



## **COURSE IN REDUCED-IMPACT LOGGING: Chainsaw Use, Safety Practices & Directional Tree Felling Techniques**



**DFID** Department for  
International  
Development

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March 2010

## Foreword

The Forestry Training Centre Incorporated is a partnership between the Guyana Forestry Commission(GFC), the Forest Products Association of Guyana (FPA) and the Tropical Forest Foundation (Virginia, USA), with core funding by the International Tropical Timber Organisation (ITTO), the GFC, the UK Department for International Development (DFID) and WWF-Guianas. Caterpillar Inc. has provided major in-kind support to FTCI.

FTCI's primary mission is to provide vocational training to operatives in the forestry sector, promote the use of reduced-impact logging practices in Guyana and the wider region and support implementation of GFC'S *Code of Practice for Timber Harvesting* by running a model logging operation and providing hands-on training to operatives. The target group of forest operatives) include forest managers, forest technicians involved in timber harvesting across the forest sector, staff of the GFC and other public departments, environmental NGOs and community based enterprises.

This manual targets chainsaw operators and their assistants (choker-men).The course is also useful for forest managers and other staffs engaged in supervising chainsaw operators.

It is recommended that experienced chainsaw operators be trained over a one week period while green or aspiring operators should be trained for a three week period.

This manual is a modified version of Chapters 12, 13 and 14 of FTCI's general RIL manual.

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## Acknowledgements

This manual has been derived from the following training and operation manuals:

Training manuals provided by the Fundação Floresta Tropical of Belém, Pará, Brazil

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In addition, some content is based on the following publications:

- a) New South Wales (Australia) Chainsaw Operator's Manual
- b) Skogsarbeten (Forest Operations Institute of Sweden) Felling Manual
- c) Stihl AG: 066 Owner's Manual
- d) AMAZON: Floresta Para Sempre - RIL manual
- e) Allied Systems Co.: Ranger F68 Skidder Operators Manual
- f) Caterpillar Performance Handbook Editions 16-32 (1985-2002)
- g) Caterpillar: 966F Series II Wheel Loader Operation and Maintenance Manual
- h) Caterpillar: 528B Skidder Operation and Maintenance Manual
- i) Caterpillar: D6D, D6E & D6E SR Track-type Tractors Operation and Maintenance Manual
- j) Equipment Manufacturers Institute: Wheel Loader Safety Manual
- k) URS' "Training of Trainers in RIL" course notes and lesson plans
- l) Notes by Frank Cole (URS)
- m) The Guyana Forestry Commission's Code of Practice for Timber harvesting.
- n) Steve Conway: Logging Practices – Principles of Timber harvesting Systems. Miller Freeman Publications

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## Introduction

Course participants are reminded that each tree to be felled should be part of a plan: the tree meets a number of criteria (legality, species, diameter at breast height, bole height, risk class, form, etc.) before being selected for felling. Further, ideally, several activities preceded the felling activity: surveying and mapping, forest inventory, preparation of a tree stock map, skid trail alignment and identification and delimitation of log markets. Further several activities will follow those of the chainsaw operators including skidding, log sorting and grading and its haul to a point of sale or point of processing (most likely, a sawmill). Chainsaw operators are therefore part of a system, and all care taken during felling will add value to the overall timber harvesting and timber utilization tasks.

The second point chainsaw operators should bear in mind is that the felling activity is the start of the timber utilization process. When the tree is standing we have several (marketing) options; however, once we throw the tree, we have taken a non-reversible position. It is vital that the felling activity create conditions for the logger to realise the marketing and utilization goals for that log. Ideally, the sale of the log or its full utilization (pole, pile, sawn timber, hewn square for example) should be determined prior to the felling of the tree. If a tree is unduly damaged while felling, then the logger may not be able to realise his original marketing decision. It is useful for the chainsaw operator to bear in mind that it is only when the log or other products from the tree is sold that planning and operational costs are recovered.

The third point to bear in mind is that tree felling activity is one of the most hazard prone activities in logging. Indeed, we should bear in mind that accidents in forestry frequently occur in an isolated areas, far from medical centres. The observation of a few basic precautions and methods outlined in this manual can change operators' behaviour and drastically reduce the number of accidents in forestry. Note is taken here of the dramatic modifications made on chainsaws over the years to minimise harm to the operator from stress or injury due to excessive noise and vibration.

The substance of this manual does not in any way replace the manuals issued by manufacturers. Chainsaw operators are encouraged to read the manuals that accompany the chainsaws they use.

FTCI encourages chainsaw operators to review the models of chainsaw on the market and buy according to their needs. Once the chainsaw is bought, the chainsaw operator must **know** the saw inside-out.

Module 2 provides basic information on chainsaw use and safety, Module 3 contains useful information on cross cutting techniques and Module 4 contains information on directional felling practices.

Finally, practice makes perfect; chainsaw operators are encouraged to focus on what they do because *chainsaw operators make or break* logging enterprises. Put another way, in large measure, the success of a timber harvesting operation depends on the capabilities of their chainsaw operators.

## 2. CHAINSAW SAFETY

### 2.1 Introduction

#### 2.1.1 Professional attitude

A professional operator:

- ✓ cares for his equipment
- ✓ can assess a tree he intends to fell
- ✓ can fell a tree in the “desired direction of fall”
- ✓ has a keen sense of safety
- ✓ has a sense of responsibility towards the environment and the final condition of the tree being felled.

#### 2.1.2 Safety first

Working with a chain saw involves many different - sometimes-complicated - situations. The chain saw is a very effective tool, but it can also be dangerous if used improperly. In order to avoid accidents and unnecessary strain, you should use:

- ✓ a chain saw with functioning safety features,
- ✓ appropriate safety equipment and,
- ✓ correct techniques.

#### 2.1.3 Occupational Hazards

- Falling Limbs, Lianas and Branches
- Eye Injuries
- Industrial Deafness
- Foot Injuries
- Reynaud's Phenomenon “White Fingers”
- Back Injuries
- Kickback
- Environment
- Safety Distance
- Hand Tools and Accessories

All safety equipment should be checked regularly to make sure it is complete and fully operational!

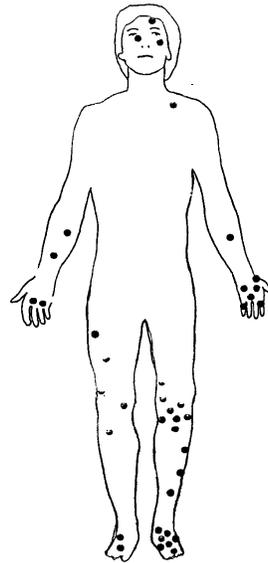


Figure 1: Main areas prone to chainsaw injuries.

## 2.2 Personal Protection Equipment

- ✓ Safety helmet
- ✓ Ear muffs or plugs
- ✓ Visor or safety glasses
- ✓ Chainsaw protective boots incorporating steel toe cap and chainsaw protection
- ✓ Close fitting clothes
- ✓ Protective trousers or chaps with front protection in both legs
- ✓ High-visibility vest/shirt
- ✓ Gloves (with protective pad on the back of the left hand)

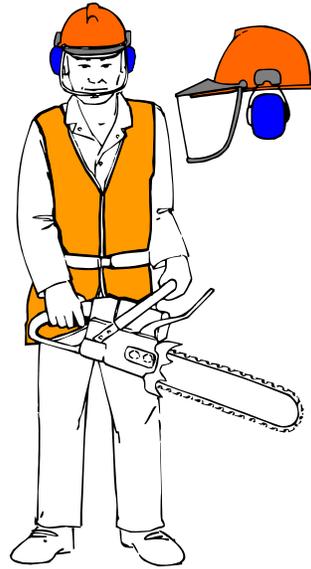


Figure 2: Personal protection equipment

## 2.3 Chain Saw Safety Requirements

A modern chain saw must be equipped with the following safety features:

- Kickback guard and chain brake
- Throttle lock
- Effective vibration reduction
- Chain catcher
- Right-hand guard
- Accessible master control

All safety equipment should be checked regularly to make sure it is complete and fully operational!

