

OSHA

Occupational Safety & Health Administration
U.S. Department of Labor



LOGGING eTOOL

● SCOPE & APPLICATION

● SAFETY & HEALTH PLAN

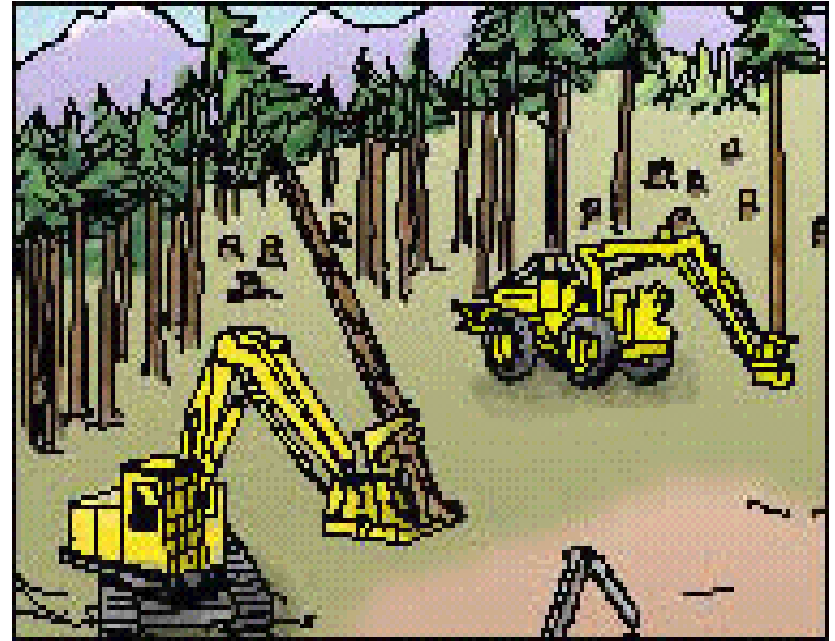
● BIBLIOGRAPHY

● CREDITS





Manual Operations



Mechanical Operations

Logging

By many measures, logging is the most dangerous occupation in the United States. The tools and equipment used in logging, such as chain saws and logging machines pose hazards wherever they are used. As loggers use their tools and equipment, they are dealing with massive weights and irresistible momentum of falling, rolling, and sliding trees and logs. The hazards are even more acute when dangerous environmental conditions are factored in, such as uneven, unstable or rough terrain; inclement weather including rain, snow, lightning, winds, and extreme cold and/or remote and isolated work sites where health care facilities are not immediately accessible. The combination of these hazards present a significant risk to employees working in logging operations throughout the country, regardless of the type of timber being logged, where it is logged or the end use of the wood.

OSHA Standards

- [1910.266](#), Logging operations.
 - [App A](#), First-aid Kits (Mandatory).
 - [App B](#), First-aid and CPR Training (Mandatory).
- [1910.68](#), Vehicle-Mounted Elevating and Rotating Work Platforms. Note: The reference to 1910.68 in 1910.266 (d)(1)(v) appears to be an error; the reference should be 1910.67.
- [1910.95](#), Occupational noise exposure.
- [1910 Subpart H](#), Hazardous Materials.
- [1910.147](#), The Control of Hazardous Energy (Lockout/Tagout).
- [1910.157](#), Portable Fire Extinguishers.
- [1910.212](#), General Requirements for all Machines.
- [1910.219](#), Mechanical Power-Transmission Apparatus.
- [1910.333 \(c\)\(3\)](#), Overhead Electric Lines.
- [1910.1030](#), Bloodborne Pathogens.
- [1910.1200](#), Hazard Communication.
- [1917.18](#), Log handling. Standards applicable to log handling at marine terminals.
- [1918.88](#), Longshoring. Standards Applicable to Log Operations.
- [1928 \(a\)\(3\)](#), Logging Operations.

(b)

Scope and application.

(b)(1)

This standard establishes safety practices, means, methods and operations for all types of logging, regardless of the end use of the wood. These types of logging include, but are not limited to, pulpwood and timber harvesting and the logging of sawlogs, veneer bolts, poles, pilings and other forest products. This standard does not cover the construction or use of cable yarding systems.

(b)(2)

This standard applies to all logging operations as defined by this section.

(b)(3)

Hazards and working conditions not specifically addressed by this section are covered by other applicable sections of Part 1910.

The standard applies to:

- **All types of logging, regardless of the end use of the wood.**
- **Examples of logging activities include pulpwood and timber harvesting and the logging of sawlogs, veneer bolts, poles, pilings and other forest products.**
- **All logging operations from pre-felling planning to the transport of logs and forest products to the point of delivery, with the exception of the construction and use of cable yarding systems. Tree marking activities including the marking of danger trees or wildlife trees, which take place in advance of and separate from tree harvesting, are NOT covered by these regulations.**
- **Examples of logging operations include: felling, limbing, bucking, debarking, chipping, yarding, loading, unloading, storing, and transporting of forest products, and the transporting of logging equipment and personnel to and from logging sites.**
- **Agricultural employers who are engaged in logging operations incidental to their agricultural operations are also covered by these logging regulations pursuant to Part 1928, Occupational Safety and Health Standards for Agriculture. Reference: 29 CFR 1928(a)(3).**

UNIT 1 INTRODUCTION

Lesson 1. Scope of OSHA Logging Standard

Lesson 2. Developing a Safety and Health Program

Developing a Tree Harvesting Plan

UNIT 2 MANUAL OPERATIONS

Lesson 3. Loggers and Their Equipment

A. Training of Loggers

B. Personal Protective Equipment

C. Chain Saws and Practices

D. Other Hand Tools and Equipment

Lesson 4. Tree Felling

A. Potential Hazards

B. Felling Direction

C. Retreat Path

D. Hinge Size

E. Making the Cuts

Lesson 5. Limbing and Bucking Yarding

UNIT 3 MECHANICAL OPERATIONS

Lesson 6. Mechanical Logging

A. Feller Buncher and Feller Forwarder

B. Grapple Skidder

C. Forwarder

D. Processor/Harvester

E. Operators

Lesson 7. Yard Operations

A. Processing (delimiting, slashing, and chipping)

B. Log Loading and Transporting

Lesson 8. Other General Requirements

A. Flammable and Combustible Liquids

B. Machines and Vehicles

C. First Aid

D. Explosives

Developing a Site Safety and Health Plan



A site Safety and Health Plan describes the potential hazards of the work site, along with all company policies, controls and work practices selected to minimize those hazards. The most important factor in reducing workplace injuries is implementing the plan. Implementation requires management's commitment to provide adequate resources for training, accountability, self audits, and employee involvement.

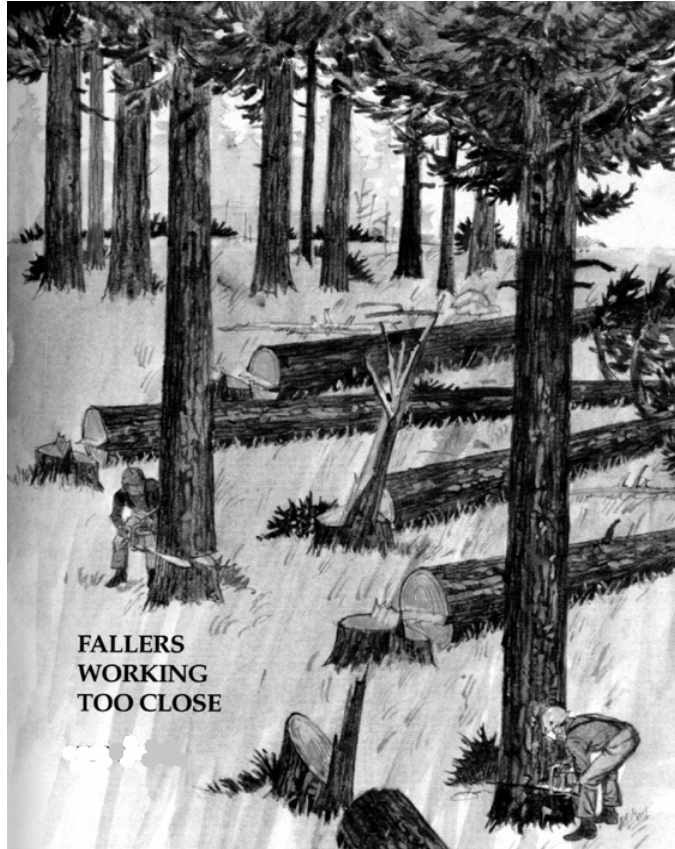
Although required by some states, OSHA does not require a written comprehensive Safety and Health Plan. However, OSHA does require that employees and their supervisors be trained in the specific hazards and control measures associated with their assigned tasks. The written Safety and Health Plan is a valuable tool in providing this training.

This section provides references which may be useful in developing your site Safety and Health Plan.

Topics to be included in your site Safety and Health Plan

- Tree Harvesting Plan
- Daily safety checks and surveys
- PPE Program
- Equipment Maintenance Program
- Training and Training Records
- Assignment of responsibilities for carrying out the safety plan Hazard Communication Program
- Lockout/Tagout
- Bloodborne Pathogens
- Hearing Conservation
- Accident Investigation

Developing a Tree Harvesting Plan



- A tree harvesting plan should be developed to address the hazards associated with a specific logging site.
- Hazards to consider in developing the plan include:
 - Overhead hazards including electric lines (29 CFR 1910.333(c)(3))
 - Danger Trees including [Stubs](#), [Spring Poles](#), [Wind Blows](#) and [Widow Makers](#)
 - General Environmental and Working Conditions
 - Adequate separation of operations while maintaining visual or audible contact

What are the general safe practice requirements?

- Employees must be spaced and the duties of each employee must be organized so the actions of one employee will not create a hazard for any other employee.
- Assess for and limit hazards associated with electrical storms, strong winds which may affect the fall of a tree, heavy rain or snow, extreme cold, dense fog, fires, mudslides, and darkness.
- Trees must be felled in a manner that does not create a hazard to employees (i.e. work areas must be assigned so that trees cannot fall into an adjacent occupied work area).
- Generally, employees must not approach a feller or mechanical felling operation any closer than 2 tree-lengths of the trees being felled, until the feller or felling machine operator has acknowledged that it is safe to do so.
- Felling must be done uphill from or on the same level as previously felled trees. This will limit the hazards associated with the rolling or sliding of logs or trees.
- Each employee performing a logging operation at a logging work site must work in a position or location that is within visual or audible contact with another employee.
- The employer must account for each employee at the end of each workshift.

