m (measured from the person's feet above the ground), employers **must**, so far as is reasonably practicable, ensure that suitable means are provided to prevent them from falling.

These means could include a suitable fall restraint device or other suitable fall protection.

If this is not reasonably practicable, PCBUs will need to consider other ways to manage the risk.

21.16.30 Another person will be required to help getting the rope up the tree. This person can also act as an observer.

21.16.31 The faller controls the operation. The faller:

- checks that all required equipment is available and fit for use
- checks that the communications system with the machine operator is working
- selects a safe position and clears the escape route to the safe position
- positions the strop (or supervises the positioning of the strop)
- moves to the safe position and supervises the positioning of the machine
- instructs the operator to apply enough tension to pull the tree slightly forward
- moves from the safe position to put in the scarf and back-cut, and at least one wedge
- moves back to the safe position and instructs the machine operator to pull the tree over.

21.16.32 The machine operator:

- conducts prestart checks to ensure the machine is suitable and in a safe condition for use
- ensures the safety and stability of the machine
- discusses with the faller on the best machine position
- make sure effective communication is maintained
- follows direction from the faller
- applies force when directed by the faller.

21.16.33 For industry guidance, see Resources webpage

22.0 Managing the risks – cable logging

IN THIS SECTION:

22.1 What is cable logging or cable harvesting?

22.1.1 Cable logging is a method of moving stems from a felling site to a landing area. It uses a stationary machine with powered drums/winches, booms or towers, blocks, wire ropes and butt rigging/head gear. Harvested stems may be fully or partly suspended for all or part of the yarding distance.

22.1.2 Cable logging is mainly used to harvest timber from steep slopes where conventional retrieval methods are unsuitable due to the risk of mobile plant rolling over. It can also be used in broken terrain, where the ground is wet or soft, or where logs need to be lifted over environmentally sensitive areas.

22.1.3 There are many different types of cable logging machines and rigging systems. To find out more about the different systems and the specifics of their rigging, see industry guidance, see Resources webpage

22.1.4 Breaking out is a key part of the cable harvesting process. For the breakers-out, it involves stopping and positioning the rigging, hooking on the drag (the stems to be extracted), and after retreating to a safe position, signalling for the break-out of the drag by the yarder and then watching it until it reaches the landing.

22.1.5 Manual breaking out is one of the most hazardous tasks in forest harvesting. You **must** eliminate risks from manual breaking out so far as is reasonably practicable (for example, by using another harvesting method). If you cannot eliminate the risks, you **must** minimise them so far as is reasonably practicable

22.1.6 This section is split into five parts:

- general principles of cable logging
- setting up the yarder
- PPE
- communication
- safe breaking out.

22.2 General safety principles

22.2.1 To protect workers, the basic safety principles are to:

- stop operating if cable logging becomes dangerous because of bad weather conditions such as high wind or poor visibility
- keep everyone in a safe area away from moving lines, rigging, loads until the rigging or loads have completely stopped (safe retreat positions)
- keep everyone outside the bight of tensioned running lines at all times
- run lines in a straight line and ensure they are not obstructed or binding on anything
- be aware of chain shot if a mechanised faller is being used (see Section 20.3.8)
- make sure tree-felling activities are at least two tree-lengths from yarding lines and breakers-out unless fully mechanised with no workers at risk
- make sure all static ropes are marked (see Section 15.7).

22.2.2 Every person entering an operational area:

- notifies the supervisor or foreman before entering the operational area
- wears the appropriate PPE as required by the PCBU
- only enters the operational area when they have been acknowledged or signalled that it is okay to enter
- takes care when approaching workers engaged in any operation
- stays aware that workers wearing hearing protection may not hear them.

22.2.3 When on the landing, make sure workers stay in the designated safe area and clear of:

- all working machinery
- swinging or suspended logs or stems
- trucks and trailers being loaded or unloaded (see Part F).

22.2.4 Before moving into another work area, make sure the affected machine operators are contacted, and that permission is signalled back.

22.3 Setting up a safe yarder

22.3.1 A PCBU who manages or controls plant at a workplace **must**, so far as is reasonably practicable, ensure that the plant is without risks to the health and safety of any person.

22.3.2 PCBUs **must** ensure, so far as is reasonably practicable, the provision and maintenance of safe plant and the safe use, handling, and storage of plant.