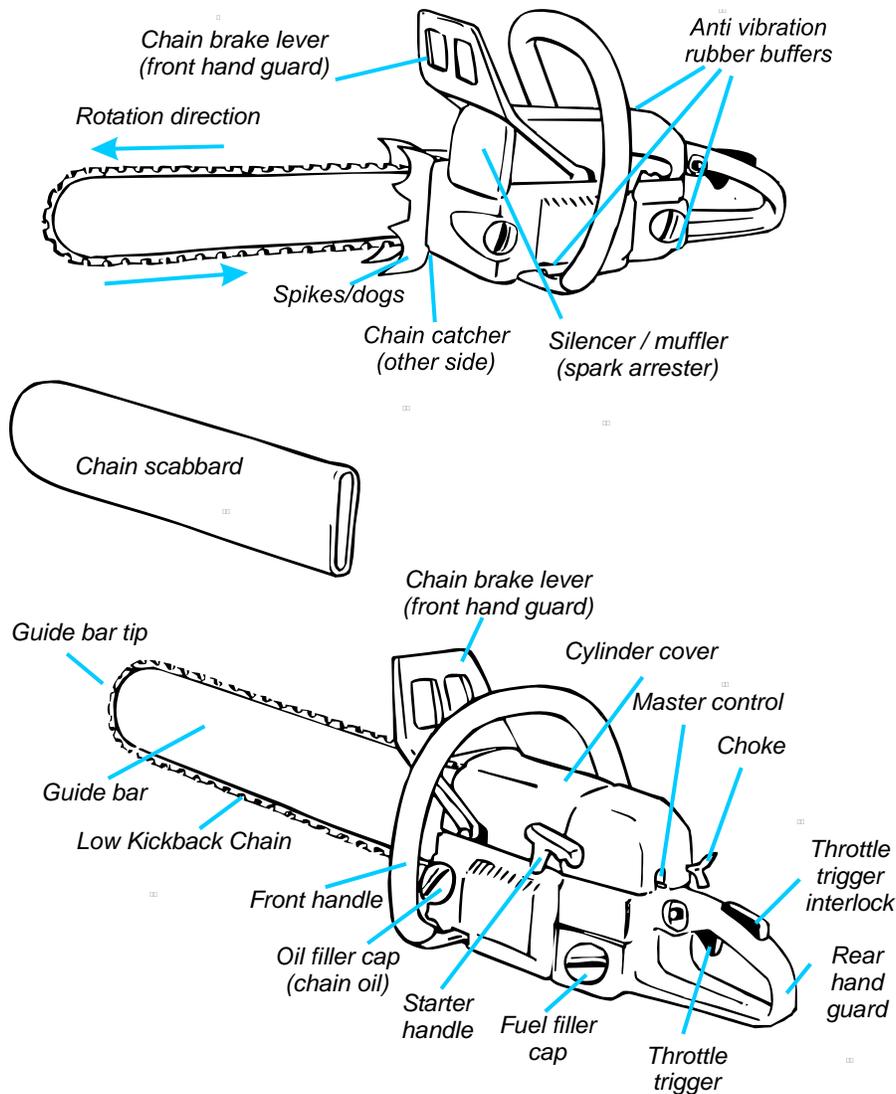


Figure 3: Safety devices on a chainsaw

## 2.4 Using a chainsaw safely

### Carrying the saw.



- Make sure the chain does not move while you are carrying the saw.
- It is best to turn off the engine if you are going to carry the saw a long way, but you can also engage the chain brake to lock the chain.
- Fit a guard to the bar before carrying the saw any distance. Always carry the saw with the guide bar pointing backwards!

### Thumb grip.

- Hold both handles firmly.
- Make sure your thumb is locked around the front handle.

### Keep it close to you!

- Hold the saw close to your body. This gives better balance and makes the saw feel lighter.

### Balance.

- Make certain you stand firmly with your feet apart. This will give you a good working balance.

### Bend at the knees.

- Whenever you must use the saw in a low position, bend your knees. This will reduce strain on your back.

## **2.5 Refuelling**

- Always stop engine before refuelling..

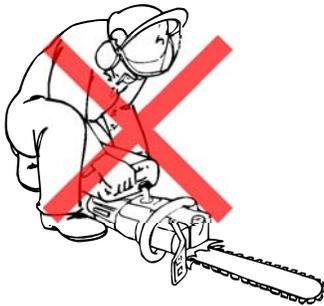


Figure 4: Do not smoke when refuelling



Figure 5: Do not start the saw at the place of refuelling

## **2.6 Starting a Chainsaw**

The safest way of starting a chainsaw is by placing the saw on the ground and starting it from there.

### Starting saw on ground

- Apply chain brake.
- Place saw on ground.
- Clear away any obstacles, particularly near tip of guide bar.
- Place the right foot through the rear handle and left hand on the front handle.
- Pull the starter rope with the right hand.

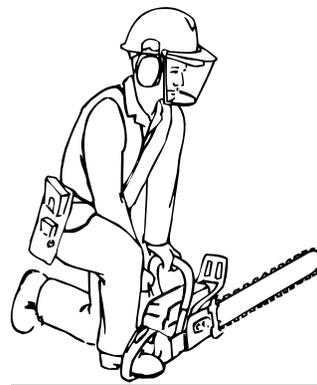


Figure 6: Starting saw on the ground

### Starting saw off ground

- Apply chain brake.
- Grip the front handle with left hand, keeping arm straight.
- Grip rear handle between knees at the angle shown in the diagram.
- Use right hand to pull start rope.
- Maintain straight back, look straight ahead.



Figure 7: Starting saw off the ground

Do not drop start!

### **2.7 Kickback**

Kickback is one of the most common causes of chainsaw accidents. It occurs when a moving chain in the upper quadrant on the nose of guide bar contacts an obstacle, or becomes pinched, and rather than cutting through it, the bar is thrown out of the kerf (backwards and upwards) and can hit the operator if he/she is in line with the bar when this occurs.

Kickback can also occur when the depth gauge is too low or not rounded, because

too much of the cutter will “bite” into the wood without being able to sever it.

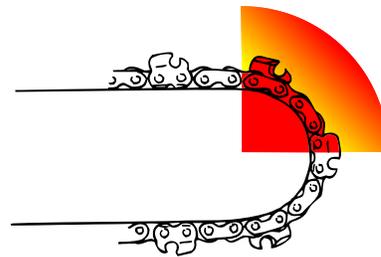


Figure 8: Kick-back zone (upper section of the tip)

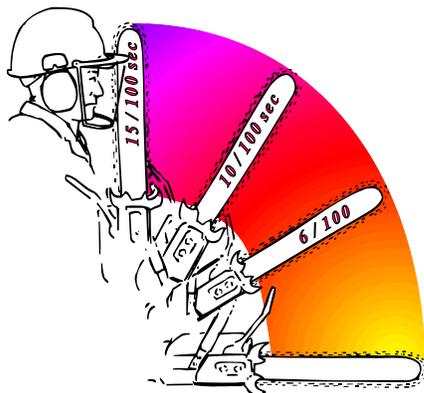


Figure 9: Time taken for guide bar to reach your face following severe kickback

- Automatic chain brake: 6/100 sec
- Standard chain brake: 10/100 sec
- Time taken to reach face: 15/100 sec

