Production Felling Through Safety

A Guide to Proper Technique in Tree Felling

MEMIC

Partners for Workplace Safety℠

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Introduction

MEMIC Safety Services and its parent company, Maine Employers' Mutual Insurance Company offers the Production Felling Through Safety - A Workshop for Professional Chain Saw Users, as a training method to improve safety and production for loggers in Maine. This workshop is modeled after the Game Of Logging offered by world famous trainers, Soren Eriksson and Tim Ard. Most loggers who have participated in this workshop find that the techniques help them accomplish their work with greater efficiency and safety while in more complete control of their surroundings.

Many students have requested a printed summary of techniques learned in the workshop. The purpose of this publication is to summarize the Production Felling Through Safety Workshop in an easy to read format.

The workshop is delivered in four levels. Each level is presented as a full-day, hands-on workshop with students practicing the techniques. Levels are generally separated from the next by at least one month so that students have time to practice the techniques on the job and to work with instructors to reinforce these techniques. The following is a summary of training included at each level:

Level One

- personal protective equipment
- the saw tooth
- chain saw reactive forces
- the hinge
- precision felling
- chain saw safety features
- the bore cut
- the open face notch
- information before felling

Level Two

- reduced down time maintenance
- chisel bit chain filing
- felling wedges
- carburetor adjustment
- spring poles
- side lean and felling accuracy

Level Three

- segment calculation
- height measuring
- delimbing
- precision felling

Level Four

- practice of difficult trees and patterns
- recap of training
- delimbing
- discussion of competition

SAFETY CLOTHING

It is important that chain saw operators wear proper clothing. Clothing should not only protect, but should also keep loggers warm in the winter and cool in summer. Clothing that does not restrict movement will make it possible for loggers to accomplish their tasks safely and with less fatigue.

The following are the items of safety clothing recommended:

1. **Hard hat** - This needs to be replaced every two to three years as ultraviolet rays destroy the plastic. ***Do not*** paint or alter hard hats.

2. **Eye protection** - This should be used whenever hazards from flying particles exist. Face screens or safety glasses with side shields are acceptable.

3. **Hearing protection** - This may be muffs or plugs. Hearing protection should always be in place prior to starting the chainsaw.

4. **Boots** - Steel toed boots with a cut resistant lining are ideal. Chain saw operators should consider calk soles for non-slip footwear. Some skidder operators use a padded material such as conveyor belt cloth on skidder floors and other surfaces to reduce slipping while wearing calk boots.

5. **Leg protection** - Ask for UL listed leg protection. Most leg protection materials are made of Kevlar, polyester, or Nylon. They should be wrap around, especially on the lower leg. All leg protective garments should be replaced if they have been cut with the saw. Keep leg protective garments clean as recommended on the label.

6. **Tool belt** - This should include wedges, first aid kit and tools needed to maintain a saw.

7. **Axe -** Needed to drive wedges. Also useful to cut the chain out should it become pinched.

CHAINSAW STARTING TECHNIQUES

The workshop stresses safe chainsaw starting techniques. Any method that uses the chain brake and ensures that the saw is secure is acceptable. We recommend the method illustrated below.

Left hand holds front handle on corner to tilt saw. Rear handle of saw is held between legs with handle pressing against right leg. Starter cord is pulled with right hand.

A quick pull starts saw with complete control.

CHAINSAW MAINTENANCE

In the workshop this is sometimes referred to as reduced down time (RDT). The chain saw is the major tool which loggers use for felling, limbing and bucking. It is important that it be in perfect operating condition. During the workshops and visits to logging operations, we often find that saws are either unsafe to operate or are improperly maintained and tuned causing saws to be unsafe, run inefficiently and even wear out prematurely.

There are many things that can be done to maintain your saw. If you are unsure how to make a repair or tune a saw, it is best that it be taken to a dealer. However, if you understand what to look for, you will better know when your saw needs the attention of a trained professional.

The following is a summary of basic maintenance steps. Some of these need to be completed weekly and others need to be completed daily. Please refer to your owner's manual for a list of daily and weekly maintenance schedules.