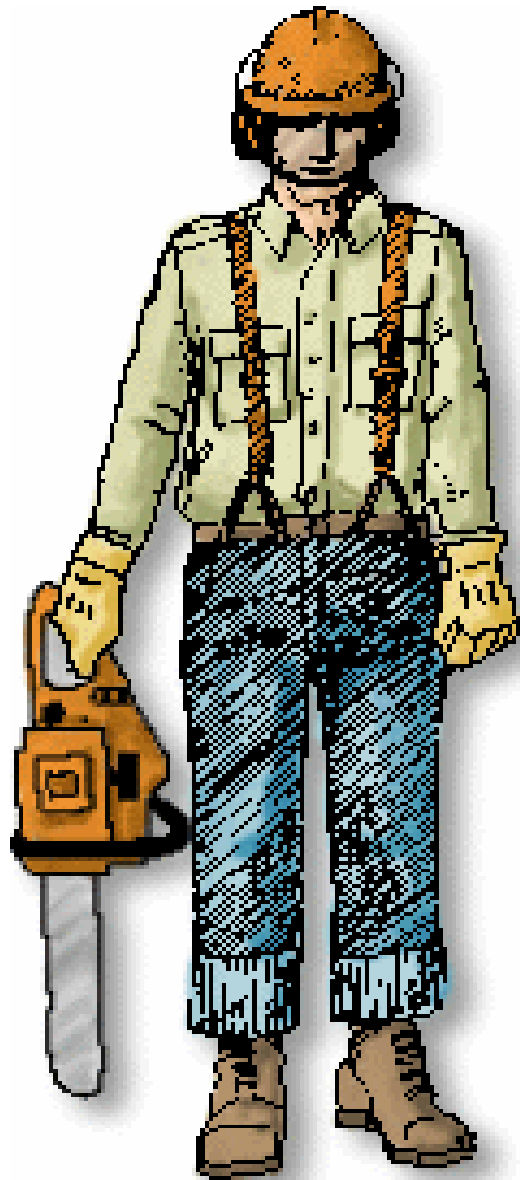
What precautions must be taken when "danger trees" are in the felling area?

- Each danger tree must be felled or removed using mechanical or other techniques to minimize employee exposure before work is begun in the area of the danger tree.
- Before felling or removing a danger tree, loose bark and damage must be removed or held in place.
- If the danger tree cannot be felled or removed, it must be marked and there shall be no work allowed within 2 tree-lengths of it, unless the employer demonstrates that a shorter distance will not create a hazard for an employee.
- When cutting a spring pole or other trees under stress, no employee other than the feller must be within 2 tree-lengths of the tree when the stress is released.



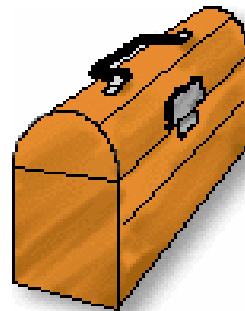
An example of unstable Wind Blown danger trees.

Logger



- Loggers who manually fell trees with chain saws are exposed to the greatest logging risks. OSHA requirements which reduce some of the risks are presented in the following areas:

- [Required Training and Qualification for Loggers](#)
- [Personal Protective Equipment](#)
 - [Head Protection](#)
 - [Hearing Protection](#)
 - [Eye/Face Protection](#)
 - [Leg Protection](#)
 - [Foot Protection](#)
 - [Hand Protection](#)
- [Chain Saw](#)
- [Other Hand Tools and Equipment](#)



Required Training and Qualifications for Loggers



Proper training gives loggers the skills to perform their work efficiently and safely. Employers involved in logging are required to assure that their employees are able to safely perform their assigned tasks. When loggers are trained to work safely, through the requirements of this section, they should be able to anticipate and avoid injury from the job related hazards they may encounter.

Who is required to be trained and when?

Training must be given without cost to all employees, including supervisors, prior to their initial assignment, and when assigned new work tasks, tools, equipment, machines or vehicles. Training is also required when employees utilize unsafe work practices. New employees who have had prior training from previous jobs are not required to be retrained if the employer has determined that the employee has been adequately trained.

What must be included in the required training?

- Specific work procedures, practices and requirements of the work site, including the recognition, prevention, and control of general safety and health hazards associated with logging.
- The requirements of the OSHA Logging standard, Bloodborne Pathogens standard and [First Aid](#) and CPR training.
- How to safely perform assigned work tasks, including the specific safety and health hazards associated with each task and the measures and work practices which will be used to control those hazards.
- How to safely use, operate, and maintain tools, machines and vehicles which the employee will be required to utilize in completing the assigned requirements. Emphasis must be placed on the manufacturer's recommended operating and maintenance instructions.

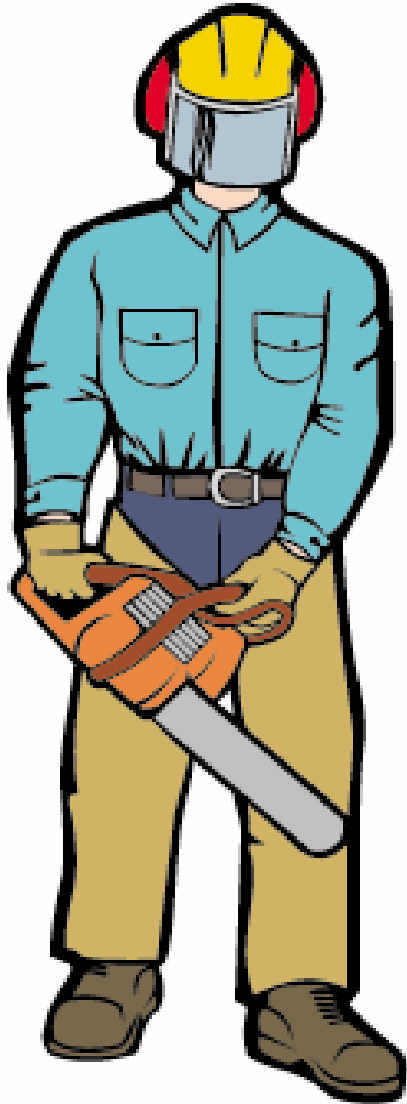
Is on-the-job training and refresher training also required?

- Employees requiring training must work under the close supervision of a designated person until they demonstrate the ability to safely perform their duties.
- Each employee must attend a safety and health meeting at least monthly to remind them of the hazards and safety considerations of their jobs.

Are training records required?

- A written training certification record must be maintained by the employer and contain at least: the name or other identity of the employees trained, the date(s) of the training, the signature of the employer or the person(s) who conducted the training or the employer, and the date the employer determined that the training given prior to hiring the employee was adequate.

Personal Protective Equipment



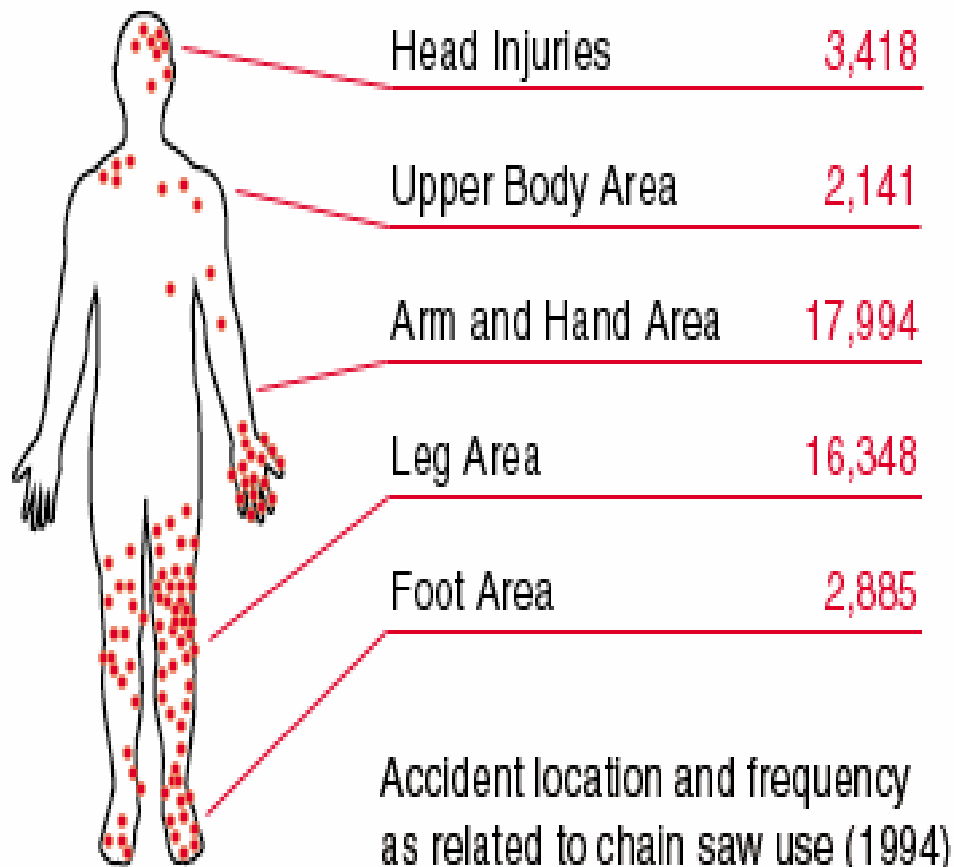
- Personal protective equipment (PPE), for the head, ears, eyes, face, hands, and legs are designed to prevent or lessen the severity of injuries to loggers. Click on the equipment for a description.

Highlights of PPE Requirements

- PPE must be inspected prior to use on each work shift to ensure it is in serviceable condition (1910.266(d)(1)(i-ii)).
- The following PPE must be used when hazards make it necessary (1910.266(d)(1)(iii-vii)). Except for foot protection, all PPE must be provided by the employer at no cost to the employee.
 - [Head Protection](#)
 - [Hearing Protection](#)
 - [Eye/Face Protection](#)
 - [Leg Protection](#)
 - [Foot Protection](#)
 - [Hand Protection](#)

Chain Saw Injury Locations

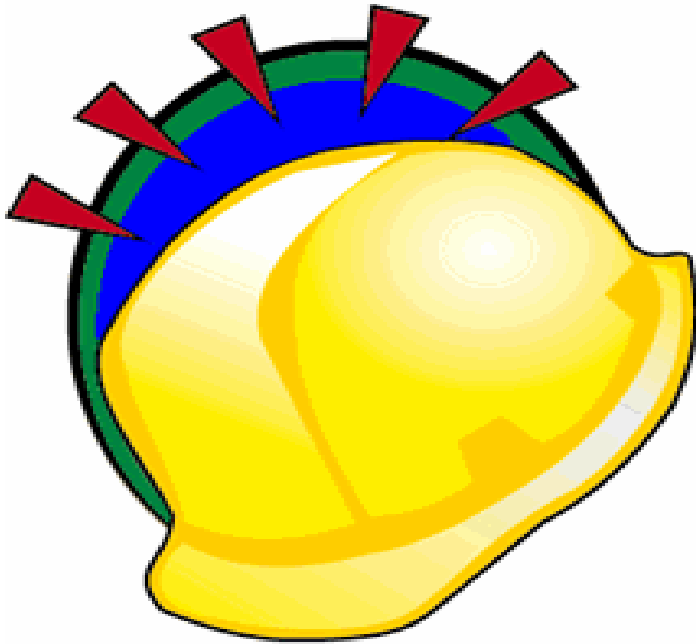
Notice how most injuries occur on the lower left leg and the left arm. Be sure to protect those areas well.