## 2.8 Measures to reduce kickback

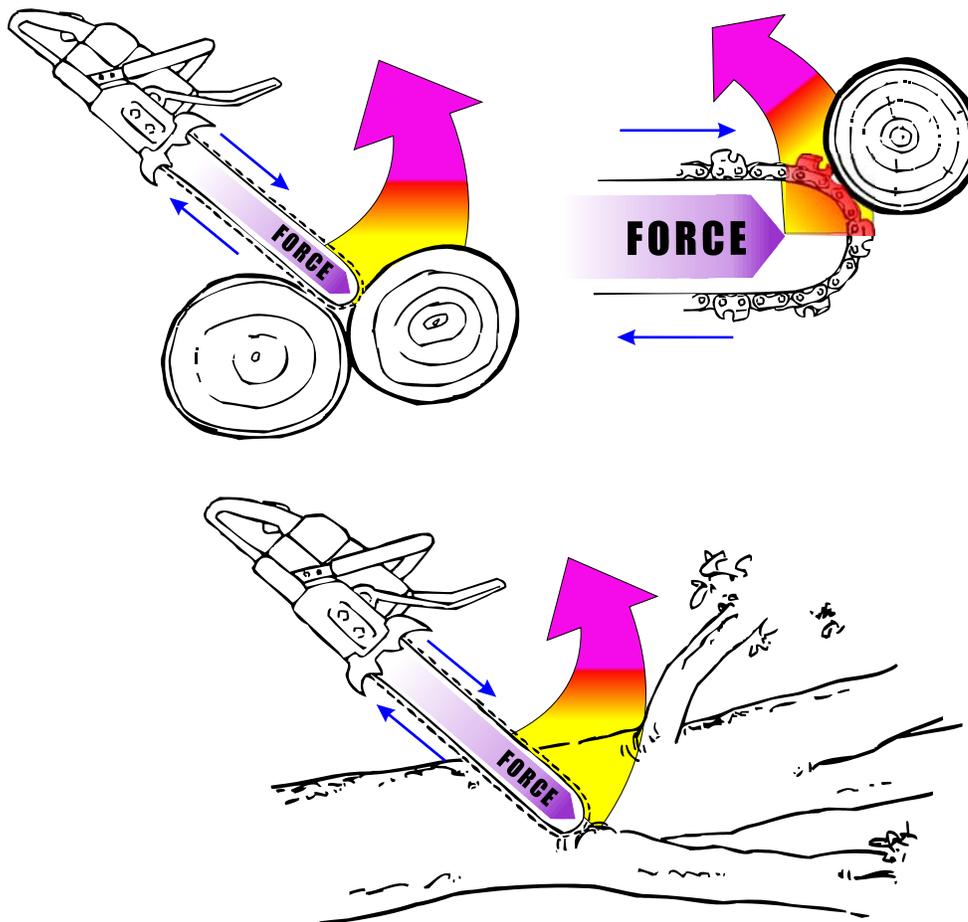


Figure 10: Common kickback situations

- ↪ Maintain a firm grip (good footing, keep chainsaw close to body, straight wrist, and thumb behind front handle).
- ↪ Cut at peak revs (more chance of cutting through an obstruction).
- ↪ Be conscious of where the nose of the bar is at all times.
- ↪ Use correct boring techniques.
- ↪ Avoid limbing with upper section of bar nose (tip).
- ↪ Sharpen chain correctly.
- ↪ Tension chain correctly.
- ↪ Correct depth gauge setting.
- ↪ Keep front of depth gauges well rounded.
- ↪ Ensure chain brake is functioning correctly.
- ↪ Only use reduced kickback chain for felling trees and bucking logs.

### 3: CROSS-CUTTING TECHNIQUES

#### 3.1 Definition

Crosscutting is making a cut across the grain or axis of a log).

#### 3.2 Objectives

- To sever the crown or butt from the log
- To acquire a desirable length of log.
- To eliminate defective or unwanted portion(s) of a log.
- To cut two or more blocks (bucking)

#### 3.3 A chainsaw's performance during wood-cutting

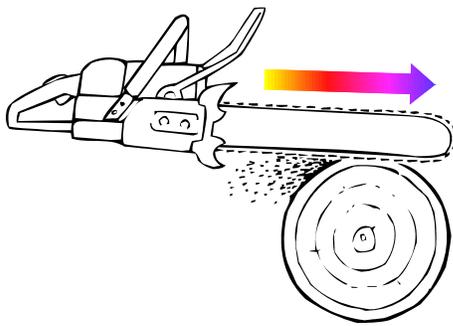


Figure 11: Pull-in

**Pull-in** occurs during cutting on top of the log, when the chain is pinched or encounters an object on the bottom of the bar. The reaction of the chain pulls the saw forward.

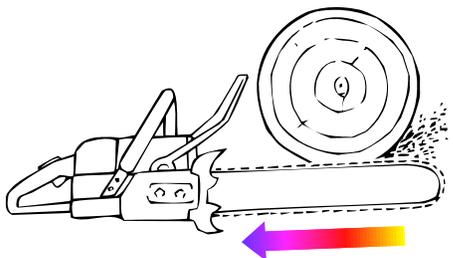


Figure 12: Pushback

**Pushback** occurs during cutting underneath the log, when the chain is pinched or encounters an object on the top of the bar. The reaction of the chain drives the saw straight back toward the operator.

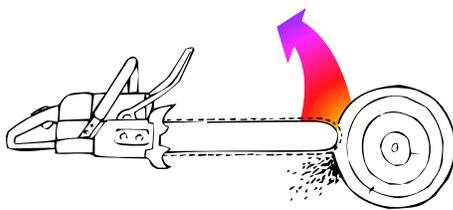


Figure 13: Kickback

**Kickback** occurs when boring straight into the log. Instead of boring straight, begin cut by applying lower portion of the guide bar nose; swing saw slowly into plunge-cutting position. Danger of pushback remains!

### 3.4 Techniques in minimising chainsaw performance during cutting

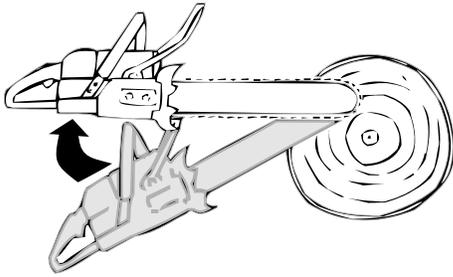


Figure 14: Starting at the top of the log

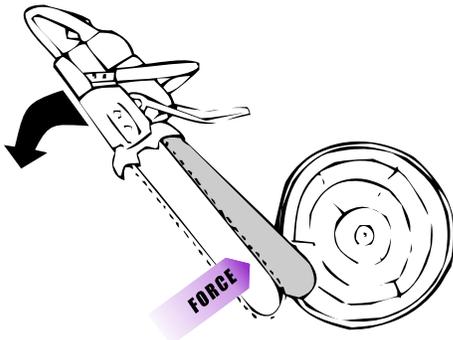


Figure 15: Starting in the middle of the log

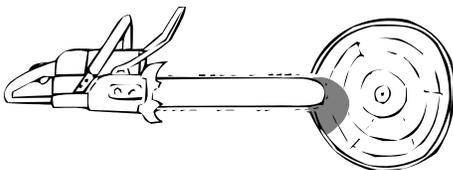


Figure 16: Swing into plunge cut position

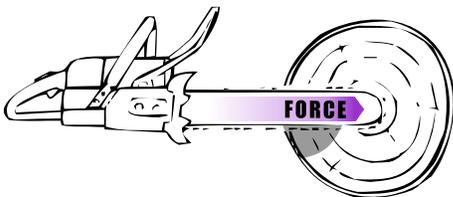


Figure 17: Bore at full throttle

#### Starting at the top of the log

1. Commence cut with the lower section of the guide bar nose until the depth of the kerf is about the same as the width of the bar. (Fig. 14)

#### Starting in the middle of the log

2. Keep the bar in line with the side of the log
3. Commence cut with the top section of the guide bar nose until the depth of the kerf is about the same as the width of the bar. (Fig. 15)

3. Swing saw slowly into plunge cutting position. (Fig. 16)

4. With the saw at full throttle, insert the guide bar in the trunk. If possible, support the saw against your legs. (Fig. 17)

Beware of risk of pushback and kickback

### Good crosscutting techniques will:

- Minimise the chance of injury.
- Minimise damage to engine and cutting attachment.
- Avoid pinching of the guide bar.
- Maximise utilisation of felled timber.

## 3.5 Basic principles of cross-cutting

### 3.5.1 Points to note

- Do not stand on log while cross-cutting
- Always assess the bind relationships in the log and choose sequence of cuts to suit.
- Stand to one side of cut.
- If there is a chance of either half of the log springing, keep an escape route open.
- Stand on the opposite side to which a log will spring or roll (on the uphill side) (Fig. 71).
- Wherever possible cut the opposite side of the log first.
- Instead of strenuous cutting upwards, boring in and cutting downwards may be easier.
- Watch cut to see whether it is opening or closing.
- Use the saw as a lever and the log as a pivot point to minimise work effort.
- Insert a wedge in the cut if there is a high risk of the log dropping or twisting.
- Take special care when cutting shattered wood - sharp slivers of wood may fling in your direction

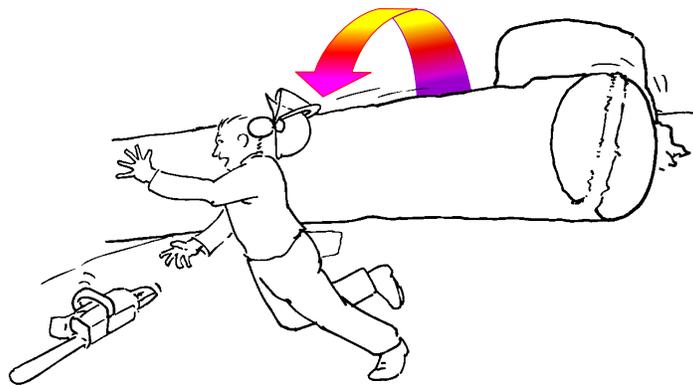


Figure 18: Stand on the opposite side to which a log will spring or roll

### 3.5.2 Assessment of internal stress

- In cross-cutting, always cut at the compression side first
- If the compression side is cut last, the saw will jam and/or the timber will split

There are four situations that can occur: top bind, bottom bind, side bind, and 'log trap'.