General safety principles for yarders

22.3.3 Take the following actions:

- Rig all cable logging installations in accordance with the manufacturer's specifications or industry-specified requirements, whichever is the higher standard.
- Make sure all yarders are securely anchored before yarding operations start. Complete an anchor plan.
- Put the yarder on solid, level ground and protect from pooling rainwater. Make sure outriggers and levelling pads have a stable base.

22.3.4 Make sure guylines used to stabilise the yarder are at least the size, strength and number recommended by the machine manufacturer. Follow industry best practice in the placement and angles of guylines. For industry guidance, see Resources webpage

- Have certified falling object protective structures (FOPS) and operator protective structures (OPS) on yarder cabs, and chain shot protection if required. An exception can be made where cable yarders are remotely operated, and the operator is not located on the yarder.
- Securely guard or totally enclose transmission, machinery and hazardous moving parts on yarders. For industry guidance, see Resources webpage

- Maintain control levers, pedals, brakes and other equipment on yarders so they are in safe working order. Make sure yarder consoles have a safety lock-out system for when workers are working around ropes and rigging.
- Have non-slip pad surfaces on foot-operated mechanisms such as brakes.
- Securely fix ropes to the winch drum. Have ropes long enough to ensure that there are four or more complete wraps of rope on the drum in every working position.
- Use lagged drums, a guide pulley, tool, iron bar or other mechanical or manual means to guide ropes onto drums. Make sure that no part of a worker's body is in direct contact with the rope.
- When moving a yarder with an integral tower, lower or support the tower according to the manufacturer's guidelines so the machine remains stable. Assess the access for hazards before moving and have a qualified person guide the yarder operator when moving.
- Do not move yarders until everyone is in a safe area.

Guylines

22.3.5 When setting up guylines:

- Position and use the guylines used with yarding equipment according to the plant manufacturer's specifications.
- Make sure the number of guylines attached to integral steel towers are at least the minimum recommended by the equipment manufacturer.
- Do not splice guylines together. When they are connected to extensions or anchors, use one of the following:
  - spliced or swaged eyes with shackle connectors with all splices tucked at least three times on each side
  - white metal babbitted or swaged ferrules with double-ended chokers between extensions.
- Make sure guyline connections have at least 1.5 times the breaking strength of the guylines themselves.
- Make sure load bearing guyline angles are 45 degrees or less when measured vertically. If suitable anchors are unavailable, or the terrain is so steep that the guyline angle exceeds 45 degrees, rig an extra guyline to oppose the load.
- Make sure guylines are securely tightened and locked in position while the tower is in use and adjusted to share the load as equally as possible.
- Make sure shackles used in the rigging are rated appropriately and the pins are secured.

Anchors

22.3.6 Securely anchor all skylines, guylines and tailrope blocks to one of the following:

- suitable-sized stumps or combinations of stumps capable of resisting the forces applied to the stump, for example:

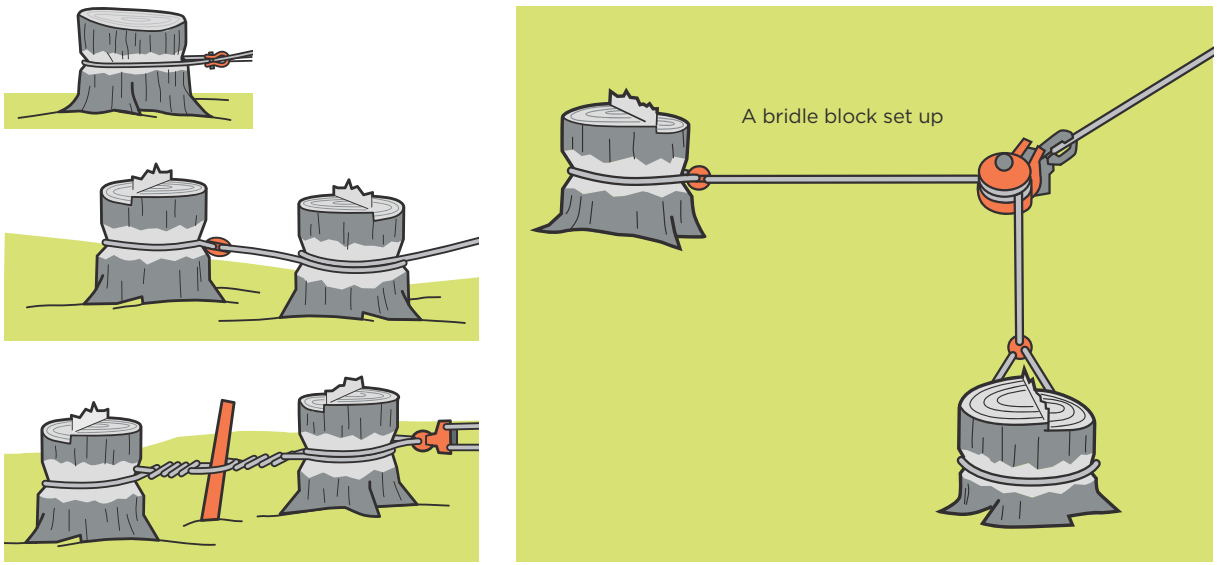


FIGURE 27: Suitable stumps or combinations of stumps[6]

- deadman anchors of sufficient size and buried to an adequate depth, for example:

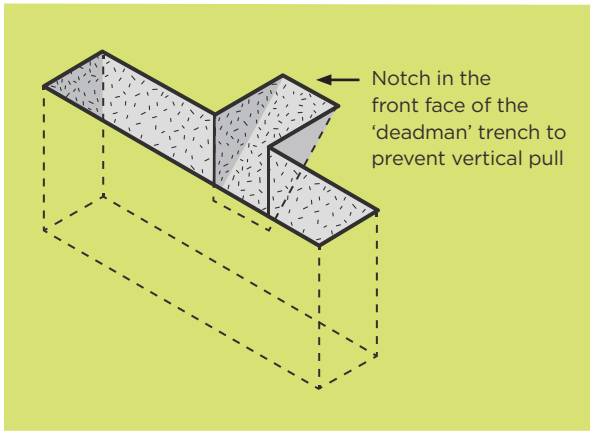


FIGURE 28: Example of a deadman trench[7]

[6] Adapted from Safe Work Australia's guidance: Forestry: Guide to managing risks in cable harvesting (2013)

[7] Adapted from Safe Work Australia's guidance: Forestry: Guide to managing risks in cable harvesting (2013)

- suitable mobile plant anchors that are of sufficient size and correctly braced, for example:

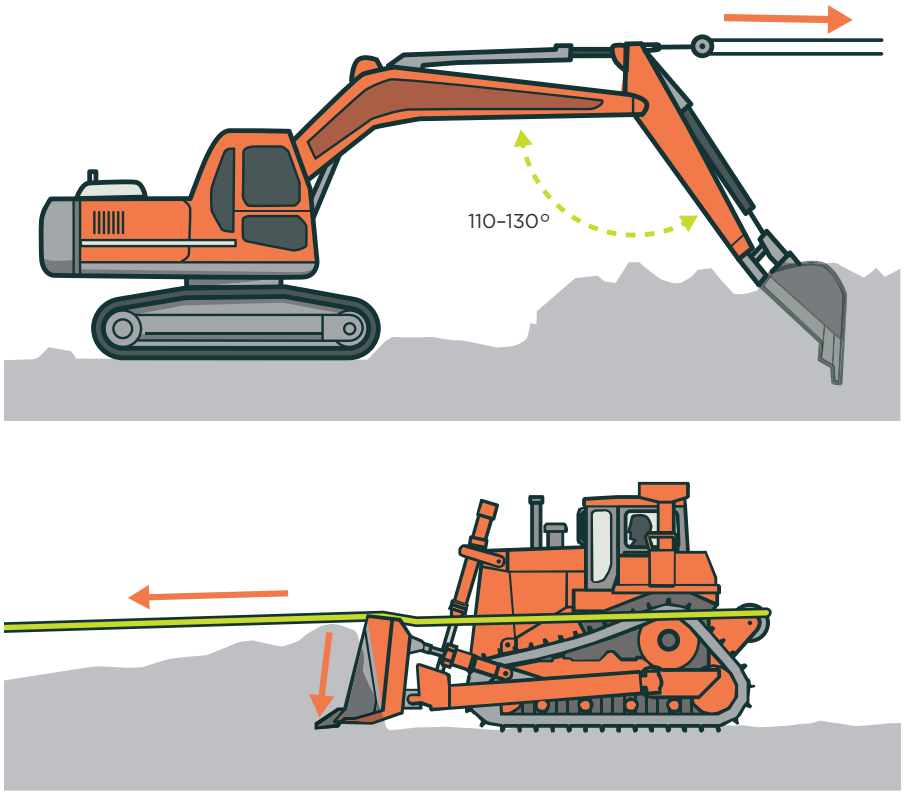


FIGURE 29:
Example of using mobile plant as anchors[8]

- correctly installed artificial anchors providing sufficient strength.