Accident location and frequency
as related to chain saw use (1994)

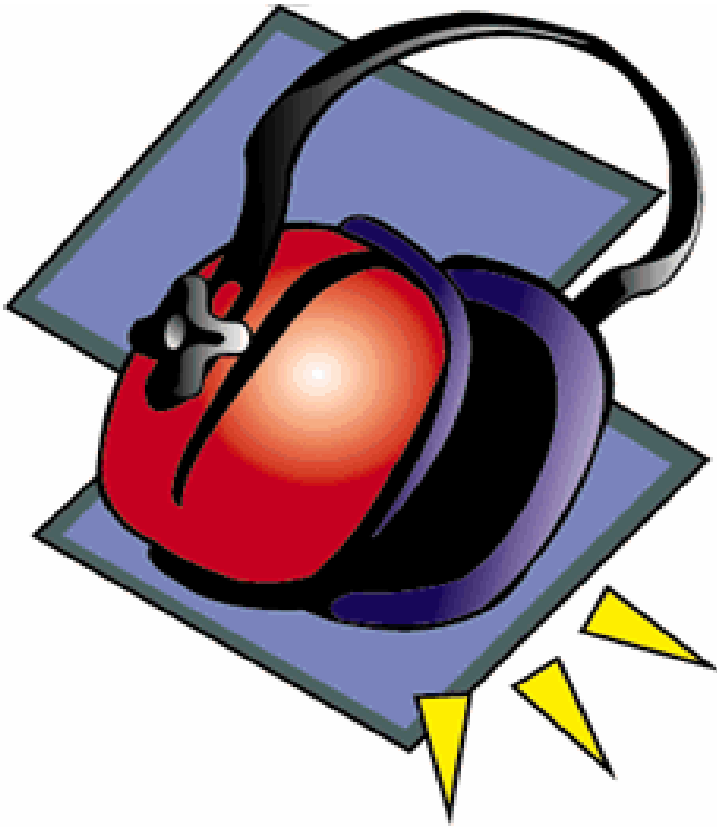
U.S. Product Safety Commission

Head Protection



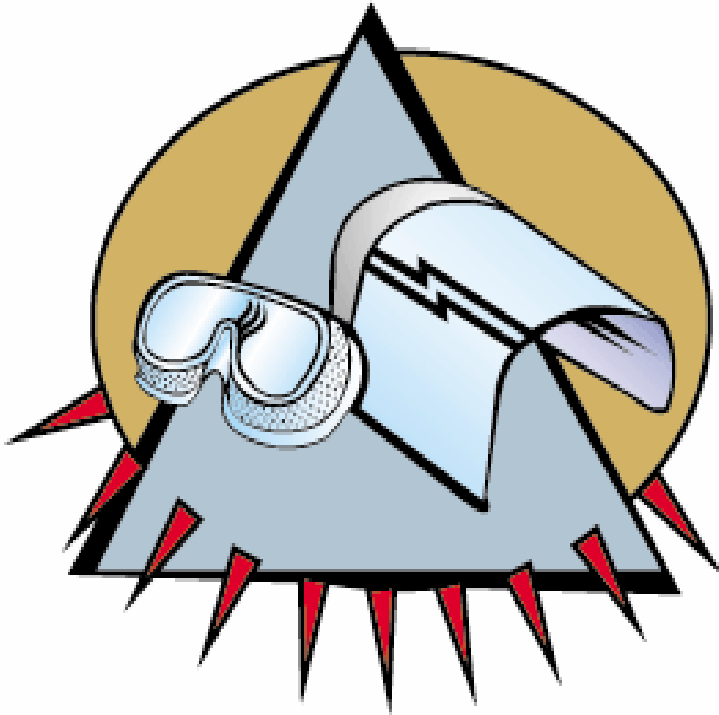
Hard hats must be worn when overhead hazards are present. The hard hats must comply with ANSI standards (Subpart I, ANSI Z89.1-1986, if purchased after July 5, 1994, or ANSI Z89.1-1969 if purchased before July 5, 1994). Check for an ANSI label inside the hat.

Hearing Protection



Requirements for hearing protection are found in 1910.95. Particular attention should be paid to monitoring the logging operation to determine the noise levels employees are exposed to. This will determine whether the employer is required to implement a hearing conservation program. Some basic elements of a hearing conservation plan are providing audiograms, training employees, and providing hearing protection in a variety of forms at no cost to the employee.

Eye/Face Protection

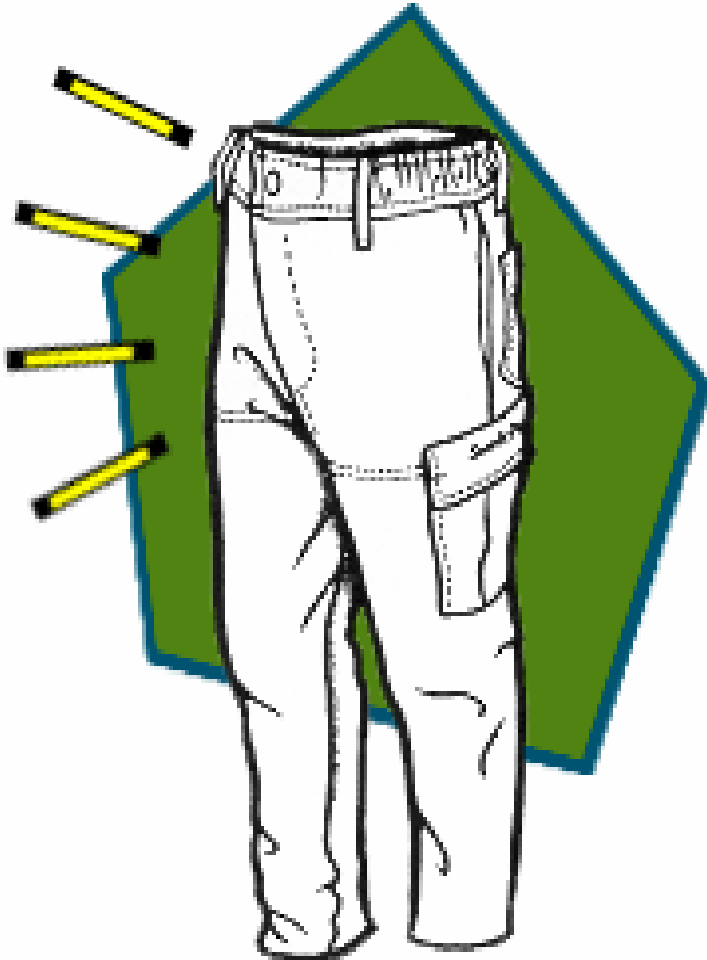


Eye and face protection must be worn where there is potential for injury to the eyes or face. The protective equipment must comply with ANSI standards (Subpart I, ANSI Z87.1-1989 if purchased after July 5, 1994, or ANSI Z87.1-1968 if purchased before July 5, 1994).

Logger type mesh screens are considered to be adequate eye and face protection for chain saw operators.

Leg Protection

Each employee who operates a chain saw must wear leg protection constructed with cut-resistant material. The leg protection must extend from the upper thigh down to the boot top and adequately cover the leg.



- Leg protection is available in a variety of forms, including chaps, logger pants, and leggings. The protective material also comes in a variety of forms including ballistic nylon, polyester, Kevlar, Engtek, etc.
- Underwriters Laboratories (UL) currently tests and labels leg protection which meets minimum cut resistance requirements. (Reference ASTM F1414-92a)

Foot Protection

Employers must assure that each employee wears heavy duty logging boots that are waterproof or water repellant, and cover and provide support to the ankle. If the employee uses a chain saw, the footwear must be constructed with cut-resistant material that will protect against contact with a running chain saw. Calk soled boots are acceptable when they are required for the employee's job.



- Underwriters Laboratories (UL) currently tests and labels foot protection which meets minimum cut resistance requirements. (Reference ASTM F1818-97)

Hand Protection

Employees who handle wire rope are required to wear hand protection that protects against puncture wounds, cuts, and lacerations.





Chain Saw

- The chain saw is one of the most efficient, productive, and dangerous portable power tools used in any industry. If you learn to operate it properly and maintain the saw in good working condition, you will avoid injury as well as be more productive.

Parts of a Chain Saw



Safe Operation of a Chain Saw



OSHA requires the following practices when using a chain saw:

Before Starting the Saw

- Check controls, chain tension, and all bolts and handles to ensure they are functioning properly and adjusted according to the manufacturer's instructions.
- Fuel the saw at least 10 feet from sources of ignition.
- Start the saw at least 10 feet from fueling area, with chain brake engaged, and with the chainsaw on the ground or otherwise firmly supported.
- Check the fuel container for the following requirements:
 - Must be metal or plastic
 - Must not exceed a 3 gallon capacity
 - Must be approved by the Underwriters Laboratory, Factory Mutual (FM) or the Department of Transportation (DOT).

While Running the Saw

- Keep hands on the handles, and maintain secure footing while operating the chainsaw.
- Clear the area of obstacles that might interfere with cutting the tree or using the retreat path.
- Do not cut directly overhead.
- Shut off or throttle released prior to retreating.
- Shut off or the chain brake engaged whenever the saw is carried more than 50 feet, or on hazardous terrain.

Personal Equipment Checklist

- Hard hat
- Eye/Face protection
- Hearing protection
- Foot protection
- Snake Bite/Bee Sting kits as appropriate
- Tools (wedges, axes, etc.)
- Hand protection if handling wire rope
- Leg protection
- First Aid Kit

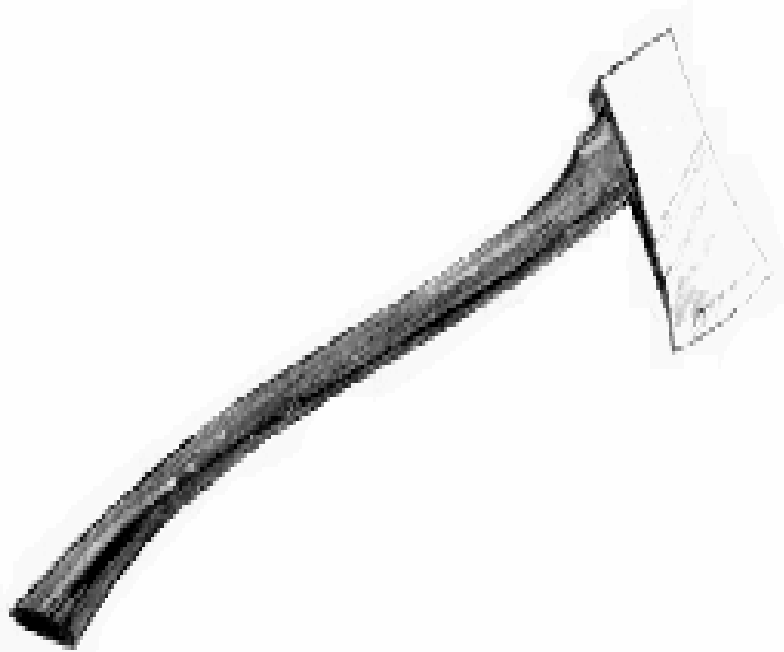
Chain Saw Checklist -- 29 CFR 1910.266(e)(1)(ii)

- Chain brake
- Trottle interlock
- Chain catcher
- Chain tension
- Muffler
- Chain saw kickback
- Chain sharpness, cutter shape, depth uage setting, lubrication
- Handles + Guards - On Tight
- No chain movement when engine is idling