### 3.5.3 Top bind and Bottom bind

Top bind occurs when both ends of the log are supported (Fig. 19)

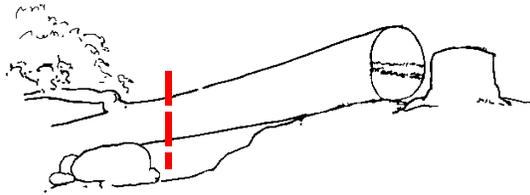
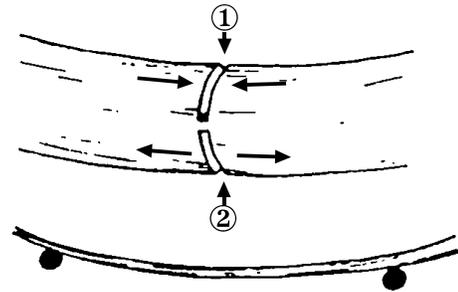


Figure 19: Top bind



#### Sequence of cutting to avoid top bind

##### Small log

Compression

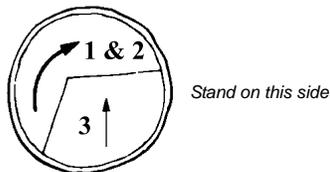


Figure 20: Small logs with top bind

1. Begin cutting on the side of the log away from you for about 1/3 of the log diameter
2. Bring the saw towards you and cut downwards for about 1/3 of the log diameter or until the cut begins to pinch the guide bar.
3. Continue from the bottom side of the log. Try to bring the two cuts together. (Figs. 73 and 74)

##### Large log

Compression

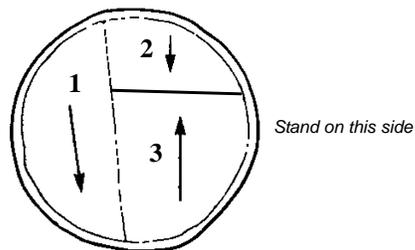


Figure 21: Large logs with top bind – alternative 1

Or

- 3, 4, 5 Bore in and cut down, but finish the cut coming upwards
- When you cut from above the saw pulls itself against the log. This is safer and easier than cutting from below.
  - When you cut from below the saw tries to move towards you.
  - Grasp the front handle with your thumb underneath to ensure a firm grip. (Fig. 75)
  - Keep the saw as close to the trunk as possible for maximum safety.

Compression

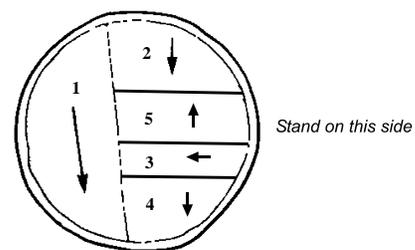


Figure 22: Large logs with top bind – alternative 2

**Bottom bind** occurs when one end of the log is supported (Fig. 23)

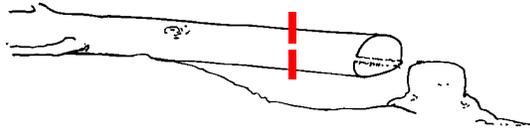
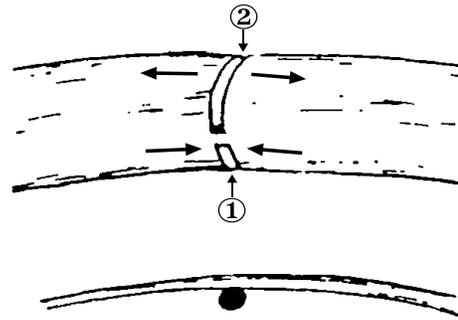


Figure 23: Bottom bind



**Sequence of cutting to avoid bottom bind**

**Small log**

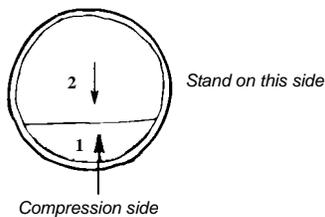


Figure 24: Small logs with bottom bind

**Small log**

1. Begin cutting upwards for about 1/3 of the log diameter or until the cut begins to pinch the guide bar.
2. Continue from the top side of the log. Try to bring the two cuts together.

**Large log**

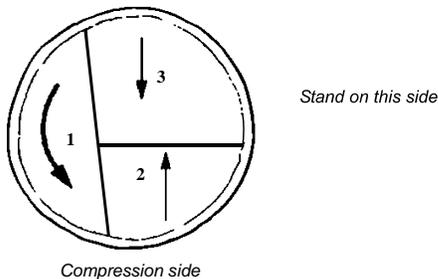


Figure 25: Large logs with bottom bind – alternative 1

**Large log**

1. Begin cutting on the side of the log away from you for about 1/3 of the log diameter
2. Take the saw out and cut upwards for about 1/3 of the log diameter or until the cut begins to pinch the guide bar.

or

- 2, 3, 4 Bore in and cut down, before cutting upwards
- 3 (5). Continue from the top side of the log. Try to bring the two cuts together.

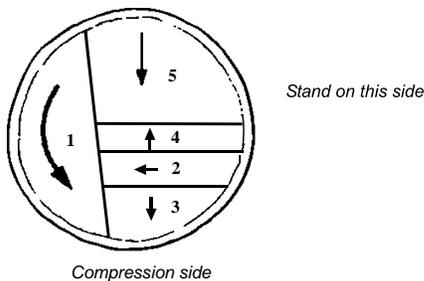


Figure 26: Large logs with bottom bind – alternative 2

**A Log trap occurs when one end of the log is unable to move (Fig. 27)**

If one end of the log is unable to move and the other end can drop away when cut, the saw will jam (or worse) when applying ordinary cross-cutting techniques

1. Begin by making a downward cut at the compression side
2. For the bottom cut an angled cut is used
3. Ensure that the angled cut is sloped to the correct side so that the release cut will not cause the guide bar to be trapped when one end drops away.
4. Alternatively, use a staggered cut for the bottom cut

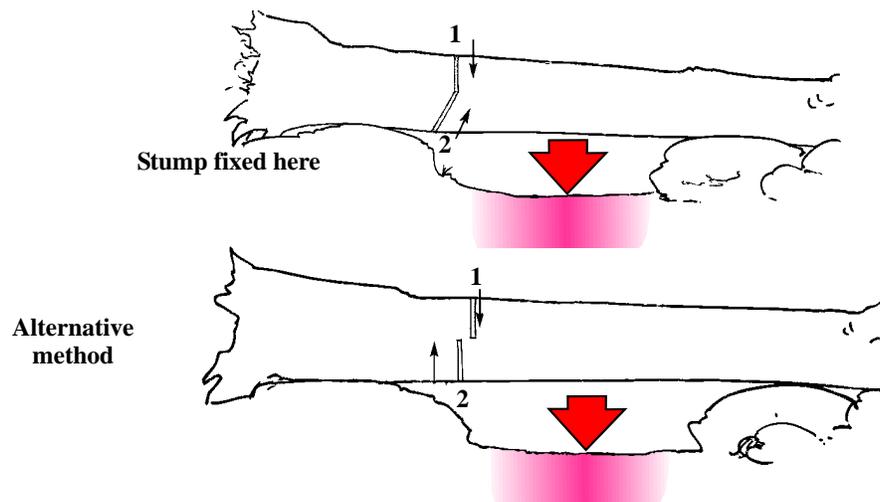


Figure 27: Sequence of cutting in case of a 'log trap'

## 4. FELLING TECHNIQUES

### 4.1 Introduction

#### 4.1.1 Definition

Tree felling is the throwing (cutting) of the commercial trees previously selected, using the best directional felling techniques.

#### 4.1.2 Objectives

- To reduce damage to the stem of the tree being felled,
- To reduce damage to protected and residual trees,
- To cause less damage to the forest,
- To avoid unnecessary, exaggerated gaps, and
- To facilitate proper skidding operations.

#### 4.1.3 Team

- 1 chainsaw operator; properly trained to execute the felling and bucking activity
- 1 helper (choker man); a skilled person who will assist in tree location, tree cleaning, wedging and the transport of materials.

One of the team members should be trained in first aid.

#### 4.1.4 Equipment & Materials

- Chainsaw (high power to weight ratio such as Stihl 066 or Husqvarna 395) complete with 30" (75 cm) guide bar with nose wheel
- 4 lb. Sledge hammer



- Safety gear feller



- Cutlass
- 3 aluminium felling wedges (10")



- Safety gear helper



- First-aid kit, snake-bite kit
- Spare felling chain
- Spare guide bar
- Round file (correct diameter for chain type)

- File holder
- Flat file (depth gauge)
- Filing gauge
- Tool kit for chainsaw
- Repair kit for chainsaw
- 2-in-1 Combination Jerry Can (2T gasoline, chain oil)

#### 4.2 Considerations before felling a tree

It is important that tree felling be planned carefully. Trees must be felled safely, in the desired direction, without damaging the stem of the felled tree and with minimal environmental impact. Well-planned felling also makes it easier to continue the felling team's work.

