

Guide to safe manual tree felling

INTRODUCTION

This Guide has been developed by WorkSafe New Zealand for principals and contractors involved in tree felling operations. The Guide offers some advice on managing the key causes of harm in manual tree felling. Note that this advice is primarily relevant to clearfell harvest operations. While many of the recommendations are relevant to thinning, there are other factors to consider.

Input into the development of this Guide has been received from industry stakeholders and Competenz.

This Guide is a practical way of meeting the requirements of the Health and Safety in Employment Act 1992 (the Act), and the recommendations in the Approved Code of Practice for Safety and Health in Forest Operations (ACoP).

THE GUIDE HAS BEEN SPLIT INTO TWO PARTS:

Part one – principal and contractor

Part one is for principals and contractors. It includes guidance on the process a principal and contractor should use before tree felling commences to communicate hazards and agree on how to manage them.

Part two – contractor and crew

Part two is for the contractor and crew members involved in felling. It includes advice on:

- 2.1 planning;
- 2.2 the five step tree felling plan;
- 2.3 the seven key causes of fatal harm in tree felling;
- 2.4 tree driving; and
- 2.5 wind-throw.

KEY

Green boxes contain ACoP rules.

1. HARVEST PLANNING – PRINCIPAL AND CONTRACTOR

ACoP rule 2.4.4 The principal shall identify significant hazards specific to each work area which are caused by operations over which they have control and then:

- supply the employer with documentation on the hazards
- jointly with the employer, determine measures to control the hazards.

1.1 Harvest plan

Before harvesting starts, the principal and contractor should agree on a plan for the area to be harvested. At this time, principals and contractors should share information on any potential hazards involved in the work or the site, as well as other health and safety management requirements. The harvest plan should include the principal's requirements for the tree felling operation.

The harvest plan should contain the following information:

- maps showing road and landing locations, as well as key landmarks;
- terrain;
- mean tree height;
- all known felling hazards including:
 - natural features like cliffs and tomos ;
 - physical features like power lines and fences;
 - stand features like areas of windthrow, dead trees and vines;
- stand characteristics including piece size, species, pruned/unpruned; and
- resource consent conditions.

This harvest plan should be used by the contractor when developing a tree felling plan. This felling plan should include the identification of areas of wind throw or steep terrain and other issues that should be communicated to their crew before the harvest starts.

1.2 Hazard Management

The principal has an obligation to do more than just provide information on the hazards. The ACoP states that the principal and the contractor (or employer) shall jointly determine measures to manage the hazards.

1.3 Health and safety System

Before any work begins, the principal is required to verify that the contractor (or employer) has a documented health and safety system in place. When a WorkSafe New Zealand inspector visits, they will want to see evidence of that system, and will look for the following things:

- the tree faller holds the appropriate unit standard and has been deemed competent using a robust process;
- the faller does not hold that unit standard, that they are working towards achieving it and, in the interim, have been deemed competent to do the work or are under close supervision;

- there is a system to audit competence on a regular basis, especially for high risk work like felling windthrow;
- there is a designated, competent observer for complex felling situations;
- 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 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; and
- 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 can be customised by the contractor (or employer) for their operations, and should be reflected in their training records and hazard register. The processes should be known to, understood, and followed by, the tree faller. There should also be a system to record any on-the-job deviation from the planned processes.

2. MANUAL TREE FELLING – CONTRACTOR/EMPLOYER

ACoP rule 2.5.1 The employer shall ensure that a competent person is in charge of each operation, who shall supervise and ensure work is supervised and performed in a safe manner.

2.1 Planning

The person in charge of tree felling operations controls and supervises the work to ensure that safety precautions are being observed. That person should be fully experienced in the kind of work to be undertaken.

Hazard identification

The tree fallers and the person in charge of the operation shall identify hazards specific to the site.

Competency

Tree fallers need to be deemed competent to the task following a robust assessment process, and where there is a complicating factor such as a hung-up tree, the faller should have a greater degree of experience and proven skill.

2.2 Five Step Tree Felling Plan

Any tree faller should ensure that they follow the five step tree felling plan.

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.
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 you can fell it safely 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.
3. **Preparation of the work area and escape route**
 - Clear vegetation and obstacles from around the base of the tree.
 - Always think about your escape route before you begin any felling cuts. Where possible, the escape route should be at a 45-degree angle opposite the felling direction. (See Figure 1.)
 - Be sure your escape route is clear of obstacles or hazards before beginning.
4. **Fell the tree using safe felling techniques**
 - Good felling technique is critical to safe, accurate, consistent results.
 - All trees over 200mm at the stump must be felled using a scarf and back cut.
 - The degree of forward or back lean will determine how many wedges and/or whether a pull rope will be necessary and how much power may be required to pull

the tree over.