Required Work Practices -- 29 CFR 1910.266(e)(2)

- ii - Continuous Pressure Throttle
- iii - Operated and adjusted in accordance with the manufacturer's instructions
- iv - Fueled 20 feet from sources of ignition [Standard says "10"]
- v - Started 10 feet from fueling area
- vi - Starting Methods
- vii - Chain brake engaged when starting
- viii - Thumb and finger position on handles
- ix - Footing/body position
- x- Clear area prior to felling
- xi - No cutting above head
- xii - Carrying the saw
- xiii - Retreating with the saw
- xiv - Moving with a running chain saw

Other Hand Tools and Equipment

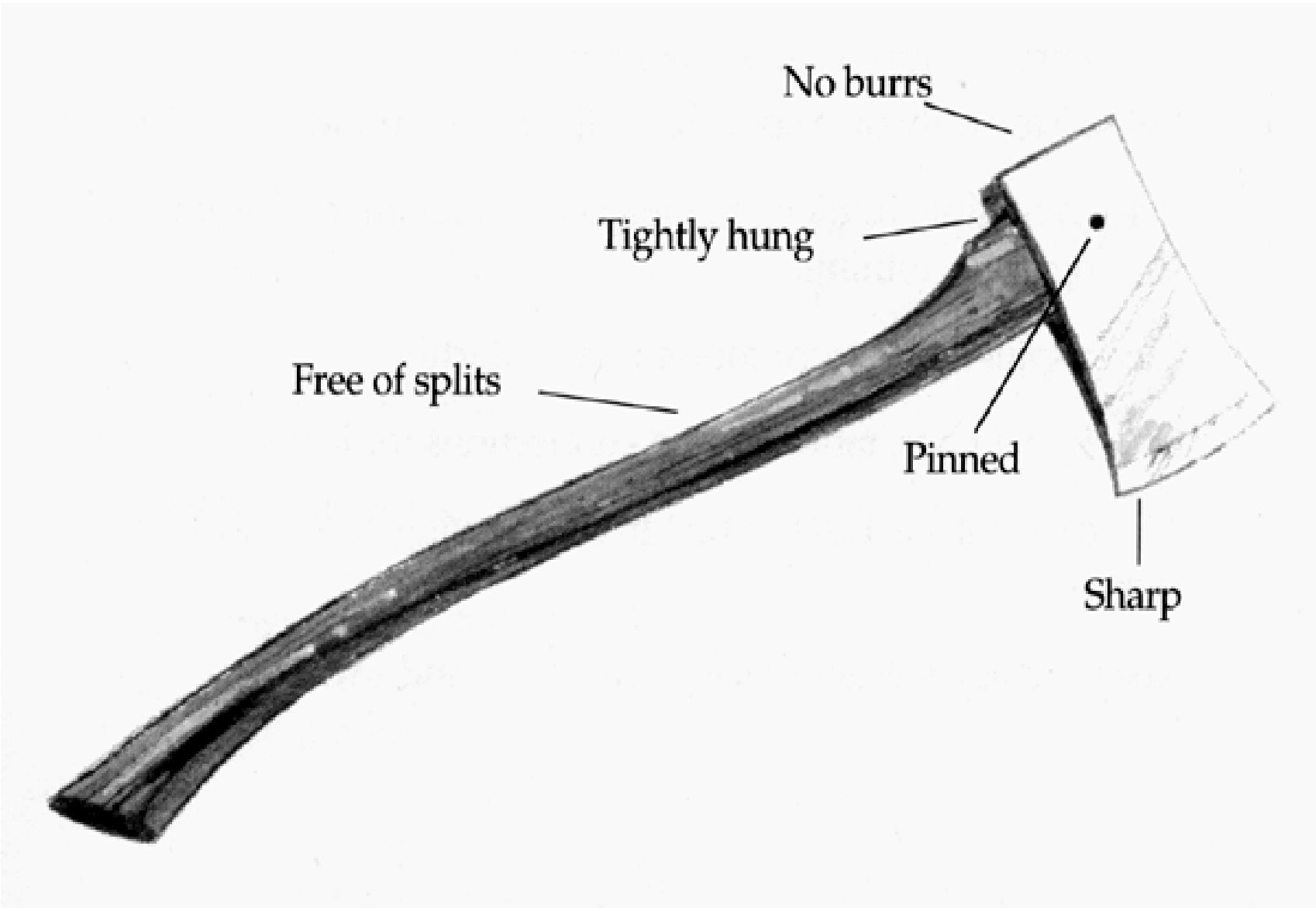


Professional loggers use a wide variety of tools and equipment to perform their jobs. This section lists and describes many of these tools and the OSHA regulations required for their safe use and maintenance. Tools and equipment that are properly used and maintained will increase the safety and productivity of any logger.

[Description of Hand Tools and Equipment](#)

How are tools required to be used, maintained and transported in logging?

- All tools used by employees must be in serviceable condition. Inspections before each work shift must assure that handles and guards are in place, sound, tight-fitting, properly shaped, and free of splinters and sharp edges; there is no "mushrooming" or chipping of the heads of shock, impact-driven, and driving tools; cutting edges are sharp and properly shaped; and all safety devices are in place and functioning properly.
- All tools must be used only for the purposes for which they are designed and be stored in their assigned location or container when not in use.
- When transporting tools in a vehicle, they must be secured or arranged to prevent causing a hazard to the vehicle driver and passengers.



No burrs

Tightly hung

Free of splits

Pinned

Sharp



Felling Trees

More people are killed while felling trees than during any other logging activity.

These accidents CAN be avoided!

To "fell a tree" means more than just cutting it down. Felling means to cut the tree in such a way that it falls in the desired direction and results in the least damage to the tree.

To safely fell any one tree, you must

Eliminate or minimize exposure to [potential hazards](#) found in the tree and in the surrounding area

Determine an appropriate [felling direction](#)

Plan and clear a [retreat path](#).

Determine the proper [hinge size](#).

Use a proper felling technique in [making the cuts](#).

Considerations Prior to Felling Checklist

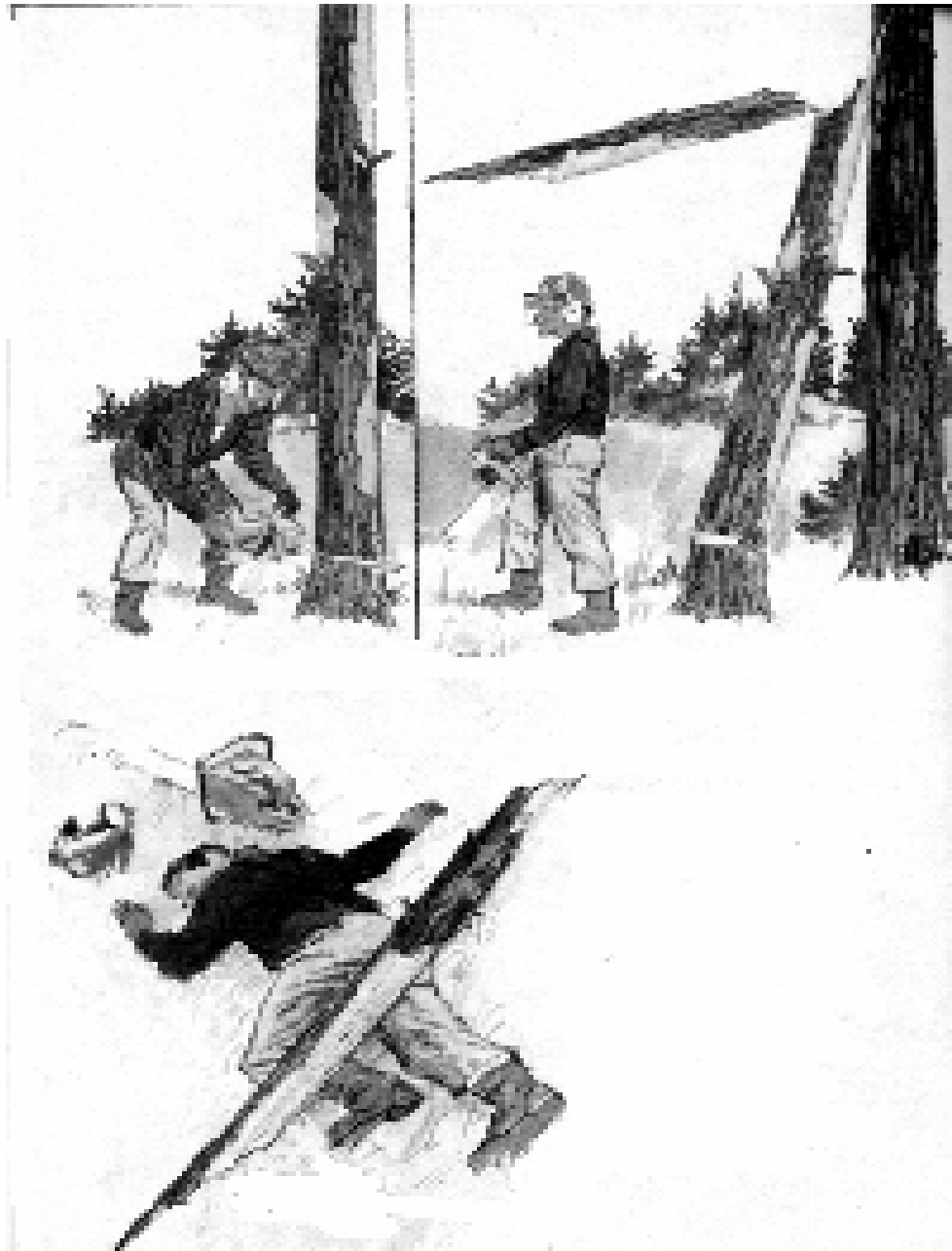
- What hazards are present in the area where the logger will be working.

- Determine the felling direction and how to deal with forward lean, back lean, and/or side lean.

- Provide a retreat path so the logger can reach safety while the tree is falling.

- Determine the proper hinge size to safely guide the tree in its fall.

- Proper felling methods allow the logger to safely fell the tree.



Hazard

Ways to Eliminate or Avoid

Throwback

As the tree falls through other trees or lands on objects, those objects or branches may get thrown back toward the logger.

If possible, avoid felling into other trees or onto objects. Don't turn your back on the tree as it falls, and hide behind a standing tree if possible.

Lodged Tree

A tree that has not fallen completely to the ground because it is lodged or leaning against another tree.

If possible, move the obstacle.

Terrain

If the tree falls onto stumps, rocks, or uneven ground, a hazard may be created.

Do not work in the presence of lodged trees. Have these death traps pushed or pulled down by a machine.

Widowmaker

Broken off limbs that are hanging freely in the tree to be felled or in the trees close by.

Knock them down or pull them down with a machine.

Snag

Standing dead tree, standing broken tree, or a standing rotted tree to be felled or nearby.

Use a machine to bring it down.

OR

It must be felled or avoided by at least two tree lengths.

Spring Pole

A tree, segment of a tree, limb, or sapling which is under stress or tension due to the pressure or weight of another tree or object.

Use a machine to release the tension or release it with a chain saw.

Extreme Weather

Strong wind.