Following is the procedure for RDT:

1. **Air filter** - This may be referred to as the chain saw nose. An average human consumes 1,700cc of air per minute. An operating chain saw with an 85cc engine consumes over 1,000,000cc of air per minute. If the filter is not clean, the chain saw cannot run efficiently.

   *RDT inspections have discovered many air filters that are mostly or completely blocked. Air filters should be cleaned with soap and water and should be dry before putting them back on the saw. Consider having more than one filter so they can be rotated.

   Do not use cleaning agents on the filter, such as ether, which will destroy the seals. Do not use mixed saw gas which will leave an oil residue that will collect dirt.

2. **Screws and bolts** - Always check screws, nuts and bolts; especially after running a few tanks of gas through a new saw.

3. **Starter Cord** - Inspect starter cord daily. There should be some free play in the spring when the cord is pulled out completely. The cord should not be frayed and the handle should not be broken.

4. **Flywheel and pawls** - The flywheel often collects debris which can cause it to become unbalanced. The flywheel and pawls can be cleaned with a toothbrush and an ordinary bathroom cleaner such as 409. While the cover is off it is a good idea to clean the wires of the ignition. When these get dirty the vibration of the engine can cause the wires to break.

5. **Saw chain** - Inspect chain for cracks and wear.

6. **Bar** - Clean the groove. Heat generated along the bar will cook oil and chips into the rail. This should be removed daily or it will tend to clog the bar making it difficult for the chain to pass over it and reduce effectiveness of the oiler. One way to help extend the bar life is to rotate the chains. An individual might consider owning three chains which can be rotated on a daily basis. This will help the chain and bar wear at an even rate.

7. **Sprocket** - When the sprocket teeth at the end of the bar become sharp to the touch, they are worn out and should be replaced.

8. **Clutch, drum and drive sprocket** - The chain drive sprocket is made of case hardened metal. If the fingernail can catch in the drive straps, the sprocket is probably worn out. The clutch is a spring clutch which engages at approximately 3,000 RPM. The drum should be clean.

9. **Chain catcher** - The chain catcher must be in place to protect the operator from injury and the saw gas tank from rupture if a chain should break or be thrown off the bar .

10. **Throttle lock** - The throttle lock prevents accidental acceleration should something catch the trigger of the saw.

11. **Chain brake** - The chain brake stops the chain in the event of kickback. Most new brakes have an inertia function so the brake will engage even if the handle is not hit. The chain brake must be cleaned daily and can be checked by running the saw at full speed and activating the brake. The chain should stop almost instantly.

CARBURETOR TUNE-UP

A properly running saw is essential to safe and productive tree felling. Everyone who operates a chain saw should understand how to adjust the carburetor. Even if you choose not to adjust the carburetor yourself, you should understand when a carburetor is out of adjustment and needs to be tuned by someone with the proper skills.

Following are the steps for adjusting the carburetor:

1. **Clean air filter**.

2. **Balance high and low speed screws** - Start and warm the saw to operating temperature. Shut the saw off. The high and low screws are turned completely in clockwise. Each screw should then be backed off to the left one full turn, or some other amount according to instructions in the owner's manual.

Start the saw. At full throttle the high speed screw is turned clockwise to reduce fuel, (clockwise reduces fuel). As the fuel mixture is leaned out, the saw will run faster until it sounds as if it is screaming. At this point turn the high speed screw to the left to allow more fuel until a "flutter" is heard. This is the proper RPM for your saw.

This can be confirmed with a tachometer; but a tachometer alone cannot ensure that you have the correct fuel mixture. It is possible that air leaks may prevent you from obtaining the proper fuel and air mixture, and you may need to reduce the RPM to hear the "flutter". Therefore, the "flutter" is more important than the tachometer reading.

Chain saw operators must understand that the fuel mixture accomplishes two additional functions. These functions are cooling of the motor and lubricating the engine. If the saw runs too lean, neither of these functions are accomplished effectively and the saw will be ruined.

3. **Throttle** - Ensure that the saw chain is not moving when the saw is on idle. If the chain is moving, turn the throttle screw counter clockwise to slow the chain to a stop.

4. **Roll-over test** - Let the saw idle for 20 seconds then turn the saw to different positions. If the saw stalls, it is getting too much fuel which is puddling below the cylinder. Turn the low speed screw clockwise (reducing the fuel) a little bit and repeat the test.