5. **Retreat and observe**

- Remember to finish the felling cut on the safe side of the tree and use your 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.

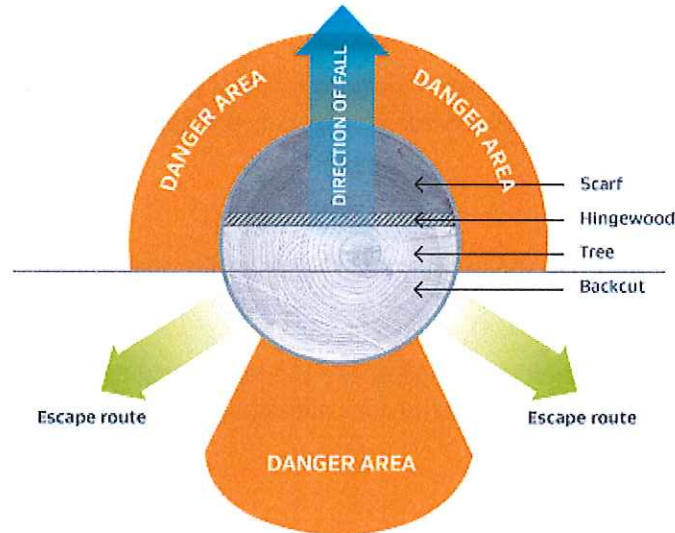


Figure 1. Escape route positioning

2.3 The 7 key causes of harm

The seven key causes of harm in tree felling are:

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

These seven key causes of harm need to be addressed. A process should be put in place by the principal and the contractor (or employer) during the harvest planning stage to assess a block before the tree faller starts work. This process will assist in developing hazard management plans for more obvious hazards in the stand.

1. Working too close to the faller

ACoP rule 11.4.3 No person shall be closer than two tree lengths to a tree being felled, unless that person is:

- the faller
- assisting the faller
- supervising
- training others or being trained
- observing or auditing.

Any person within two tree lengths of a tree being felled shall be under the direct control of the faller.

Exception: The faller is under the direct control of a trainer.

11.4.4 Aside from the tree faller no person shall operate a chainsaw within two tree lengths of a tree being felled.

Buddy cutting is not permitted.

The danger zone of a felled tree consists of a circle with the centre at the stump of the felled tree and a radius equal to twice the height of the felled tree (see Figure 2). This rule takes into account the chance that a falling tree may bring down another standing tree.

The ACoP sets out clearly who, apart from the tree faller, can be within two tree-lengths or more of a tree being felled. Further to that, those people should be:

- able to communicate with the tree faller, using clear, prearranged procedures, techniques, and signals via radio transmitter (RT), earpiece, or other established method;
- using that communication system to advise when they're coming and when they arrive;
- positioned up the escape route in full view of the faller; and
- able to see the top of the tree being felled from a safe position.

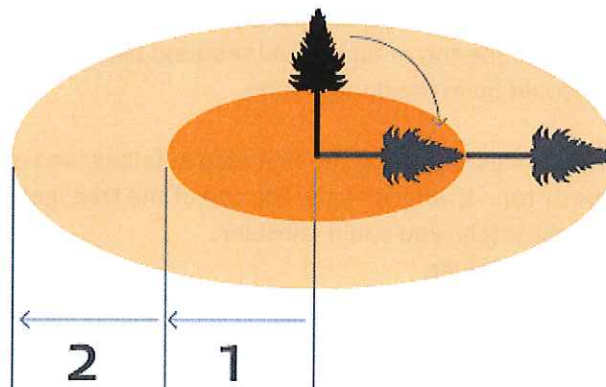


Figure 2. The two tree length rule.

2. Poor felling technique

The danger zone in the case of incorrect or poor tree felling practice consists of a circle with the centre at the felled tree stump and the radius equal to twice the height of the felled tree

A number of serious harms have occurred where the felling technique was clearly contrary to standard recommended practice.

Basic tree felling practice should follow the five step tree felling plan.

1. **Site assessment .**
2. **Individual tree assessment .**
3. **Preparation of the work area and escape route .**

4. **Fell the tree using safe felling techniques .**
5. **Retreat and observe.**

At the very first step, you should consider if you can fell the tree safely. Checking for hazards like dead or broken branches, rot, branch weight, and lean, as well as the surrounding trees, can help identify that you may need assistance to fell the tree.

The tree faller should hold the appropriate unit standards for the work they are doing, and undergo refresher training and competency assessments on a regular basis. Tree fallers should know and recognise the situations in which they can be fatally injured including when that situation is developing around them.