22.3.7 Make sure the guyline anchor locations meet the manufacturer's specifications for yarder set-up.

22.3.8 Make sure that no worker goes within 15m of a live anchor stump once an anchor is rigged, unless they are in communications with the hauler operator.

22.3.9 Do not use standing trees as anchor points unless a risk assessment has been carried out and it is safe to do so.

Selecting stump anchors

22.3.10 A stump anchor is the stump of a felled tree which has been selected as suitable to use as an anchor.

22.3.11 They may be used for:

- hauler guylines
- skyline anchors
- tailspar and intermediate support guylines
- block anchors
- anchoring other machines and equipment.

22.3.12 It is hard to predict what holding power a stump has, but this general guidance applies.

[8] Adapted from Safetree Best Practice Guidelines for Cable Logging (2005)

WHAT TO LOOK FOR IN A 'GOOD' STUMP

22.3.13 Pick a stump that:

- is freshly cut (less than 6 months old)
- is in deep and firm soil
- has a sufficient height of solid wood above the planned notch (for example, at least 30cm)
- has a larger diameter stump (for example, a 60cm diameter stump may hold approximately four times as much as a 30cm stump).

WHAT TO AVOID IN A STUMP

22.3.14 Always assess the risk when choosing stumps. In general, do not use stumps that:

- have been damaged or disturbed during road or landing construction
- are in wet swampy areas, water tables and water sumps. Stump (and soil) strength decreases as a soil gets wetter
- are located in subsidence areas, shallow, loose, or friable soil. In particular, where there is only a thin soil overlying rock
- have started to rot. The root systems in stumps over 6 months old have started to rot, and their strength may have reduced
- have been previously used as anchors. These may be in a weakened state despite looking sound
- come from wind-damaged or heavily leaning trees
- have been cut too low to allow adequate holding wood above the attachment point
- have been partially pulled out of the slope
- are in a steep face, facing the hauler.

NOTCHING A STUMP

22.3.15 When notching the stump:

- notch all stump anchors so that the rope is held around the anchor
- make sure notches are cut to a suitable depth and shape (for example, 2 times the rope diameter in width and 1.5 times the rope diameter in depth)
- make sure the notch is as close to the ground as possible – do not cut off the roots
- make sure there is at least 30cm of solid wood above the notch
- make sure the notch is cut on the same angle as the guyline under tension.

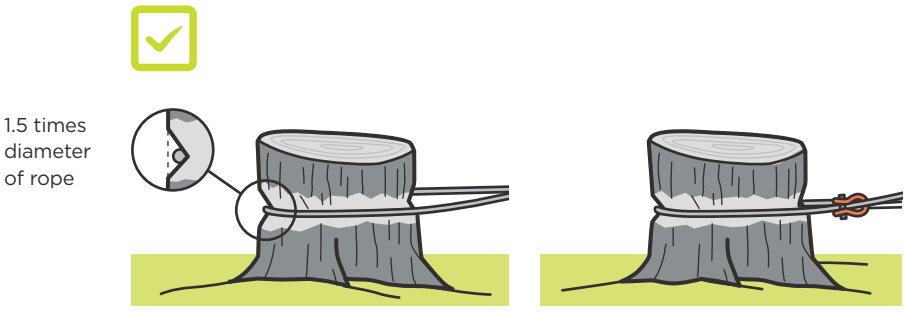


FIGURE 30:
Correct notching[9]

[9] Adapted from Safe Work Australia's guidance: Forestry: Guide to managing risks in cable harvesting (2013)

DEADMAN ANCHORS

22.3.16 Deadman anchors are logs buried in the ground to provide an anchor point when suitable stumps are not available.

22.3.17 If using a deadman anchor, make sure:

- the logs are properly installed and of a strength, length and diameter to withstand the load to be imposed
- the log size and design of the installation takes into account the:
  - soil conditions
  - slope and angle of the ground
  - angle of pull on the guyline
  - size of the yarder
  - rigging system being used
- trenches for deadman anchors are at right angles to the line of pull and have a vertical front wall
- the strop connecting the rope to the deadman anchor:
  - passes around the deadman and has both ends evenly protruding from the ground
  - is positioned so that the ends share the load equally
  - is at least the strength of the rope that it is being attached to
  - has both eyes of the strop attached to the rope with a shackle
  - the deadmen are checked to make sure they have been installed properly.