Therefore, the operator should:

1. Consult the list of trees to be felled and their location on the tree location map
2. Plan the sequence of felling and work pattern (work from the end of the skid trail towards the log market; always consider ease of extraction by machinery; avoid covering up previously felled trees, or the base of the tree to be felled next)
3. Have regard for his own safety and for the safety of others
4. Verify the felling direction indicated by tree marker
5. Consider the nine principles in selecting the direction of fall
6. Assess the standing tree, before making a final decision on the direction of fall

#### 4.3 Nine principles surrounding felling direction

1. Felling direction should not pose any danger to the saw man or others.
2. The natural falling direction of the tree should allow directional felling
3. Trees should not be felled into watercourses or their buffer zones
4. Trees should not be felled down steep slopes
5. Protected trees should not be killed or damaged
6. Trees should not be felled across obstacles such as felled and fallen tree trunks (takuba's), rocks, etc.
7. Trees should be felled in a position that facilitates extraction
8. Trees should not lodge in neighbouring trees (hang up)
9. Trees should be felled into existing canopy openings when present

#### 4.4 Assessment of a standing tree (Fig. 28)

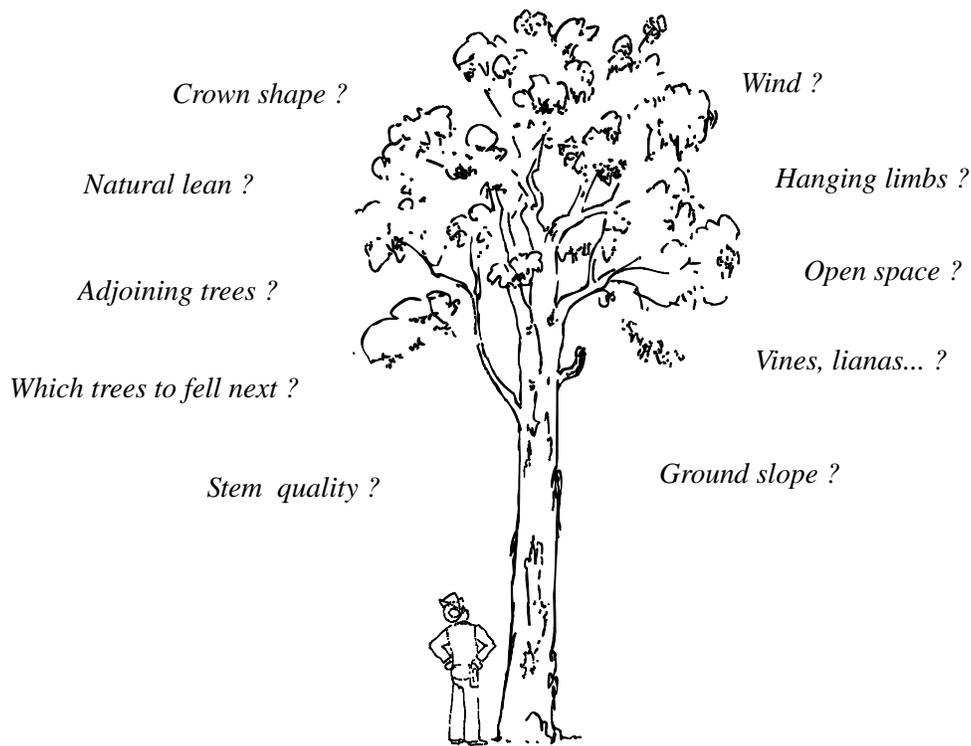


Figure 28: Factors influencing direction of fall

##### Natural lean of the tree

- It is difficult to fell a tree against all but a moderate lean

##### Weight distribution of crown

- Determine which side of crown has the most weight / mass.
- Branching or heavy growth on one side of the crown will tend to drag the tree in that direction

##### Check for defect

- Sound tree with axe, cutlass or hammer
- Look for external scars, dead wood in the crown, hollows, (wood-)ants, etc
- When in doubt, make a vertical plunge cut at the estimated felling height. If any abnormality is detected during the boring operation or if the bar is pulled into the stem, reject the tree. Indicate this on the tree location map

##### Trees should not be felled for safety reasons, when:

- The tree is inter-grown with adjacent trees.
- The tree brushes against other trees.

##### Open Spaces

- Always aim to fell into open space.
- Avoid felling into other trees, stumps, rocks or logs if possible.

## Wind

- Wind may be strong enough to overcome the tree's natural lean or lopsided crown.
- One may have to wait for “lull” in wind.

## Hangers or Widow Makers

- Take extra care when felling a tree with a hanger in it. First movement of the bole may dislodge the hanger. Continue watching during escape.

## Which tree to fell next?

Operator needs to consider sequence of felling trees to guard against:

- creating hangers or widow makers
- creating hang-ups
- creating extra work through placing heads of trees or limbs at the base of another tree to be felled.

### **4.5 Preparatory tasks before felling a tree**

Make sure no one is in the danger zone before you begin felling. Your danger zone is a distance twice the height of the tree you are felling

Prepare an escape route

- Most felling accidents occur within 4 metres of the stump.
  - If the butt kicks up as the tree falls, it will generally go straight backwards or to one side.
  - If tree splits up it will slab backwards from the line of fall.
  - If tree snaps in falling line it will generally come back straight over stump.
- Choose a line of retreat 45° diagonally backwards, away from the direction of fall. (Fig. 29).

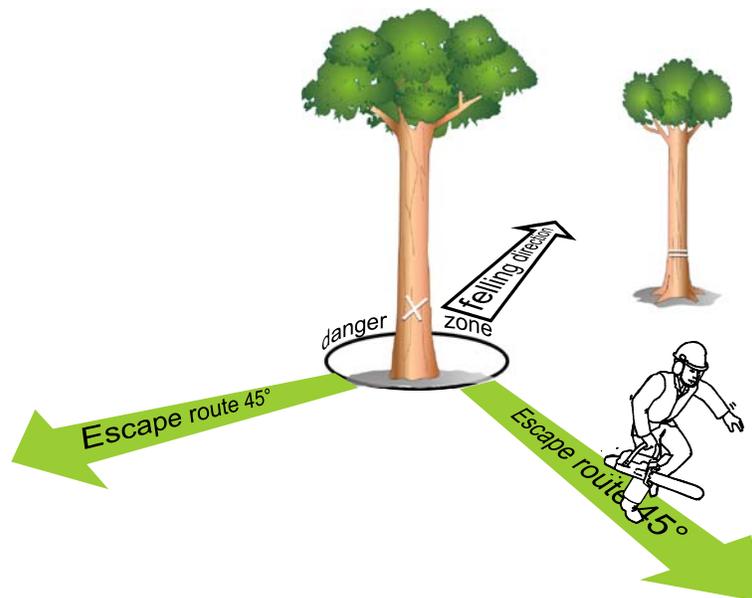


Figure 29: Create two escape routes

### Clean Around Base of Tree.

- Prepare a clean work area around tree (Fig. 83).
- Remove small bushes to enable a good footing and to prevent “kick-back” through guide bar striking hidden obstacle.
- Clean dead wood, etc. along tree felling line.

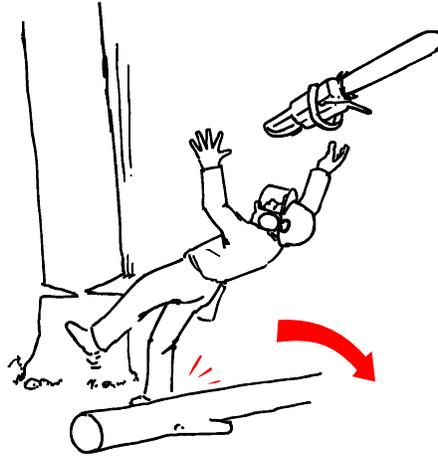


Figure 30: Clean obstacles around the base of the tree

### Clean lower portion of tree base with cutlass or hatchet.

- Remove all obstacles from escape routes
- Place all tools and equipment, including fuel cans, a safe distance away from the tree, but not on the escape routes
- When felling is being carried out close to roads or tracks, a sign “*Tree Felling in Operation*” should be placed on either side of the road facing oncoming traffic.

## 4.6 Felling Theory

### 4.6.1 Directional felling - the basics

The first two cuts create the directional notch and are made on the side the tree should fall. After the directional notch has been cut out, the back cut is made on the side away from the planned fall and slightly above the bottom of the notch. However, the cuts must not meet. Depending on the size and thickness of the tree, some holding wood must be left uncut between the directional notch and the falling cut. This is the hinge on which the tree swings when it falls and is the key to steering the tree in a chosen direction.