Do not fell trees during high winds.

Entanglement

Vines or limbs of other trees intertwined with the limbs of the tree to be felled.

Undo the entanglement if possible.

OR

Use a machine to fell the tree.

Resources

Other workers or machines in the immediate area.

Request the workers or machines to be moved.

Identifying the Appropriate Felling Direction

This planning step is very important because it determines the location and type of cuts to be made as well as prevents damage to the tree and harm to yourself.

Factors to Consider

Clear Fall Path

Along with a clear landing, this is the most important factor in deciding what direction to fell a tree. Visualize the fall path in all directions and identify those directions that are free of other trees. Finding a clear path will eliminate [lodged trees](#), [throwback](#), and damage to the tree being felled as well as the other trees.

Clear Landing

Avoid felling a tree onto stumps, large rocks, or uneven ground. This will prevent cracking and other damage to the tree.

Lean of Tree

It is generally easier and safer to fell a tree in the direction that it is already leaning. This makes for a cleaner fall and eliminates the need to use wedges, allowing gravity to do the work.

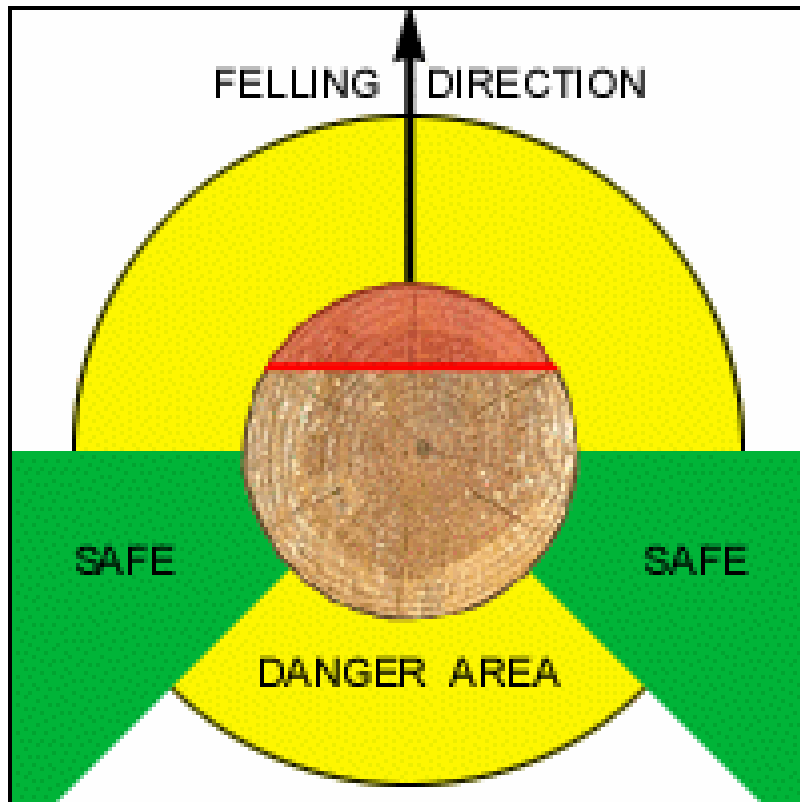
Ease of Removal

When possible, fell the tree so the butt faces the skid road. Also, fell the tree consistent with the felling pattern of other trees. This also makes for efficient limbing and removal.

Slope of Ground

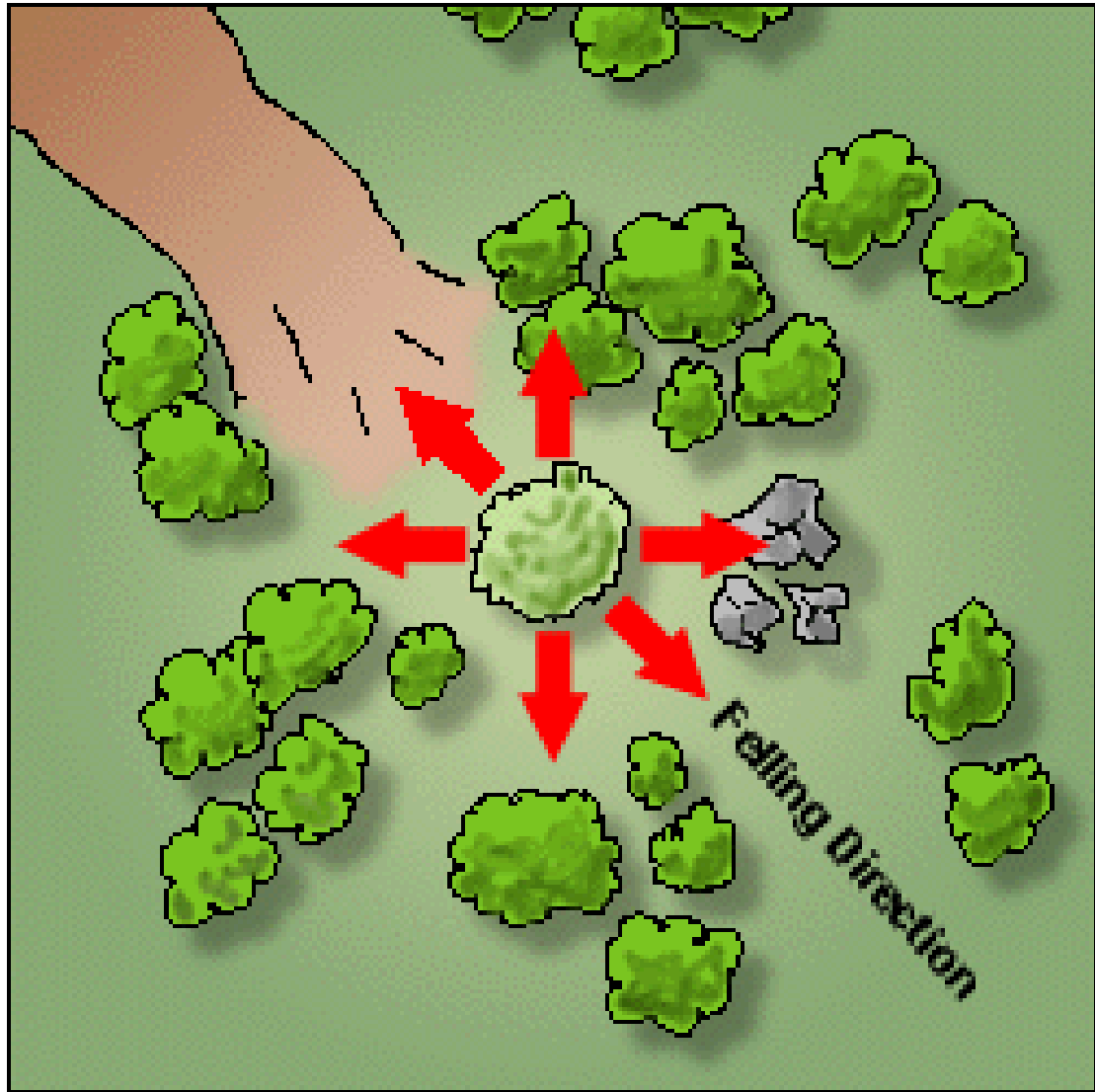
Fell in a direction that will minimize the chance that the tree will roll or slide.

Retreat Path



You must plan your escape route and clear a path **BEFORE you begin cutting.**

In this diagram, which red arrow marks the best retreat path? Click on the red arrows to find the best retreat path.

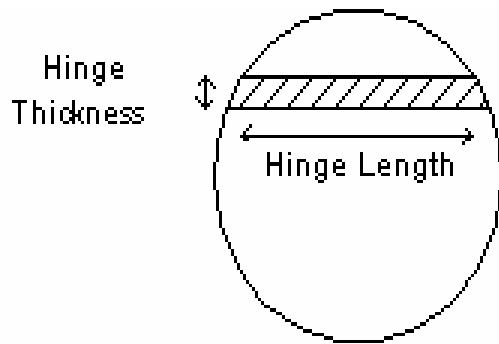


Direction of Safe Retreat

- 45 degrees from the sides and back on either side
- NEVER move away directly behind the tree - you can be seriously hurt if the tree butt kicks back during the fall

How to Retreat

- Using a bore cut and a release cut will make it easier to retreat in plenty of time
- Don't turn back on the falling tree
- Walk quickly away to a distance of 20 feet from the falling tree
- Position yourself behind a standing tree if possible



Felling Hinge The hinge is the wood between the undercut (face cut/notch) and the back cut. The purpose of the hinge is to provide sufficient wood to hold the tree to the stump during the majority of the tree's fall, and to guide the tree's fall in the intended direction. The position of the hinge will affect the direction of fall. The size of the hinge is important to prevent splitting, fiber pull, barber chairs, and other undesirable and unsafe actions.

The following describes a proper hinge:

- The length of the hinge should be 80% of the diameter of the tree at breast height.

Example: For a 12-inch diameter tree the hinge should be 9.6 inches long (12 inches \times 0.8).

- The width of the hinge should be 10% of the diameter of the tree at breast height.

Example: For a 12-inch diameter tree the hinge should be 1.2 inches long (12 inches \times 0.1).

- The hinge on a tree with no side lean should be perpendicular to the intended direction of fall.

Making the Cuts

The safe felling of a tree includes making three precise and strategic cuts.



1. Top Cut



2. Bottom or Undercut



3. Back Cut

The notch created by the top and bottom cuts in the picture above is called an "Open-face Notch." You can compare this notch with the [Humbolt and Conventional Notches](#). [Special techniques](#) are used for difficult trees.

Highlights of Manual Felling Techniques:

- An undercut must be made in each tree being felled. The undercut must be of a size so the tree will not split and will fall in the intended direction.
- A backcut must be made in each tree being felled. The backcut must leave sufficient hinge wood to hold the tree to the stump during most of its fall so that the hinge is able to guide the tree's fall in the intended direction. Except in Open Face felling, the backcut must be above the level of the horizontal facecut in order to provide an adequate platform to prevent kickback.
- Domino felling is prohibited.

The Top Cut

The top cut is the first of two cuts that result in a V-shaped notch. The notch is made on the side of the tree that you want it to fall.

The Correct Cut

1. Starting Point

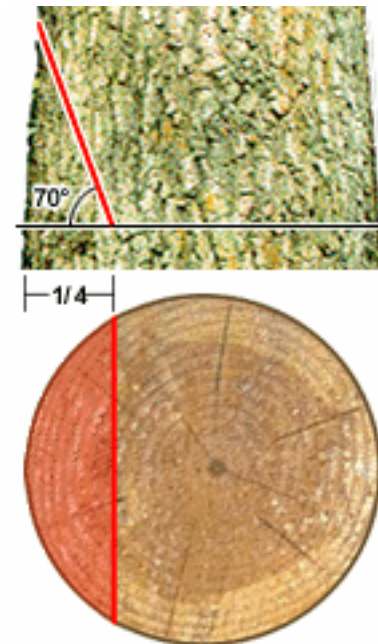
Important -- begin at any height as long as you allow enough room for the undercut

2. Angle of Attack

Important -- cut downward at an angle of 70 degrees

3. Ending Point

Stop when the cut reaches $\frac{1}{4}$ to $\frac{1}{3}$ of the trunk's diameter or when the cut reaches 80% of the tree's diameter at chest level



A Common Incorrect Cut



Here the top cut is not steep enough . . .