The tree faller should be audited on a regular basis to ensure that they are safely felling in different circumstances. These audits should be done by a person who is experienced and competent in auditing felling operations.

Fallers should know and adhere to the processes that require tree felling to stop until a support person is in place.

3. Broken limbs or tops from the felled tree

The danger zone in this situation is equal to the width of the crown of the tree being felled, assuming the limbs or top fall while the scarf and back cuts are being put in.

In the event that 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. Note that the recommended escape route could be in the danger zone.

Assessing a tree and its surroundings should be the first step in felling, and at this time you may be able to identify broken limbs or top. If you can't see the top of the tree, get an observer. If you are concerned about felling the tree safely, you could consider:

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

4. Hung-up trees

ACoP rule 11.6.1 A hung-up or cut-up tree shall be brought to the ground immediately or the hazard managed until such time as it can be brought to the ground. If the cut-up tree is to be brought down, refer to section 11.7: Tree driving.

A hung-up tree is a cut-up, wind-thrown, or pushed tree that is caught up or lodged against another tree, which prevents it from falling. (A cut-up tree is one where felling cuts have been made but the tree remains standing.) Attempting to bring down a hung-up tree is the leading cause of fatal injuries in tree felling.

If a tree faller creates or identifies a hang-up, they should alert other co-workers immediately. No one should work or be within two tree lengths of the likely direction of fall.

- never work under a hang-up;
- never 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; and
- follow ACoP Rule 11.7.4 regarding driving hang-ups that exceed one on one driving, and use a felling assistant/observer where appropriate.

Where tree driving must be employed to bring down a hang-up, there are specific rules in the ACoP to ensure it is planned and executed safely. Further information on tree driving can be found on page 11.

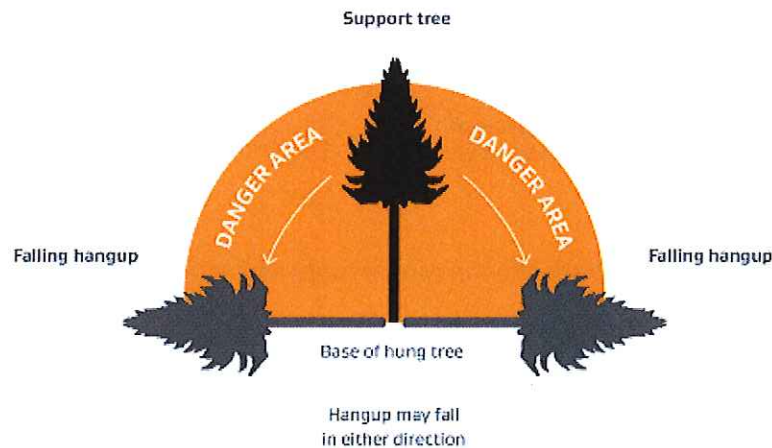


Figure 3. Danger area when felling a hung-up tree

5. Stem movement/rebound

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; and
- the tree striking an obstacle as it falls, e.g. a rock, another stem, other terrain features.

In the event that a felled tree falls into or brushes against another, the butt of the tree can rebound and strike the tree faller. Spars are most likely to rebound. A tree that is felled uphill may also slide back down the hill and strike the tree faller, so it's important to move further along your escape route. Tree-to-tree contact can also snap off branches or tops of trees, which ricochet backwards. 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.

To minimise the hazard of stem rebound:

- always have an escape route cleared at a 45-degree angle opposite the felling direction, and finish the felling cut on that safest side of the tree;
- always keep your eyes on the tree as it falls;
- move away from the stump as the tree falls; and
- avoid felling trees uphill.

Assuming the five step felling plan has been followed and the faller is well along the escape route, this hazard should be minimised.

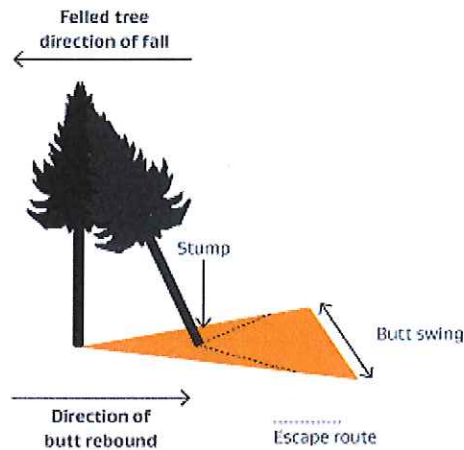


Figure 4. Danger area extending back into the escape route where a felled tree hits another and causes a rebound.