5. **Accelerate** - If there is hesitation in acceleration, the saw motor is not getting enough fuel. Turn the low speed screw counter clockwise for more fuel and repeat the roll-over test.

SAW CHAIN FILING

Smooth and efficient cutting from the saw requires a properly sharpened chain. Many chain saw operators tend to reduce the height of the rakers in an attempt to “take a bigger bite”.
Although this feels like the saw is grabbing more wood, it is putting a great deal of strain on the chain, sprocket and drive mechanism. It also reduces cutting speed and increases the chance of injury to the operator. To properly file a saw, it is important to understand the function of each of the elements of the saw chain.

The following is a brief description of the functions of the saw chain teeth:

1. **Raker (sometimes referred to as a depth gage)** - The raker determines the thickness of the chip. This should be 20 to 30/1000 of an inch depending on whether you are cutting hard wood or soft wood. A raker depth gage is the best tool to use to get the proper height of the raker. These can be purchased at local chain saw stores. Another way to determine if the raker depth is correct is to use a tachometer while running the saw through a log. RPM’s while cutting should be 9,000 to 9,500.

2. **Working corner or point** - This is the point formed by the intersection of the side and top plates. This is where the cut begins.

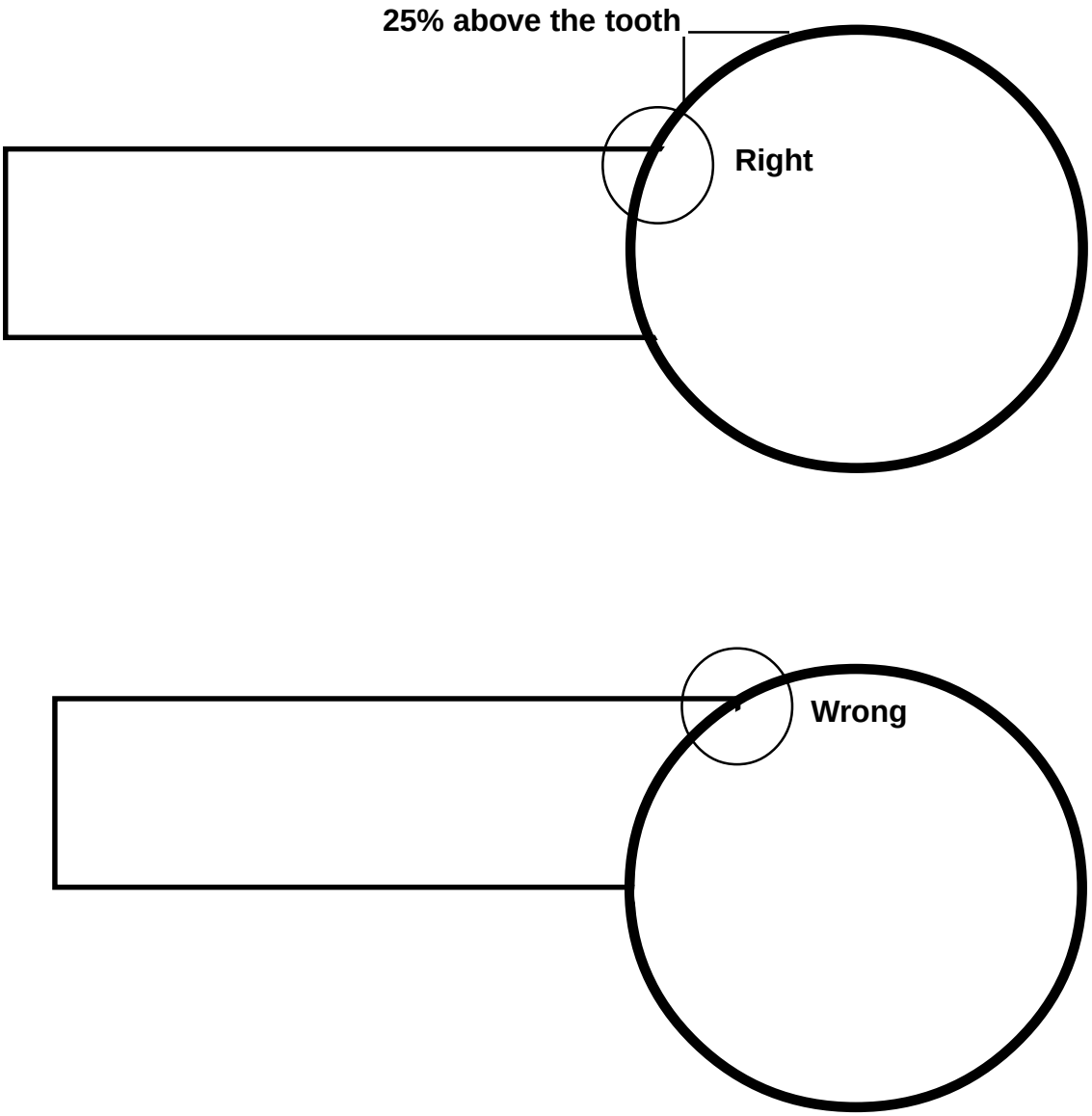
3. **Side plate** - This cuts off the fiber. The side plate should have approximately a five to ten degree forward lean. Making this angle too great will cause the tooth to be sucked into the wood creating a kickback danger. Many chain saw operators have a tendency to create a hook on the side plate. This is very dangerous and inefficient.