. . . resulting in a notch of less than 70 degrees.

The Bottom or Undercut

The undercut is the second of two cuts that result in a V-shaped notch. The notch is made on the side of the tree facing the direction that you want it to fall.

The Correct Cut

1. Starting Point

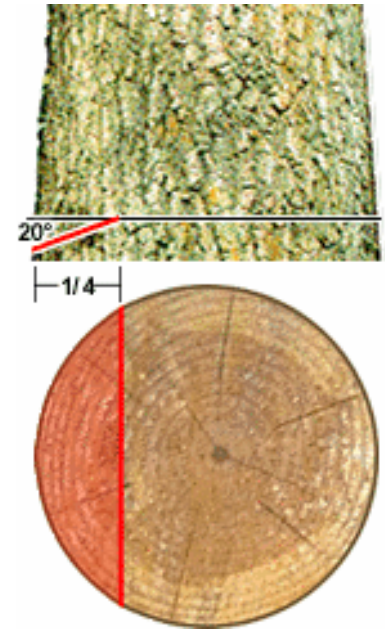
Very Important -- begin at the level that will create at least a 70 degree notch opening

2. Angle of Attack

Important -- cut upward at a 20-degree angle

3. Ending Point

Very important -- stop when the cut reaches the end point of the face cut



A Common Incorrect Cut



Here the ending point of the under cut doesn't meet the endpoint of the first cut . . .
. . . resulting in a Dutchman notch.

The Back Cut

The back cut is the third and final cut and is made on the opposite side of the notch. The back cut disconnects almost all of the tree from the stump leaving a [hinge](#) that helps to control the tree's fall.

The Correct Cut

1. Starting Point

Important - begin on the opposite side of the notch at the same level as the notched corner

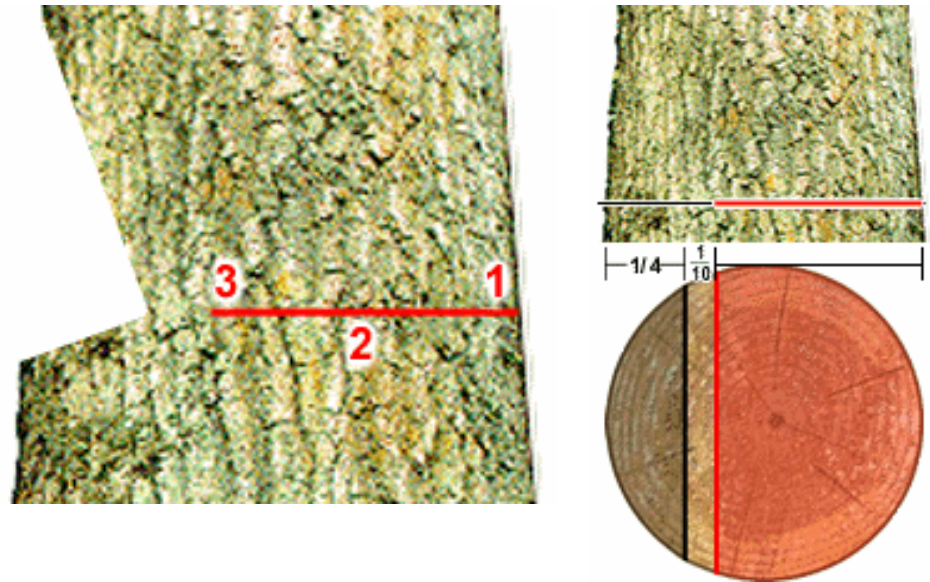
2. Angle of Attack

Important - cut flat along a horizontal plane

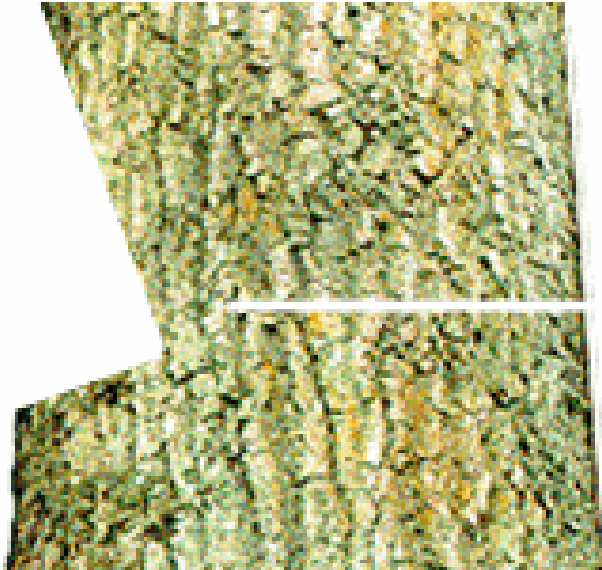
3. Ending Point

Very important - stop at the point that will leave a hinge width that is $\frac{1}{10}$ the tree's diameter

This is the simplest of all back cuts. Other back-cutting techniques may be required for [felling difficult trees](#).



A Common Incorrect Cut



Here the starting point of the back cut is higher than the notched corner . . .



. . . resulting in a poor hinge and the possible need to push the tree over.

Kinds of Notches



Open-faced Notch



Conventional Notch



Humbolt Notch

	Open-faced Notch	Conventional Notch	Humbolt Notch
Total angle	ideally 90 degrees; at least 70 degrees	45 degrees	45 degrees
Top Cut	angled downward 70 degrees	angled downward 45 degrees	flat horizontal
Bottom Cut	angled upward 20 degrees	flat horizontal	angled upward 45
Back Cut	horizontal; at the same height at the corner of the notch	horizontal; at least 1 inch above the bottom cut	horizontal; at least 1 inch above the top cut
Depth	1/4 - 1/3 of tree diameter	1/4 - 1/3 of tree diameter	1/4 - 1/3 of tree diameter
Point of notch closure	just before tree hits ground	middle of fall	middle of fall
Degree of safety	high	medium	medium
Advantages	greater accuracy of felling target hinge stays intact until tree hits ground less danger of kickback and other and other out-of-control movement	familiar to many loggers	saves slightly more wood familiar to many loggers
Disadvantages	hinge may have to be cut off	hinge breaks early	hinge breaks early

While all three of these notches are acceptable, the Open-faced Notch is clearly the safest and most accurate.



Barber Chair

Barber Chair

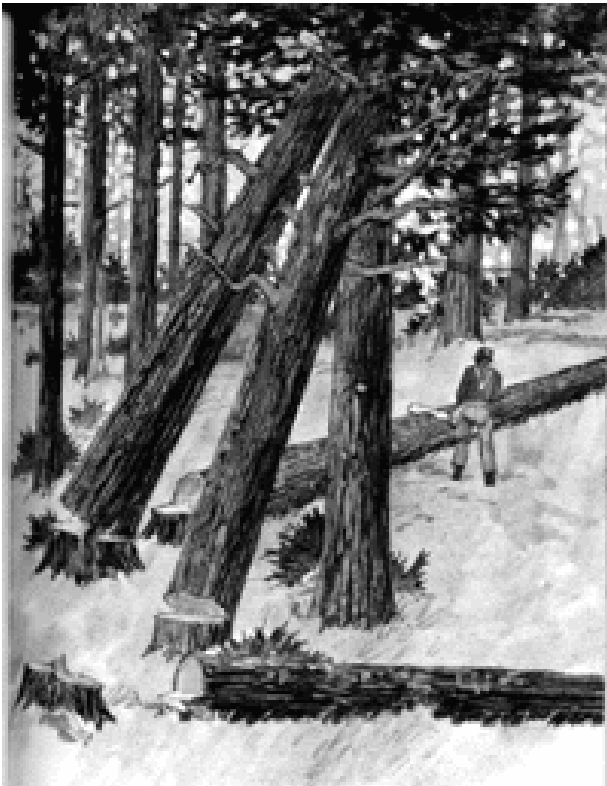
- The splitting of the butt of the log during the latter part of the fall. The tree often remains attached to the stump, thus creating a danger zone and ruining much of the log.
- Caused by a Dutchman notch.

Throwback

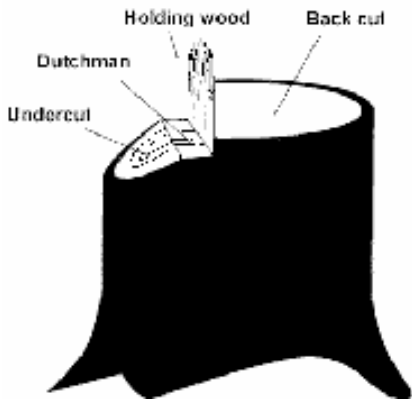
- Limbs or other material thrown back toward the logger when the falling tree contacts standing trees or fallen trees.
- Caused by not felling the tree in a clear path or onto a clear landing.

Lodged Tree (also called **A Hung Tree**)

- A cut tree that has not fallen completely to the ground, but is lodged or leaning against another tree. This is extremely dangerous. Do NOT work in the presence of hung trees. Have these death-traps pushed or pulled down by a machine.
- Caused by poor judgment of felling path or inaccurate cutting.



Lodged Tree



Dutchman

- The seat that interferes with the smooth closing of the notch
- Caused when one of the notch cuts is made too deep and extends beyond the endpoint of the other notch cut, known as "Bypass"

Kickback

Dutchman's Notch



Kickback

- When a falling tree hits the ground or other object it can bounce back causing the log to move back over the stump with great force. This is the main reason you should never stand or retreat directly behind the tree.
- Increased chance of kickback by not making the back cut above the notch on a conventional or Humbolt notch.

Stalled Tree

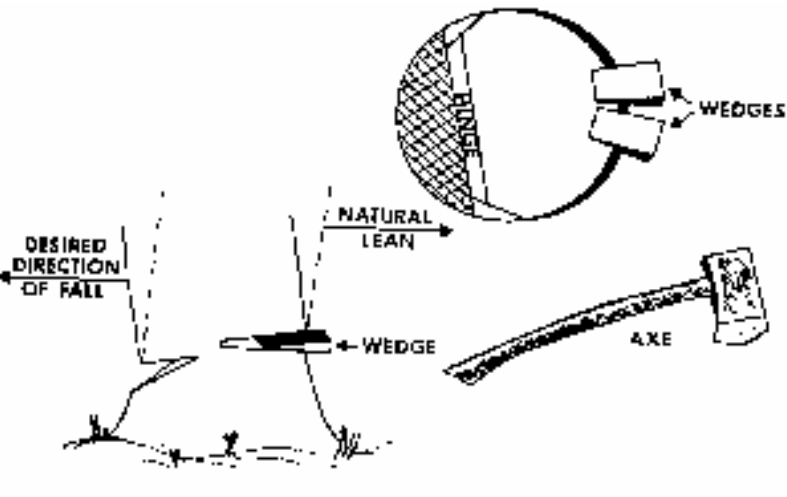


Stalled Tree

- A tree that has just begun to fall but is stopped by its own stump. This is almost as dangerous as a lodged tree and requires a machine to push it over.
- Caused by a Dutchman notch.