Rigging gear

22.3.18 When setting up rigging consider the following:

- make sure all shackles are made of high-tensile fitted with high-tensile pins and are certified
- make sure that all shackles are rated equal to, or higher than, the rigging gear (ropes) they are connected to
- secure the pins of hanging shackles with a molle grommet or split pin
- make sure guyline shackles have their pins on the yarders side of the connection unless they are on mobile plant used as a tailhold, where the shackles are reversed
- only use hammerlocks in place of shackles when they have an equivalent or greater safe working load than the shackle they are replacing
- make sure all shackles, rigging screws and turnbuckles:
  - are tested and marked with their safe working load
  - have a breaking strength at least equal to the rope to which they are rigged
- fit yarder towers with a strop or other safety device which can contain the fall of operating ropes and tackle if a failure of the lead block, blocks or securing tackle occurs
- only undertake tower maintenance when the tower is down

- if climbing the tower is ever required, assess and manage the risk of fall from heights:
  - To meet their duties under HSWA, PCBUs **must**, so far as is reasonably practicable, manage the risks of falling from any height. This applies to all work, including pruning from a ladder.
  - As well as these duties under HSWA, there are also specific requirements under regulations.
  - Where workers could fall more than 3m (measured from the person's feet above the ground), employers must, so far as is reasonably practicable, ensure that suitable means are provided to prevent them from falling.

    These means could include a suitable fall restraint device or other suitable fall protection.
  - If this is not reasonably practicable, PCBUs will need to consider other ways to manage the risk.
- Train workers to safely work at height and to use an approved fall restraint harness, a free- fall arrest system and a rope with a minimum rating of at least 22kN (kilonewtons).
- Make sure there is a competent person on site trained in the use of fall restraint harness and who is capable of carrying out a rescue.

Mobile anchors

22.3.19 When setting up mobile anchors:

- securely position mobile anchors before extraction work starts. For industry guidance, see Resources webpage
- connect skyline and tailrope to suitably engineered attachment points on the mobile plant
- make sure attachment points are inspected periodically by a competent person to confirm their structural integrity
- apply a handbrake or locking device to prevent unplanned movement
- have a monitoring system to detect unplanned machine movements.

MOBILE ANCHORS DURING OPERATIONS

22.3.20 When using a mobile anchor, consider the following:

- make sure no worker is in the mobile anchor or near the mobile anchor while logs are being extracted
- when shifting the mobile anchor:
  - contact the hauler operator to lower the ropes before getting in the mobile anchor cab
  - make sure the operator wears a seat belt while repositioning
  - after the line shift and repositioning, make sure the operator is off the machine before signalling and full tension is applied.

CARRY OUT REGULAR CHECKS

22.3.21 Consider the following:

- Make sure the yarder is inspected regularly so that it remains stable.
- Make sure yarders are checked daily by a suitably competent person to ensure the guyline anchors and rigging are secure when under load.
- Make sure guyline anchors and rigging are inspected when the working ropes have been subjected to any shock loading or failure. Do not operate the yarder until this inspection is done.

- Document guyline anchor and rigging checks. Documentation may include photographic evidence with a date and time stamp. Securely store electronic files and ensure they can be viewed on request.
- Document guyline replacement dates.

Certification and inspection

22.3.22 Make sure yarders and yarder towers are properly certified and inspected:

- Permanently attach an identification plate to each yarder tower's base with the following information:
  - name and address of the manufacturer and the yarder model number
  - maximum breaking strength and size of the mainline for which the tower is designed
  - maximum breaking strength and size of tail rope (haulback) for which the tower is designed
  - maximum and minimum inclination at which the tower is designed to be operated
  - number, breaking strength and size of guylines needed
  - maximum breaking strength and size of skyline, mainline and tail rope which can be used on a tower designed for a skyline or slackline system.
- Make sure all yarders and yarder towers are inspected annually by a Certification Board for Inspection Personnel (CBIP) certified Yarder Engineering Safety Inspector and tagged as certified. The information on the plate includes:
  - the owner of the plant
  - make, model and serial number
  - inspection expiry
  - certifier number.
- Make sure the yarder is reinspected by a Chartered Professional Engineer (CPEng) with knowledge of such plant if there is a tower tip-over or if a part is damaged, or damage is suspected. Do not operate the yarder until this inspection is done.
- Make sure critical components of the yarder tower are visually inspected by a competent person each time the tower is lowered to the ground.
- Only make structural changes to towers under the direction of the manufacturer, or a CPEng. When modifying towers, do not reduce the overall safety factor of the equipment.