4. **Top plate** - The top plate angle establishes the width of the saw kerf. The angle causes the tooth to be pushed to the side. The greater the angle, the more wood needs to be cut. Today’s saws need a top plate angle of 20 to 30 degrees.

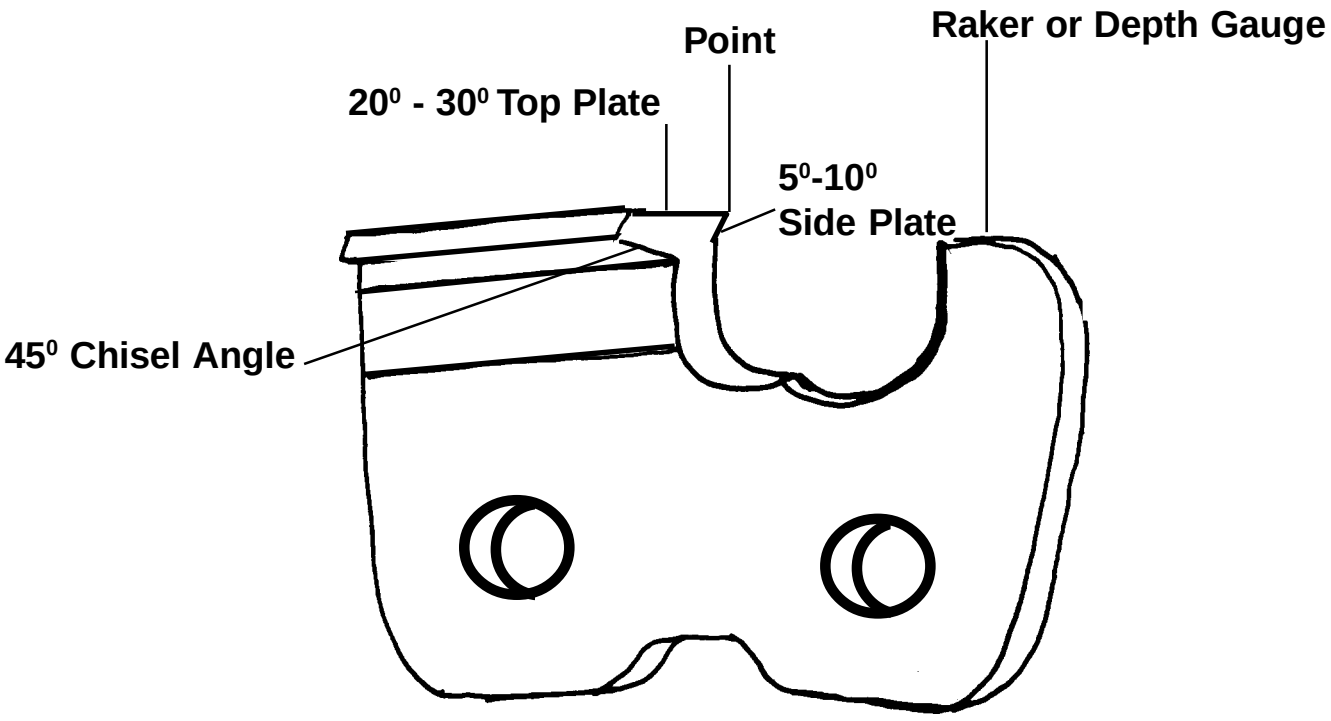
5. **Chisel angle** - This angle, which is beneath the top plate, allows chips to slide underneath the tooth. This angle should be 45 to 55 degrees.