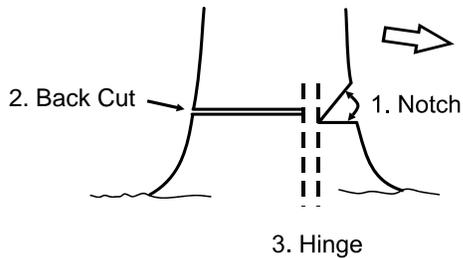


Figure 31: Basic cuts for directional felling

You can determine the direction a tree will fall by felling according to a specific system, applying:

1. Directional notch (scarf, “belly”)
2. Back cut (felling cut).
3. Hinge (holding wood, key).

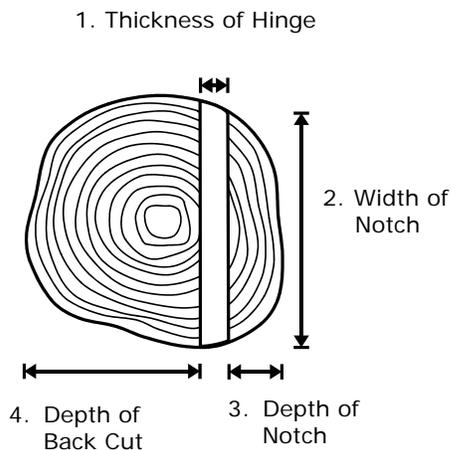


Figure 32: Dimensions of basic components

Important dimensions:

1. Thickness of hinge
2. Width of notch
3. Depth of notch
4. Depth of back cut
5. Opening of notch (angle between top and bottom cuts)

### 4.6.2 Notch

#### 4.6.2.1 Functions of the notch:

- Determines the direction in which the tree will fall
- Controls tree during fall (allows smooth steady fall of tree)
- Serves as a means of breaking holding wood
- Helps to prevent tree from splitting up

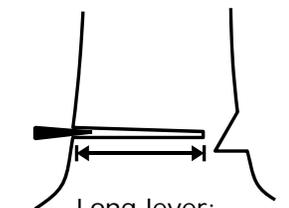
#### 4.6.2.2. Dimensions of the notch



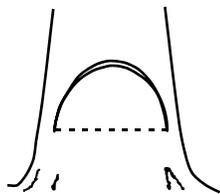
Opening too narrow - notch closes too early - hinge breaks: poor control



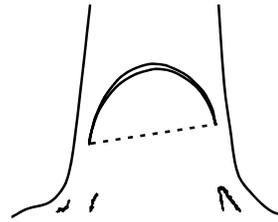
Opening large enough: good control



Long lever:  
Large turning moment



**Right: top cut level**



#### **Wrong: top cut slant:**

1. Difficult to align bottom cut
2. Uneven height of hinge will pull tree off line
3. Tree may split up

The opening of the notch should be between  $45^\circ$  and  $70^\circ$ .

- to control the tree's fall through as large an angle as possible
- If the opening is too narrow, then the notch closes too soon, hence breaks the hinge too early resulting in loss of control or the tree splitting

The notch should be deep enough to make the hinge sufficiently long to act as a strong hinge

- Therefore, the depth of the notch should be at least 20% of the tree's diameter.

Width of the notch will then be about 80% of the tree's diameter

The deeper the notch, the shorter will be the distance between the hinge and the point at which a wedge is applied, thereby reducing the total leverage.

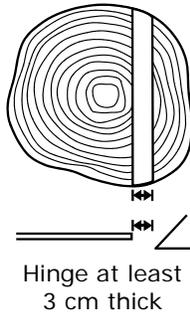
The directional notch is done in two steps: Top cut and bottom cut.

- The top cut is made first; the angle should be between  $45^\circ$  and  $70^\circ$ , the cut should end level (horizontal)
- Align the bottom cut carefully so that the top and bottom cuts meet exactly.

- The line where top and bottom cuts meet should be horizontal
- If the line of intersection is not horizontal, then holding wood on

higher corner will break first, thus pulling tree off line of fall

#### 4.6.3 Hinge

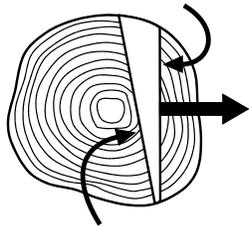


Acts as a hinge controlling the tree's fall.

Should be approximately 10% of a solid tree's diameter - but at least 3 cm (just over 1 inch).

Trees with defects: holding wood needs to be slightly thicker.

Direction always determined by this line

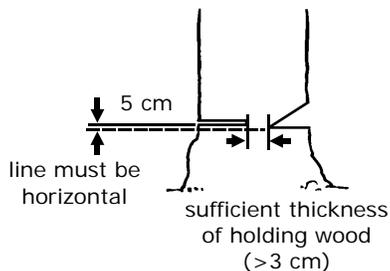


Never determined by this line

The direction of fall of the tree is determined by the front edge of the key or, in other words, by the way in which the notch is cut.

Consequently, if the notch is oriented incorrectly, this cannot be compensated for by leaving one end of the key thicker than the other end.

#### 4.6.4 Back cut

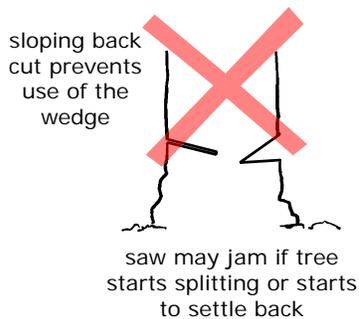
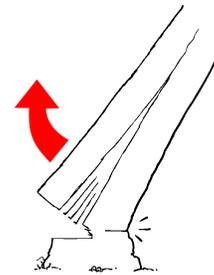
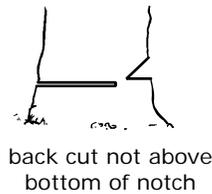


Back cut should be 2.5 cm to 5.0 cm (1-2 inches) above level of vertex of the notch (level of bottom cut if horizontal):

Provides a step, which prevents tree slipping backwards over stump (especially uphill felling).

Prevents butt log being damaged through splinters being torn out of log. (Splinters pulled out of stump.)

Trees are harder to fall with high back cuts. This creates more holding wood to be broken. (Particularly dangerous when wedging a slightly backwards leaning tree.)



Back cut should be horizontal:

Sideways sloping back cut will give uneven thickness in the holding wood; may result in trunk splitting up.

An up- or downward sloping back cut prevents efficient use of wedge.

Should leave sufficient thickness of holding wood to guide the tree through intended fall.

#### 4.7 Practical felling

Step 1: Before starting

- Make sure there is enough fuel in the tank before you start felling

Step 2: Starting

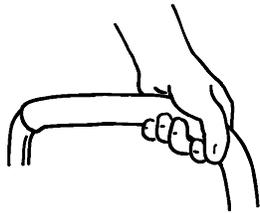
- Place your right foot firmly on the rear handle
- Grab the front handle with the left hand
- Pull the starting handle with your right hand

Step 3: Final checks

- Once the saw is running, check the chain brake function by pushing forward on the front hand guard.
- The chain lubrication should be checked by holding the guide bar over a stump and revving the engine.

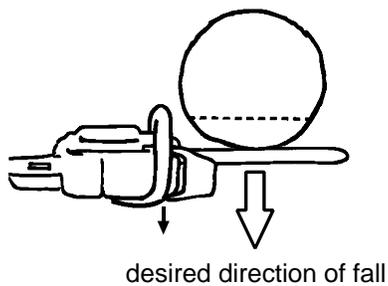


Step 4: Position yourself



- Stand facing the desired felling direction to aim properly.
- Position yourself firmly with your left shoulder resting against the tree.
- Support your right arm on your right knee, or support your right knee against the tree to take the strain off your back and enable you to guide the saw better

Step 4: Align the saw



- Grip the top edge of the front handle, since this will tilt the saw at the right angle for sawing the top cut.
- Align the saw at right angles to the felling direction. Use a straight edge or a line painted on the saw for aiming.