22.4 PPE and other equipment

Personal protective equipment (PPE) and other equipment

22.4.1 It is industry best practice for the following PPE to be used:

- high-vis shirt, vest or jacket with day-night for added visibility
- high-vis helmet, particularly when working outside a protected cab
- hearing protection
- safety footwear suitable for the terrain
- gloves for handling wire rope and rigging. Heavy cotton gloves are preferred because any puncture wounds are less severe
- protective eyewear.

22.4.2 Section 10 explains the requirements you **must** meet if you are using PPE to minimise risks.

22.4.3 Appendix 7 contains relevant standards for PPE. Look for the mark/stamp on the PPE to check it is compliant with the relevant standard.

22.4.4 Other useful equipment can include:

- a small personal first aid kit
- a hydration system such as a camelback or water bottle
- sunscreen
- a raincoat and warm clothing for cold and wet days.

BOOTS FOR BREAKERS-OUT AND SPOTTERS

22.4.5 Make sure safety footwear provide good ankle support and are suitable for the terrain and traction requirements.

22.4.6 Spiked boots are recommended for breaking out unless the ground is rocky. However, spiked boots do have their risks:

- they can wear out which can cause a slipping hazard
- they need checking to make sure spikes are not missing
- extreme caution needs to be used when climbing on or off a mobile tailhold machine. In addition, use rubber mats or wooden pads on the floors or pedals to avoid slipping.

HELMETS FOR BREAKER-OUTS

22.4.7 Provide helmets with chin straps for breaker-outs.

IDENTIFYING THE HEAD BREAKER-OUT

22.4.8 It is becoming common practice for the head breaker-out to wear a different colour high-vis and helmet to the other breaker-outs. This not only identifies the head breaker-out but is also a good visual guide as to where the breaker-outs are standing during an extraction.

22.4.9 Make sure breaker-outs always stand behind the head breaker-out when the 'go ahead' is given.

22.5 Communications

22.5.1 For remote or isolated work (see Section 3.4), PCBUs **must** provide a system of work that includes effective communication with the worker.

22.5.2 It is crucial for the breaker-out and the cable yarder operator to be able to communicate quickly and effectively. It makes sure that:

- ropes and rigging are positioned correctly before the breaker-outs move in to strop the stems
- break out does not start until all the breaker-outs are in a safe retreat position
- the cable yarder can be told of any stropping issues such as a gut hook
- an emergency can be signalled immediately
- breakers-out do not approach the safe return position until the out haul signal has been given by the yarder operator.

22.5.3 Make sure all workers are familiar with the communication system and commands used in their workplace.

22.5.4 Stop all hauling if communication becomes inaudible or not clearly understood. Do not restart until communications are fully restored.

22.5.5 Have at least two forms of effective communication, particularly for manual breaking out. The common ways of communicating are:

- RT
- tooter signals.

Radio communication

22.5.6 An RT is an important tool for clear and fast communication between the hauler operator, breaker-outs and spotter.

22.5.7 Make sure the head breaker-out and spotter has RT communication. For example, an earpiece in the helmet earmuff and a lapel microphone for fast hands-free communication.

22.5.8 Other breaker-outs need to also carry signalling equipment in case of an emergency.

22.5.9 Make sure the breaker-out:

- holds the RT during break out and in haul to allow quick communication in the event of a fouled drag or other issue
- uses approved crew commands on the RT, for example, 'go ahead', 'stop', 'raise the rigging'.

22.5.10 Test RTs daily before work starts to make sure they are on the right channel and fully charged.

Tooter signals

22.5.11 Audible (tooter) signals need to be clearly heard by all workers in the vicinity of a rope that is about to be hauled.

22.5.12 Test tooters daily before work commences.

22.5.13 All workers need to know the signals for 'emergency', and for 'stop the rope'.

SIGNAL FOR:	TOOTER	RADIO
Emergency	One long continuous blast on the tooter or horn	'Emergency, emergency, emergency'
Stop the rope	One short blast	'Stop'

TABLE 19: Signals for 'emergency' and 'stop the rope' for cable logging

22.6 Use of spotters

22.6.1 Spotters are mainly used by swing yarder operations and mechanical grapples to position the grapple over the stem.