Special Techniques for Felling Difficult Trees

A large tree may be felled against its natural lean by inserting one or more wedges in the back cut. As the back cut is sawn, the wedges are driven in with an axe.



The amount of [back lean](#) that can be overcome is based on the height and diameter of the tree to be felled. The following method determines the amount of back lean which can be overcome with 2 inches of wedging.

[Wedging Trees with Back Lean](#)

[Trees that side scar easily](#)

[Larger Trees](#)

[Heavy Leaners](#)

[Trees leaning the wrong way](#)

The following are unacceptable practices:

- [Domino Felling](#), which is cutting notches and back cuts in a series of trees and pushing them over with another tree
- [Swing Dutchman](#)
- [Bypass/Dutchman in the Notch](#)

Wedging Trees with Back Lean

- Determine the height of the tree. This can be estimated quite accurately using one of these methods:
 - Pro-Sight method
 - Clinometer method
 - Axe handle method
- Determine the diameter (not circumference) of the tree at breast height using a tape.
- Determine the number of segments in the tree by dividing the height (in feet) by the diameter (in feet).
 - Example: a 100 foot tree 24 inches in diameter (2 feet) would yield 50 segments ($100 \div 2$).
 - Example: a 100 foot tree 12 inches in diameter (1 foot) would yield 100 segments ($100 \div 1$).
- Determine the amount of back lean (in feet) by plumbing the tree.

Use the following table to determine the maximum amount of back lean that can be corrected with 2 inches of wedging.

# of Segments	Maximum amount of back lean which can be overcome with 2" wedge
30	4 feet
35	4 1/2 feet
40	5 1/2 feet
45	6 feet
50	6 1/2 feet
55	7 feet
60	8 feet
65	9 feet
70	9 1/2 feet
75	10 feet
80	11 feet
90	12 feet
100 or more	13 feet

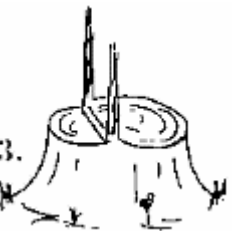
Trees that side scar easily



1. In standard felling, the sides of the hinge between the notch and the back cut are not sawn when the tree starts to fall.

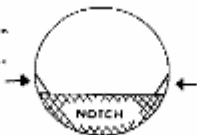


2. As the tree falls, there is strain on the sides of the tree along the dotted lines. (circled area)



3. Instead of breaking with the hinge, strips along the side of the tree rip off the stump, resulting in side scars.

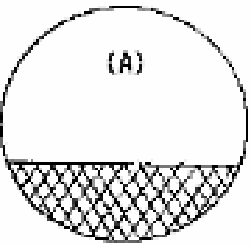
Shallow cor-
nering approx.
1" deep



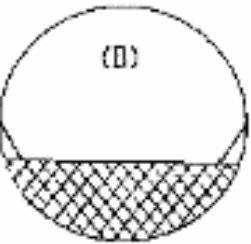
Shallow cor-
nering approx.
1" deep, notch
approx. 1/3
dia. of tree.

4. To prevent side scarring, corner to a depth of one inch before making the back cut.

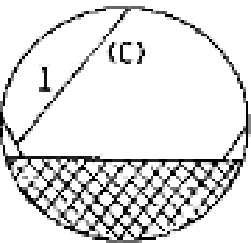
Felling Larger Trees with slight lean or with heavy tops.



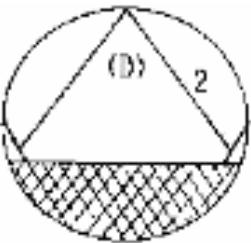
The notch is made in the normal manner (1/3 dia. of tree).



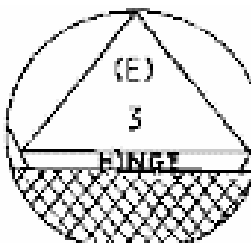
Make corner cuts



The number one cut is made as per the diagram, at the same height above the notch as a standard back cut.

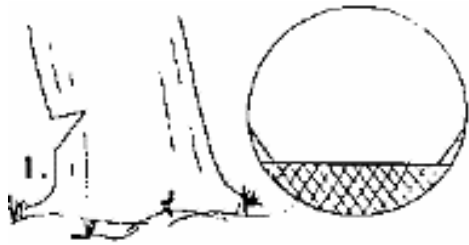


The number two cut is made as per the diagram, at the same plane as cut number one.

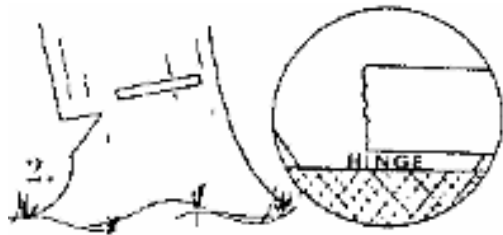


The number three cut is made at the same plane as the former cuts, leaving the standard thickness of hinge.

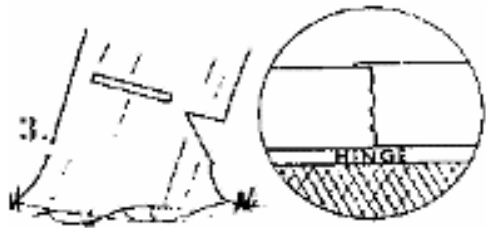
Heavy Leaners (The boring technique)



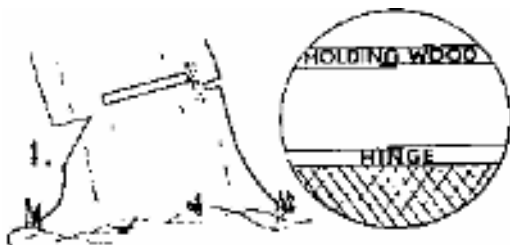
Begin by making a shallow notch (1/4 dia. of tree)



Next, holding the saw bar horizontal to the plane of the notch and at a slightly higher plane, the tree is bored out cutting back from the notch, leaving a good hinge and sufficient holding wood.



The same boring procedure is then performed on the other side of the tree, ensuring that the two boring cuts meet properly.

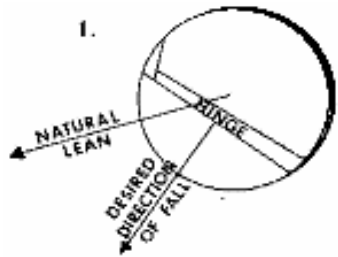


Then a back cut is made horizontal to the boring cut, a minimum, of two inches below the boring cut; the holding wood at the back severs and the tree falls, guided by the hinge.

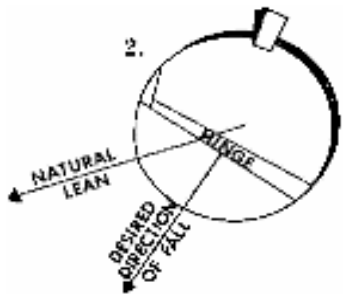
Trees leaning the wrong way

Most trees will fall on the branch heavy side or in the direction of their lean; some trees can be encouraged to fall to the right or left of their lean, the extent varying with every tree.

Two techniques can be used to control the direction of fall; they can be used individually or together.



1. The notch must be made in the desired direction of fall; by varying the thickness of the hinge on one side and cornering the lighter side, you change the direction of fall.



2. The notch is made in the desired direction of fall, a hinge is left and a corner cut (No. 1); a wedge is hammered into the back cut or a felling bar is used, forcing the tree to fall in the desired direction.



Limbing and Bucking Limbing is cutting branches off of felled or standing trees. Bucking is sawing felled trees into sections called logs. The length of the logs is dependent on the species of the tree and type of final product.

- Primary hazards include [unstable logs](#), and hazards associated with using [chain saws](#).
- Examples of proper bucking to relieve tension for [top bind](#) and [bottom bind](#) are provided below.

As a tree falls it will often brush other trees and leaves broken live limbs or dead limbs hanging in surrounding trees. Sometimes falling trees will shoot off the stump and roll sideways or ahead creating pressures on tree limbs. Loggers should never limb a tree immediately after felling. It is often a good idea to drop several trees and then refuel the saw prior to limbing. This will provide ample time for overhead hazards to come down.

Prior to limbing, loggers should evaluate five potential hazards as follows:

- Overhead hazards.
- [Spring poles](#).
- [Butt movement forward](#) (creates back pressure on limbs).
- [Butt twist](#) (creates sideways pressure on limbs).
- Butt off the ground (creates tension on the tree stem).

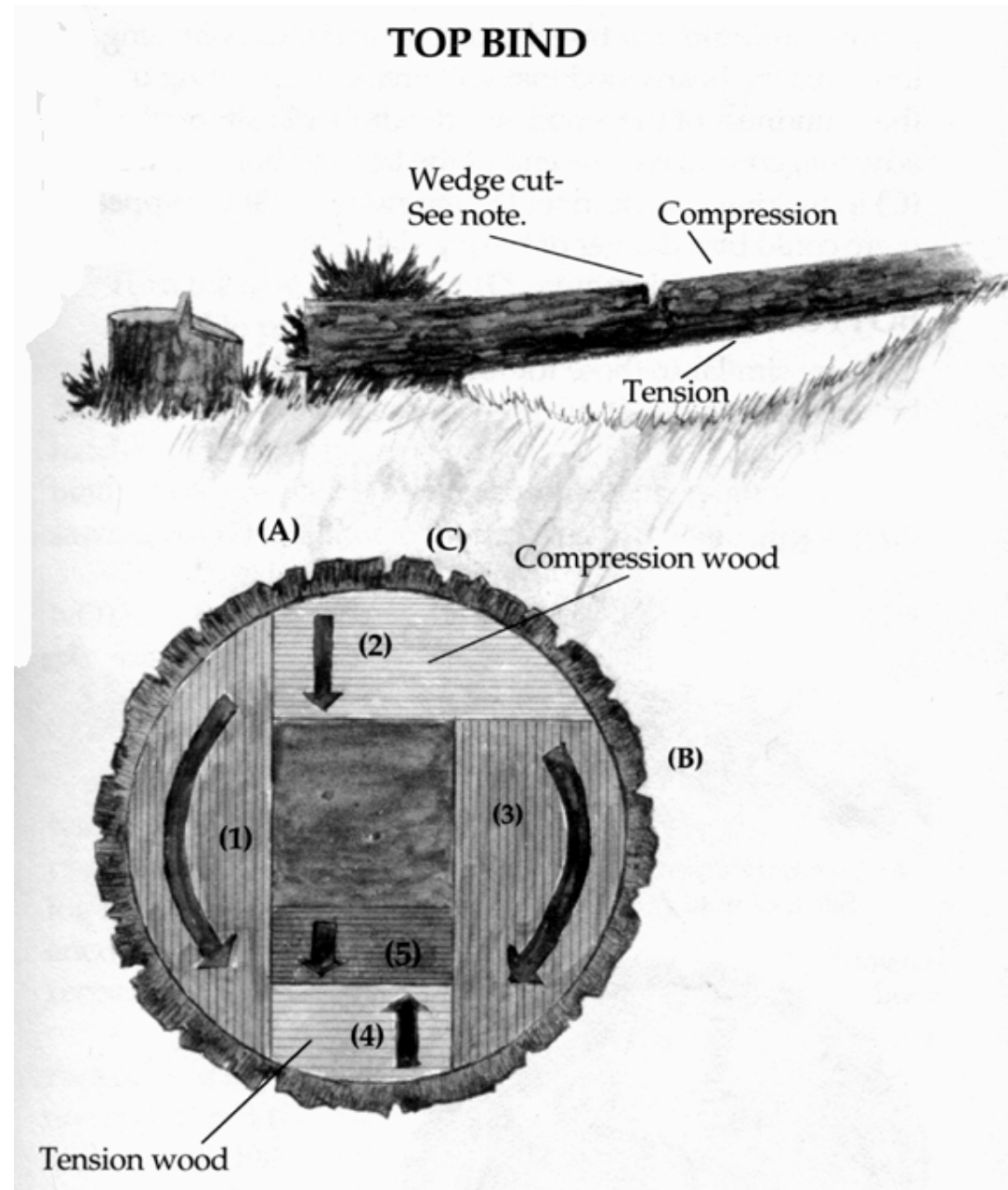
Highlights of Limbing and Bucking Requirements

- Limbing and Bucking must be done on the uphill side of each tree or log, where rolling or sliding of logs may be expected.
- Precautions, such as [chocking](#) or moving to a stable position, must be taken to prevent the logs or the butt from striking employees while limbing and bucking wind-thrown trees.