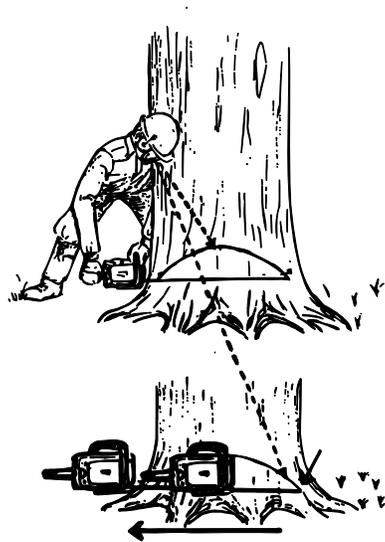
Step 5: Make the top cut

- Always make the top cut first
- Complete the top cut by sawing horizontally. If the cut is not level, make the cut again properly

- The angle between the top and bottom cuts should be as close to 70° as possible although never less than 45°.
- The bottom cut should have a depth of about 20-25% of the diameter

Step 6: Make the bottom cut

- Hold the side of the front handle.
- Align the cut carefully so that the top and bottom cuts meet exactly.
- Look through the top cut to check that the bottom cut is not made too deep.



#### Step 7: Make the back cut

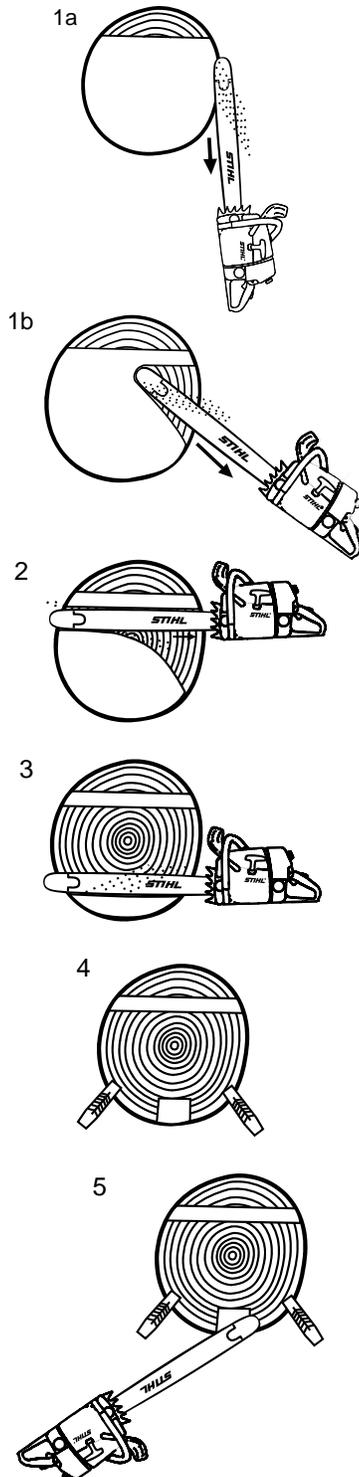
- Once the directional notch is complete, the back cut can be made.
- The technique used for making the back cut depends on the diameter of the tree, the length of the guide bar and the lean of the tree
- Whenever possible, use the backward-running part of the chain. The reason for this is that the sawdust will be ejected from the cut, making it easier to insert a wedge.
- Use a felling wedge in order to prevent the tree from settling back and pinching the bar.
- Be careful if there are signs of internal rot. The wood fibres will be weakened when a tree has been attacked by rot, which may affect the direction of the fall.

#### Step 8: When the tree begins to fall

- Withdraw saw. Do not continue sawing when fibres start breaking
- Withdraw along intended escape route
- Continuously look back at tree's fall
- Look out for falling limbs
- Do not re-enter felling site until all movement has ceased
- When felling trees uphill, they may slide straight backwards over the stump
- Trees that have lodged into a neighbouring tree must be brought down immediately. If the hung-up tree cannot be brought down, its location should be clearly indicated with suitable signalisation; e.g. flagging tape.

## 4.8 Techniques for making the back cut

### 4.8.1 Small-diameter trees, where the guide bar can pass right through



If you want to guard against the tree settling back, leave a small corner of the felling cut un-sawn

1a/b. Cut a slot a short distance from the hinge. Use the saw at full throttle and the backward-running part of the chain.

2. Cut the slot right through the tree. Straighten the hinge

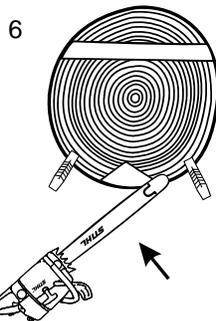
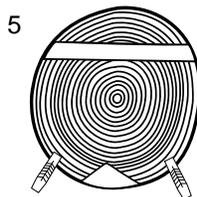
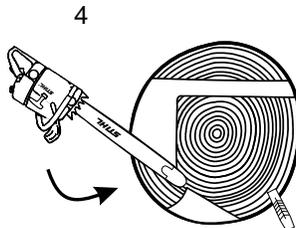
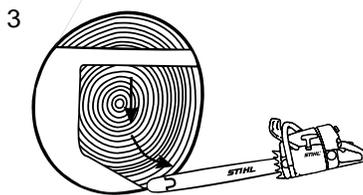
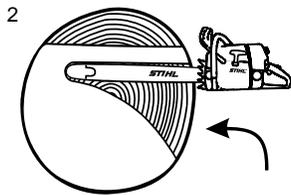
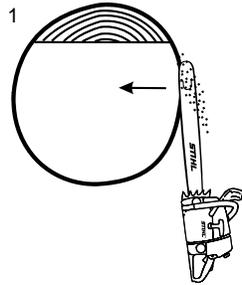
3. Continue sawing towards the back of the tree but leave a “heel” as support for the tree. If you are uncertain how thick the bark is, cut through it at the corner support first.

4. Now the tree cannot fall. Remove the saw from the cut and form the “heel”. Insert wedges on either side of the “heel”.

5. Supporting the saw against your right leg, cut through the corner support at a downward angle using the backward-running chain. Do not cut in or underneath any of the wedges

6. Drive wedges to force tree to fall

#### 4.8.2 Trees bigger than the length of the guide bar



1. Cut a slot a short distance from where the hinge will be made. Use full throttle and the backward-running part of the chain.
2. Make the cut parallel to the hinge as far in as the guide bar will reach.
3. Keeping the guide-bar parallel to the hinge, saw towards the back of the tree. Do not cut through to the back but leave holding wood ("heel") in the middle
4. Insert a wedge, aiming at the centre of the hinge. Cut a new slot on the opposite side. Finish cut by making the hinge straight.
5. Remove the saw from the cut and form the heel at the back of the tree. Insert a second wedge. The tree is still standing firmly on a large supporting base.
6. Cut the remaining corner (heel) a little below the felling cut. Do not cut in or underneath any of the wedges
7. Drive wedges to force tree to fall

## 4.9 Wedging

### 4.9.1 Types of wedges:

#### 4.9.1.1 Steel

- Durable but heavy
- Will ruin chain if it contacts wedge

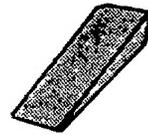
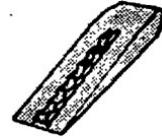
#### 4.9.1.2 Aluminium

- Lighter than steel
- Generally won't ruin chain if chain contacts wedge

- Less durable

#### 4.9.1.3 Plastic

- Light
- Easy on chain (chain will cut through plastic)
- More prone to damage and wear from hammer blows
- Some types will “pop” out if struck hard.

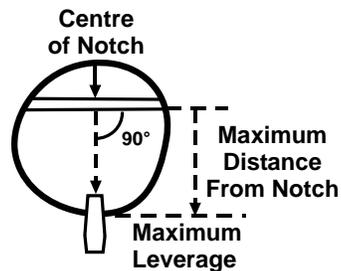


### 4.9.2 Criteria for using wedges:

- slight backward leaning trees;
- side lean trees;
- cross cutting;
- preventing guide bar from pinching;
- removing pinched guide bar

### 4.9.3 Use of Wedges:

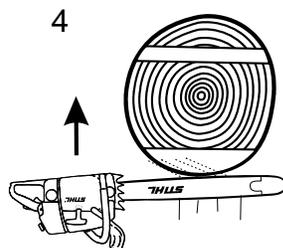
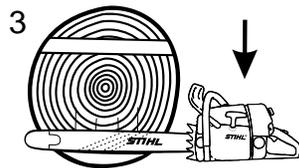
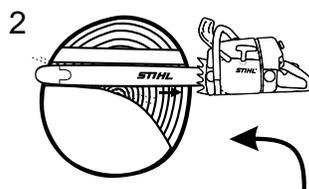
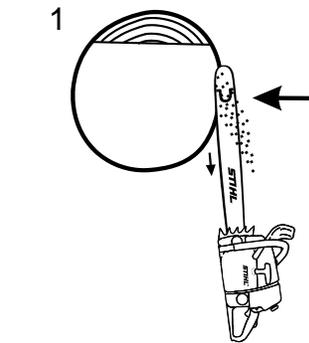
- Drive into back cut as soon as saw has cut deep enough for wedge not to come in contact with saw.
- Thick bark to be removed to allow wedge to work on solid timber.
- Whenever possible insert the wedge directly in line with the centre of the notch to obtain maximum leverage.
- If the tree does not move after three blows on the wedge, check the hinge (thickness) and back cut (cut through)