6. Felling dead trees

Dead, broken or rotted trees are particularly hazardous, and need to be felled or removed before the tree feller begins working in the area. If that is not possible, they should be felled as soon as possible. Do not leave a tree like this standing as you work around it; it may fall at any time. Until a dead tree is removed, no work shall be done in the danger zones except for the purpose of making it safe (e.g. clearing an access way to the dead tree). Machine felling is the best way to fell a dead tree.

Driving dead trees can also pose dangers as the dead tree may break, with the upper stem falling backwards towards the feller. Where possible, machine-fell dead trees. The feller should notify the person available (ACoP rule 11.1.2) of a dead tree before and after felling it.

Always remember that a dead tree can fall in any direction at any time without warning.

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.

7. Faller struck from behind

Although it is not obvious what causes it, sometimes a tree or limb can fall from a tree behind the feller and the tree they are felling. 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.

Assessing the tree you plan to fell should include assessing the surrounding trees for damage and structural weakness. Look for branches interlocking with vines or branches of other trees. Clear vegetation around the tree, and make sure the escape route is clear.

The danger zone in this hazard extends from the felled tree to the tree behind with width equal to the width of the tree behind (Figure 4). Note that this hazard is relative to the direction of fall, a factor that emphasises the importance of directional felling techniques and proper use of scarf and back cuts.

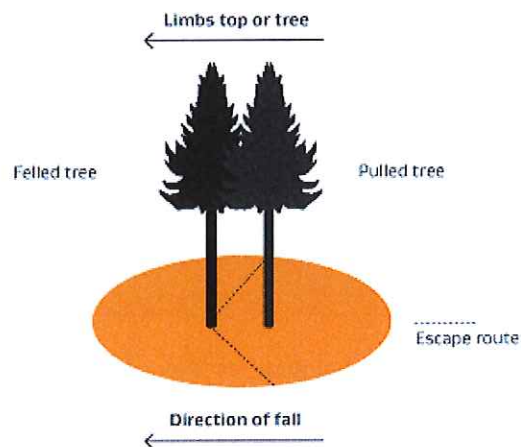


Figure 5. Danger area where the felled tree pulls another with it as it falls.

2.4 Tree driving

ACoP rule 11.7.2 Tree driving shall not exceed one onto two trees.

11.7.4 The faller shall notify the person available to them that they intend to undertake a tree drive.

- The faller shall notify the person that the drive has been completed successfully.
- If a one onto two drive is unsuccessful, felling shall cease until an observer is present to help plan management of that hazard.

The term 'driving' means pushing a tree over by felling another tree into it. Tree driving may be used to fell trees that are hung-up, cut-up, or broken, or those leaning against the intended direction of fall which cannot be safely felled using wedges (ACoP rule 11.7.1). Where conventional felling methods have failed, driving may be used.

A competent person should be advised when a tree drive is to be attempted, and again when it's successfully completed. That person should ask questions about safety issues and not just acknowledge that a drive is about to take place. If the drive fails, and another driving tree is needed, get an observer to help plan the next drive, and to warn on the movement of the trees.

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

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

Tree fallers driving any more than one onto one tree should be properly trained and hold the unit standard for tree driving.

2.5 Wind-throw and machine assisted felling

ACoP rule 11.11.1 In areas of wind-thrown salvage, machine assisted felling shall be the first choice of felling mechanism.

11.11.2 Any manual faller required to work in wind-throw shall have their competency assessed against NZQA Unit Standard 1270.

11.11.3 No person shall work directly under wind-wrenched trees.

Wind-thrown trees are very hazardous to deal with, as they can be unstable and unpredictable.

Wind-throw can cause:

- unstable root plates;
- suspended stems under high tension and compression;
- stems wedged between standing trees;
- stems leaning into standing trees;
- uprooted trees;
- spars;
- shattered tops;
- suspended hazards;
- heavy leaners;
- restricted access, i.e. heavy slash; and
- undesirable or disrupted felling patterns.

Wind-thrown trees should only be felled by competent persons. As wind-throw doesn't necessarily happen frequently or regularly, it's important to reassess the tree faller before felling wind-throw. Each wind-thrown tree needs to be assessed individually. **Wherever possible, wind-thrown trees should be felled by machine, rather than manually.**

Where access issues prevent machine-assisted tree felling, you should ensure all possible movement of a standing tree or wind-thrown stem on release of tension or compression is assessed and cuts planned beforehand.

For more information, visit www.worksafe.govt.nz

- *Approved Code of Practice for Safety and Health in Forest Operations* (WorkSafe New Zealand)
- *Best Practice Guidelines for Tree Felling* (Competenz)