22.6.2 Spotters need to be competent, experienced and trained. Make sure they hold the appropriate unit standard.

22.6.3 If they are used for hooking on logs, make sure they are trained and hold the appropriate qualification for this activity.

22.6.4 Make sure they are familiar with the safe retreat position (see Section 22.7.6).

22.7 Safe breaking out

The head breaker-out

22.7.1 The head breaker-out controls the break-out operation and the safety of the breaker-outs.

22.7.2 Head breaker-outs are in control of the break-out face at all times. They determine the location of the backline and backline anchors and manage the lineshifts.

22.7.3 The head breaker-out needs to be competent, experienced and trained. Make sure they hold the appropriate skill/unit standard for head breaker-outs – see Appendix 7. Consider industry certification (for example, Safetree).

22.7.4 Due to the importance of the head breaker-out position, consider first aid training.

Breaker-outs

22.7.5 All breaker-outs need to be competent and trained for their task. Make sure they hold the appropriate skill/unit standard.

The safe retreat position process

22.7.6 One of the most critical jobs in manual cable yarding is pre-determining and getting agreement on the safe retreat position.

22.7.7 The safe retreat position is where a breaker-out stands to be clear of moving ropes, rigging or stems or any hazard that might happen during a drag.

PLANNING – PRINCIPAL AND CONTRACTOR

22.7.8 The principal:

- develops a harvesting plan or job prescription before harvesting starts detailing the known hazards in the harvest area (such as danger triangle, mean tree height, traffic management needs, ecological and wāhi tapu sites)
- gives the plan to the contractor
- confirms that the contractor has a system to determine safe retreat positions on the block being harvested.

CONTRACTOR AND EXTRACTION TEAM

22.7.9 The contractor and/or crew foreman then works with the extraction team (the head breaker-out, breaker-outs and yarder operator) to determine the safe retreat position.

22.7.10 Document the safe retreat position process. Make sure the process is clearly understood, agreed and carried out by the extraction crew.

22.7.11 Mark the high-risk (red), medium-risk (orange) and low-risk (green) zones on the safe retreat plan with a description of the safe retreat distance in each zone. Detail the distance in metres (if using a rangefinder) or tree lengths.

22.7.12 Make sure all breaker-outs know and understand these safe retreat positions at the start of each session's work.

22.7.13 Hold a daily meeting to determine the breaking out plan and agree on safe retreat positions for the setting or day's work.

DETERMINING THE SAFE RETREAT POSITION

22.7.14 When determining the safe retreat position take into account:

- the risk of a swinging or upending log or stem
- the mean tree height
- the terrain
- obstacles that may restrict movement or obscure vision
- material likely to be dislodged during extraction
- overhead hazards that may fall into the work area
- any rope bight
- the risk of logs or stems being dislodged from the landing and sliding downhill
- the risk of chain shot from any felling operation.

MEASURING THE SAFE RETREAT POSITION

22.7.15 The head breaker-out needs to:

- make sure that all breaker-outs are at the pre-determined safe retreat position behind the head breaker-out before signalling the break-out.
- have a method of accurately measuring this distance.

22.7.16 The method to measure distance could include using:

- rangefinders
- GPS monitoring.

CHANGING THE SAFE RETREAT POSITION DURING THE DAY

22.7.17 Make sure you have processes for changing the safe retreat position during the day as hazards or risks change.

22.7.18 Communicate any changes to the plan to the hauler operator or crew manager. Document any changes.

22.7.19 The head breaker-out can decide if the safe retreat position needs to be moved further away from the ropes.

22.7.20 Get the approval of the crew manager before moving the safe retreat position closer to the ropes.

USING THE DEFAULT PROCESS

22.7.21 Have a documented process for determining the safe retreat position.

22.7.22 If for any reason there is no documented process, the default process is that the safe retreat position is a distance of at least 1.5 tree lengths (based on the mean tree height) at right angles and horizontal to the drag.

22.7.23 With the default process, clearly mark the safe retreat position with flags or other visible markers.

Stay away positions at all time

22.7.24 Make sure breaker-outs do not move or are positioned underneath:

- any moving rope
- a mechanical slack-pulling carriage feeding slack
- any carriage or butt rigging being raised or lowered during break out
- a tensioned skyline during outhaul or inhaul
- operating ropes being shifted by a mobile tailhold.