#### 4.10 Special felling situations

- Trees leaning backwards
- Trees with forward lean
- Trees with side lean
- Defective trees

##### 4.10.1 Trees with forward lean



If felled in the conventional way, a tree with a forward lean is likely to split

1. Bore in behind where the hinge is to remain

2. Cut the slot right through the tree and make sure that the hinge is straight.

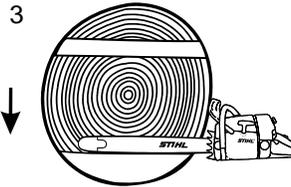
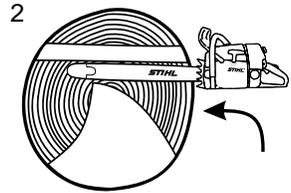
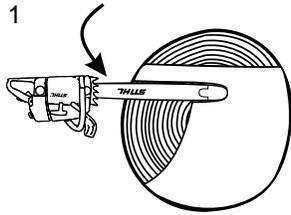
3. Saw backwards in a straight line to complete the cut. Watch out for the butt kicking up.

or

3. Withdraw the saw leaving a wide “heel” at the back of the felling cut.

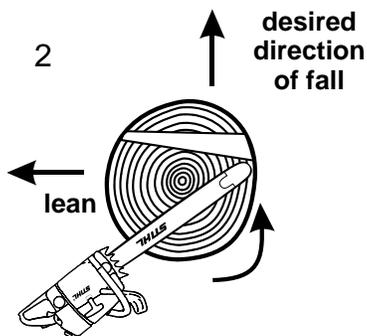
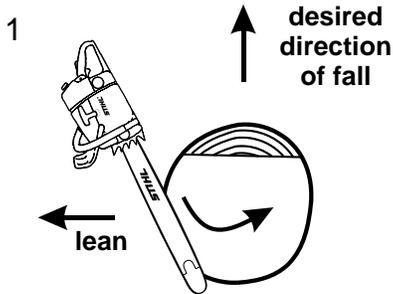
4. Cut the “heel” from the back. Watch out for the butt kicking up.

If the tree is bigger than the length of the guide bar...



1. Bore in behind where the hinge is to remain
2. Bore in from the other side
3. Saw backwards in a straight line
4. Make sure the remaining “heel” is in the middle of the tree; withdraw the saw
5. Cut the “heel” from the back .Watch out for the butt kicking up

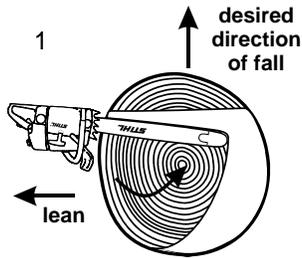
#### 4.10.2 Trees with side lean



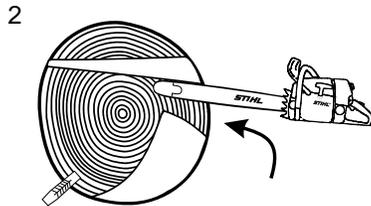
1. Start the felling cut on the side of the lean, to prevent the guide bar from pinching
2. Leave thicker holding wood on the opposite side of the lean (tapered hinge). The thicker holding wood will break last, thus swinging the tree towards the desired direction of fall

Note with this method the tree may split or the guide bar may get pinched.

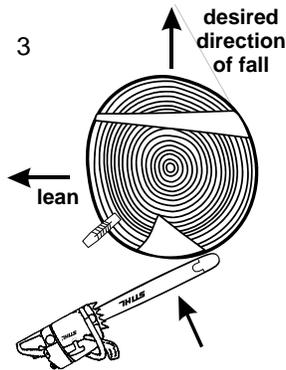
### Safer method



1. Start the felling cut on the side towards which the tree is leaning, to prevent the guide bar from pinching but do not cut all the way through the bole.

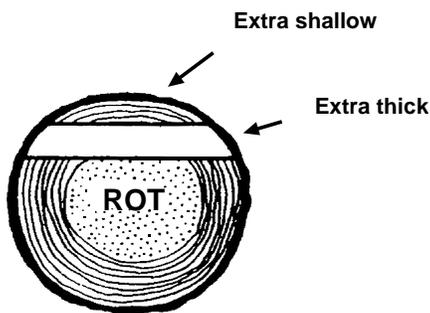


2. Insert wedge on the side of the lean. Bore on the opposite side; a bit further away from the notch, leaving a tapered hinge. Saw backwards



3. Withdraw the saw and cut the heel from the back.

### 4.10.3 Trees with internal rot



If you suspect that a tree may have butt rot, make a vertical plunge cut before making the notch.

If you discover the tree is afflicted with butt rot, but the hole appears not be that large:

1. Fell the tree in the easiest direction
2. Saw a shallow notch to leave a hinge with as much healthy wood in it as possible
3. Leave an extra thick hinge to avoid the tree falling in the wrong direction (one side of the hinge may have rotten fibres in it)

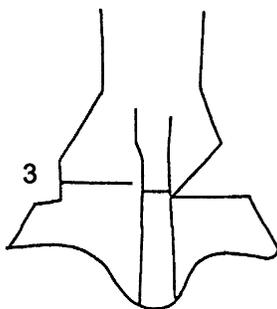
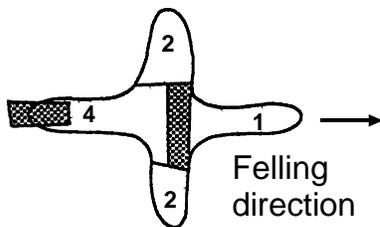
#### 4.10.4 Trees that split easily on the sapwood

1. Cut a wide notch (approx. 70°) to guide the tree throughout its fall and break the hinge as quickly as possible
2. Make two side cuts ("dog ears") to prevent splintering
3. Make the felling cut according to guidelines

#### 4.10.5 Trees that split easily on the heartwood

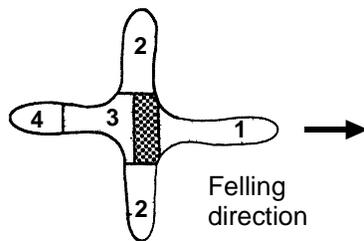
1. Cut a wide notch (approx. 70°) to guide the tree throughout its fall and break the hinge as quickly as possible
2. Make a boring cut into the centre of the scarf at the height of the intended back-cut ("heart-cut"). Because the hinge doesn't run all the way across the stump, it must be wider than normal
3. Make the felling cut according to guidelines

#### 4.10.6 Trees with buttresses, no lean: alternative 1



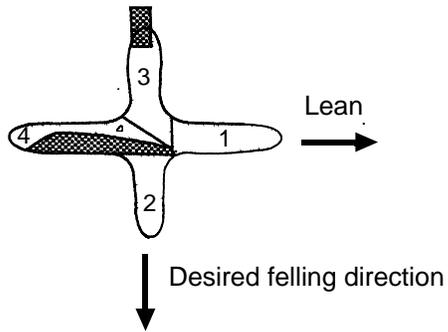
1. Make an open directional cut. The depth of this cut should be at least as deep as the buttress, and preferably go a bit into the actual stem.
2. Cut off buttresses perpendicular to the desired felling direction. Cut horizontally, at the same level as the directional cut. Pay attention to possible tensions in the tree that may squeeze the guide bar
3. Cut a wedge at the back-buttress. This is to achieve maximum lifting power with the wedges.
4. Begin the felling cut at the back. Secure the tree with a wedge. Work with care and keep pushing the wedge further into the tree as you progress.
5. Leave a hinge of at least 10 cm. If necessary, use a wedge to push the tree over.

#### 4.10.7 Trees with buttresses: alternative 2 (imperative with forward lean)



1. Directional cut as in Alternative 1
2. Cut off buttresses perpendicular to the intended felling direction
3. Make an incision, work your way towards the directional cut. Leave a hinge of at least 15 cm.  
Cut backwards, but leave at least 1/3 of the backside of the buttress to hold the tree, "holding buttress"
4. Cut off the holding buttress. Cut somewhat below the felling cut (3).

#### 4.10.8 Trees with buttresses, felling 90° against the lean



1. Start by cutting off the buttress in the leaning direction of the tree
2. Make the directional cut.
3. Cut off the buttress opposite to the directional cut. Insert wedges tightly. Angle the felling cut to the hinge according to the figure.
4. Finalise by cutting the last buttress. Work with care until the tree falls. It is important to retain a solid hinge.