Diagrams on the following page.

Proper Round Filing



Saw Teeth


Point
Raker or Depth Gauge
20⁰ - 30⁰ Top Plate
5⁰-10⁰
Side Plate
45⁰ Chisel Angle

SAFETY VIOLATIONS

Safety is emphasized when students are scored. Points will be taken deducted for failure to observe safety procedures.

The following is a list of safety requirements:

1. Chain saw operator must be wearing all personal protective equipment outlined earlier.

2. Chain brake must be activated when starting the saw.

3. Chain brake must be activated when taking more than two steps.

4. Chain brake must be activated when holding the saw with one hand, especially when clearing brush or reaching over or around the saw.

5. The kickback corner of the bar should never be used to start a boring cut.

6. When the tree starts to fall, the chain saw operator must begin retreat.

7. Never bore more than half way through a tree from the bad side. If the operator should inadvertently cut too much fiber off on the bad side, the tree can set down on the saw and pinch it.

8. Thumb and fingers must completly encircle saw handles.

TREE FELLING

Information before felling:

All chain saw operators must obtain information before felling trees. This is important if a proper felling plan is to be formed and executed.

The following are the five information points prior to felling:

1. **Hazards** - Hazards may include dead stubs, widow makers, forked trees, vines, tied together limbs, wind, snowload and other hazards common to your area.

Hazards must be identified not only around the area to be cut, but also around the area where the tree will fall.

2. **Side lean and side weight** - It must be determined which is the good side and bad side of a tree. A chain saw operator should always finish the felling cut on the good side of the tree to avoid getting the saw pinched and avoid injury to the operator and saw.

The bad side of the tree is always that side towards which a tree is weighted or leans. The rare exception is if an overhead hazard should cause a logger to determine that they would prefer not to work under that hazard and choose the other side of the tree as the good side.

3. **Escape route** - An escape route should always be determined and cleared prior to cutting. It is a good idea to have an alternative escape route.

4. **Hinge** - A good hinge is essential to controlling the fall of a tree. A rule of thumb for hinge length is 80% of the diameter of a tree. Therefore, a 10 inch diameter tree should have a hinge length of 8 inches. This is just a general guide and some trees with a heavy side lean may require a longer hinge and other trees with odd shaped fluted trunks may be felled with a shorter hinge.

Hinge thickness should be even over its entire length. After felling a few trees in your work area, you can quickly determine the proper hinge thickness for different species of trees. You may find that some trees with strong fibers, or with fibers that pull easily, need a thinner hinge.

5. **Cutting technique** - This refers to the plan of the back cut. This plan should be established prior to cutting and, if something starts to go wrong, should be reevaluated before finishing the fall of the tree.

The back cut should be level with the notch if the open face notch is used.

The Open Face Notch

The function of the notch is to allow the tree to fall without breaking the hinge prematurely. Typically most notches today are less than 45 degrees. These small notches close up before the tree has fallen even half way to the ground. When this happens, stress is put on the hinge causing fiber pull, splitting of the butt log, or barber chairing.

A proper undercut should be an open face notch with a 90 degree opening. The best way to form this opening is to make the top cut first. The logger saws in a downward and slightly inward direction until the width of the notch is approximately 80 percent of the diameter of the tree. The operator then removes the chainsaw and finishes the notch by making the second cut in a slightly upward direction.

The first cut is made sloping down and into the tree. The second cut slopes slightly upward to meet first cut exactly.

A good open face notch is 90^0 or more .