Top Bind

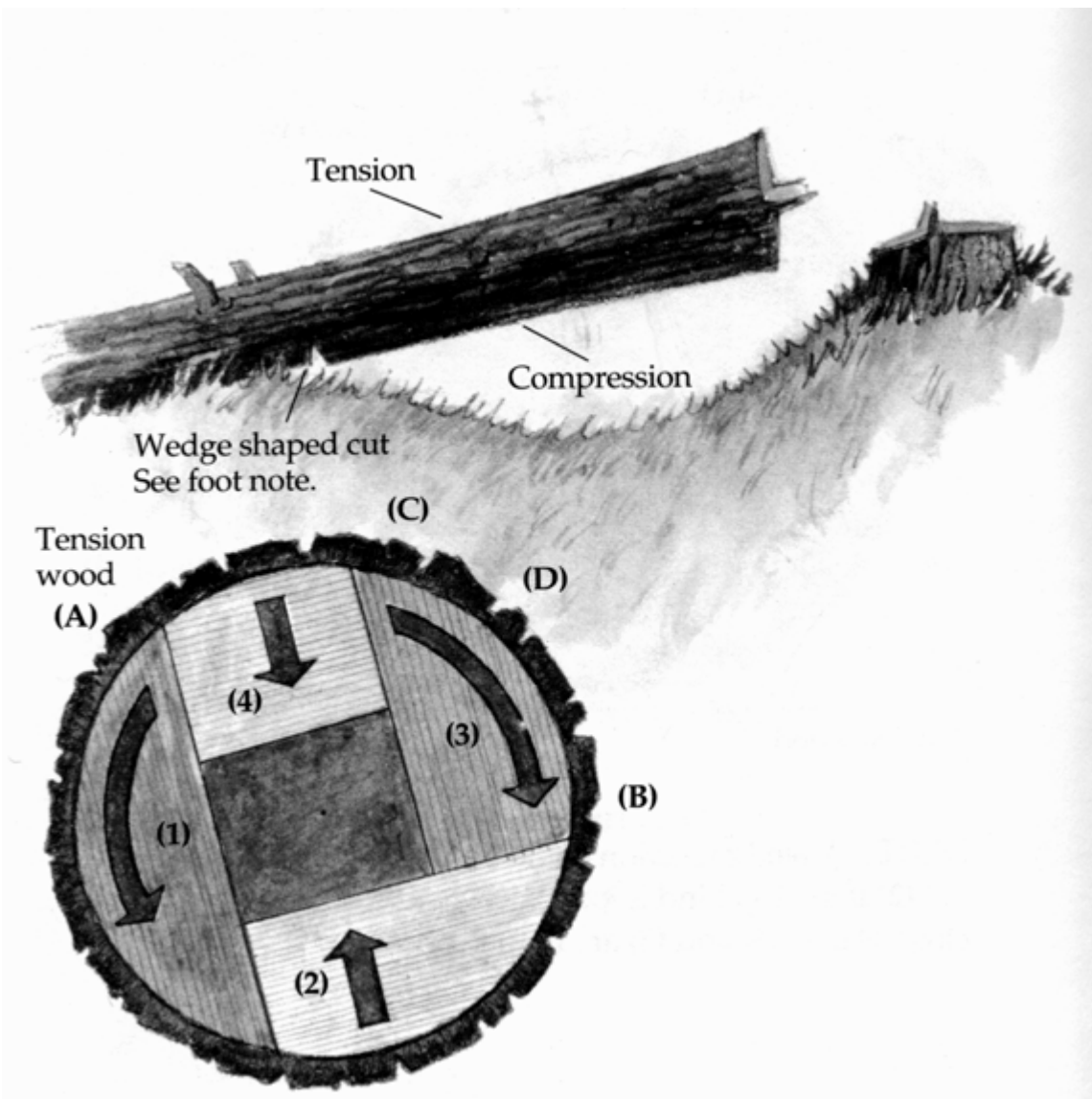
Arrows indicate saw travel direction and cross-hatching indicates the heartwood that will break. Depending upon the soundness of the wood and the timber lie, it may be advantageous to use the end of the bar and bore from point **(C)** in making cuts number **(1)** and number **(3)** if it appears there could be a danger of the log slabbing.

NOTE: A wedge section could be removed when sawing cut **(2)** if the top bind is excessive, to allow the tree cut to close as cuts **(4)** and **(5)** are made.



Bottom Bind

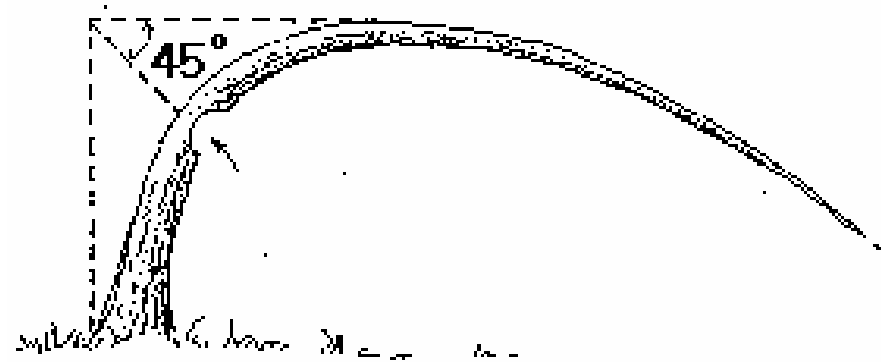
Cuts are similar to those for top bind, except top and bottom cuts are reversed.



Spring Poles:

The safest way to release a springpole is to shave a sufficient amount of wood from the underside of the springpole to allow the wood fiber on the top side to release slowly.

To decide optimum point of springpole release, determine a straight vertical line from the stump to where it meets a straight horizontal line from the highest point of bend, and come down at a 45° angle from where the two lines intersect.

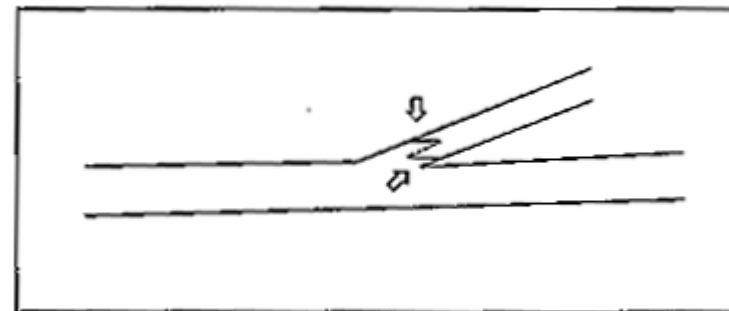


Limb Lock:

Back and sideways pressure on limbs can be handled using a limb lock.

If limbs have back pressure on them, they can severely injure a logger when they are severed from the tree. A good precaution to use in these circumstances is a limb lock. The purpose of a limb lock is to prevent a limb under pressure from kicking back and striking the leg or pinching the saw. The first cut is made on either the topside or bottom side of the limb (top and bottom refer to top and bottom of the limb as if the tree were standing up). It is preferable to make the first cut on the side with compression pressure and the second cut on the side with stress.

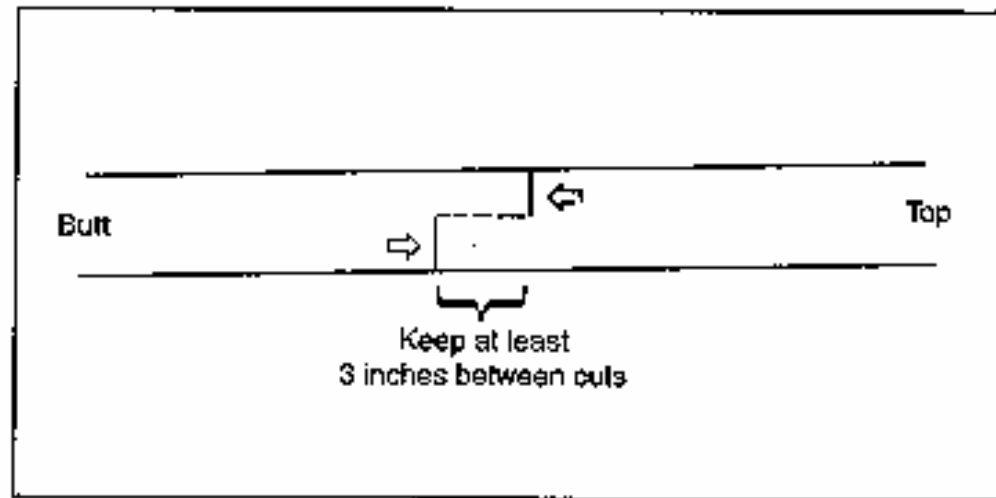
The cut on the top of the limb is made closer to the trunk of the tree and the cut on the bottom is made further out on the limb. It is important that the two cuts by-pass so that all fiber is severed. This will create a step in the limb which will prevent the limb from kicking back and hitting the logger.



Top Lock:

Twisting of trees and butts off the ground create pressure on the stem that can be handled with a top lock.

If the stem of the tree is under stress, a top lock can be used to prevent the top from kicking up and striking the logger. The first cut of a top lock is made on the side of the tree that is under compression, in the top or bottom of the stem. The second cut is made on the side of the tree which is under tension. This prevents pinching the saw. The top cut is always made closer to the top of the tree and the bottom cut is made closer to the bottom of the tree (the reverse order of the limb lock). Both cuts must by-pass so that all fiber is severed.



Tongue and Groove:

If there is danger of a tree or portion of a tree rolling on the logger, a tongue and groove can be used. To make the tongue and groove, the stem of the tree is bored in the center. Then up and down cuts are made either closer to the top or butt of the tree, so that each of them by-pass the bore cut, but do not meet. With all fiber severed, the tongue and groove will prevent the tree from rolling.