During outhaul

22.7.25 During outhaul, make sure all breaker-outs are a minimum of 15m from any moving rope or twice the length of the longest strop, whichever is greater.

Before hooking-on

22.7.26 Make sure breaker-outs stay out of the hook-on area until:

- the 'Stop' signal has been given and the head breaker-out gives verbal clearance
- the carriage or rigging has stopped moving
- the swinging strops can be safely controlled.

Hook-on

22.7.27 Make sure breaker-outs never stand directly under ropes or rigging when slack is being fed out or ropes are being lowered.

22.7.28 Breaker-outs may stand to the side of the rigging, holding onto their strop as it is lowered, provided they:

- have been warned that the lowering is happening
- are watching from a safe position.

HOOK-ON WITH BUTT-PULLED STEM

22.7.29 Attach strops to butt-pulled stems within 3m of the butt-end of the stem.

HOOK-ON WITH HEAD-PULLED STEM

22.7.30 Attach strops to head-pulled stems within 5m from the top end of the stem.

GUT-HOOKED OR LONG-STROPPED STEMS

22.7.31 If any drag is long-stropped or gut-hooked, the head breaker-out:

- immediately communicates to the yarder operator so that others can be warned of the hazard, or
- stops after the break-out so the stems can be re-hooked.

Signalling the break-out

22.7.32 Before signalling the break-out, the head breaker-out needs to make sure that all breaker-outs are in the safe retreat position and behind the head breaker-out. Make sure all breaker-outs face and watch the drag.

The drag

22.7.33 The head breaker-out needs to watch the lines and the drag until either:

- the drag is out of sight
- the yarder operator takes over control, or
- another competent breaker-out is assigned to monitor the lines and the drag.

A fouled drag

22.7.34 If a drag becomes fouled, make sure the breaker-out signals to stop the drag immediately.

22.7.35 Before any attempt is made to release strops or cut any stem with a chainsaw, slacken the mainrope, tailrope and slack-pulling rope (if appropriate) to release tension. Make sure breaker-outs do not leave the safe retreat position while the ropes in a fouled drag are under tension.

22.7.36 Only the head breaker-out can:

- move out of the safe retreat position to access the fouled drag
- call in other breaker-outs to assist.

22.7.37 Once the drag is clear, make sure all breaker-outs retreat to the predetermined safe position behind the head breaker-out before any signal is given for the drag to resume.

Clearing the chute

22.7.38 The head breaker-out confirms that all breaker-outs are in a pre-determined safe position before clearing stems from the chute.

Line shifts

22.7.39 When any line-shift operation is taking place, make sure all breaker-outs and other operators are in a designated safe area and clear of any rope movement.

Strawline retrieval

22.7.40 Make sure that the risks for retrieving strawlines are assessed and that procedures are put in place to manage the risks.

22.7.41 Make sure that there is a procedure for clearing an obstruction and agreed practices for the release of tension on lines to avoid recoil.

22.7.42 Make sure that the breaker-outs and hauler driver are familiar with the procedures.

22.7.43 Once the obstruction is cleared make sure that the breaker-outs are in the safe retreat position before the signal is given to apply tension to the ropes.

Stems on the landing

22.7.44 The poleman is one of the most hazardous tasks on a landing site. You **must** eliminate risks from unhooking stems so far as is reasonably practicable (for example, by using electronic chokers). If you cannot eliminate the risks, you **must** minimise them so far as is reasonably practicable.

THE POLEMAN

22.7.45 The poleman works on the cable logging landing site. They unhook landed stems and monitor the condition of the carriage, ropes, rigging and strops during unhooking.

- Make sure the poleman has a designated safe area away from the yarder and remains in this area whenever working ropes are operating.
- Make sure the poleman has an RT to communicate with the operator.

- Make sure all ropes are stopped and locked before the yarder operator signals the poleman that it is safe to unhook. Make sure that all rope movement remains stopped until the poleman is back in the designated safe area.
- Do not allow unhooking to start until the poleman and yarder operator make sure the drag/stems are stable and not likely to shift.
- Do not allow workers to work under a suspended stem or log or go in to unhook stems/logs before the drag is landed.
- Do not allow workers to stand more than 1m off the ground when unhooking stems or logs.
- Make sure all rope movements are signalled before movement.