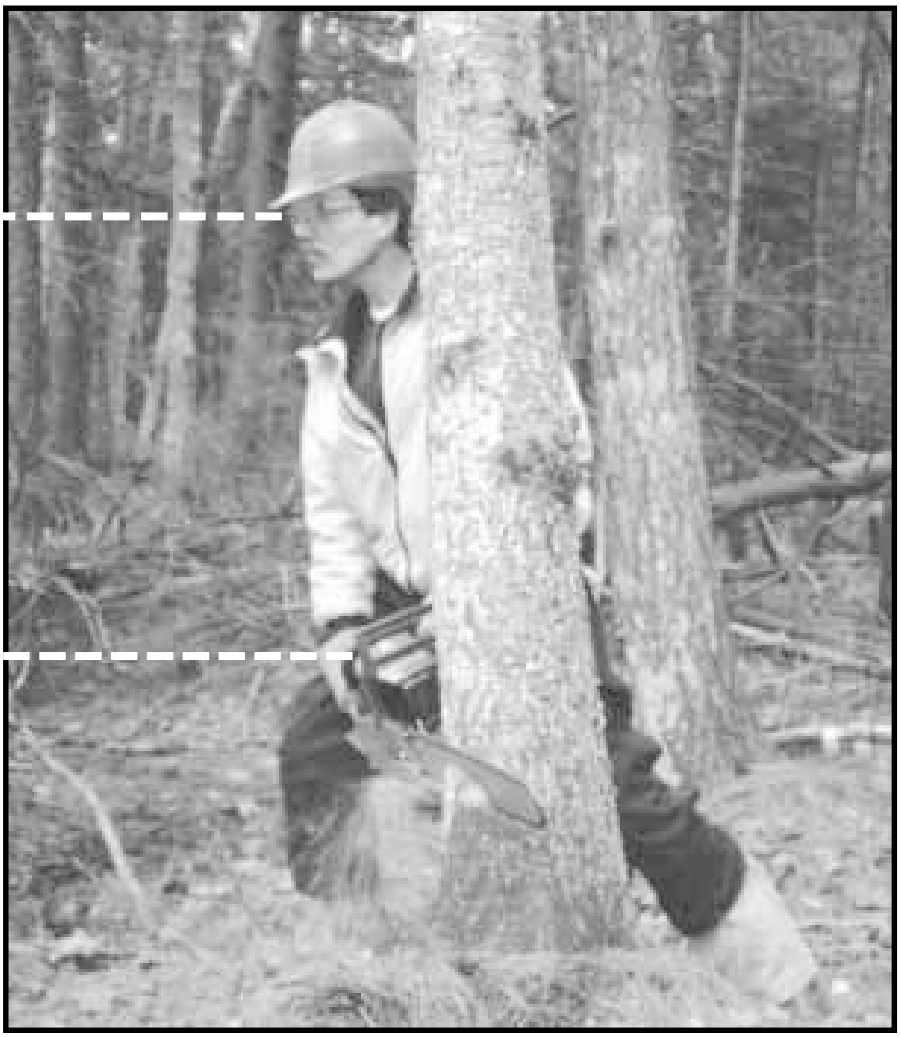
The advantages of making the top cut first are that the operator can easily establish hinge width and can also look into the top cut and actually see when the second cut meets. With practice, a chainsaw operator should be able to have both cuts meet exactly on the first try. A by-pass of no more than 3/8 inch is acceptable.

If the two cuts do not meet exactly (by-pass) the notch cannot perform its function. As soon as this by-pass closes, the tree will stop falling while it is still standing almost straight up. At this point loggers often cut off all or part of the hinge, the hinge breaks by itself, the tree splits and barber chairs, or splinters pull from the butt log. All of these actions are dangerous and non-productive.

Sight Line

Many saws have a built-in sight line which can be used to establish falling direction of a tree. The line is usually a raised ridge of plastic or a decal. In the absence of a sight line, any seam on the casing which is perpendicular to the bar is acceptable.

The logger stands behind the saw while leaning against the tree and sights over the saw. When the target is in line with the sight line, the logger begins the first downward cut of the notch. The resulting face will determine the falling direction of the tree.

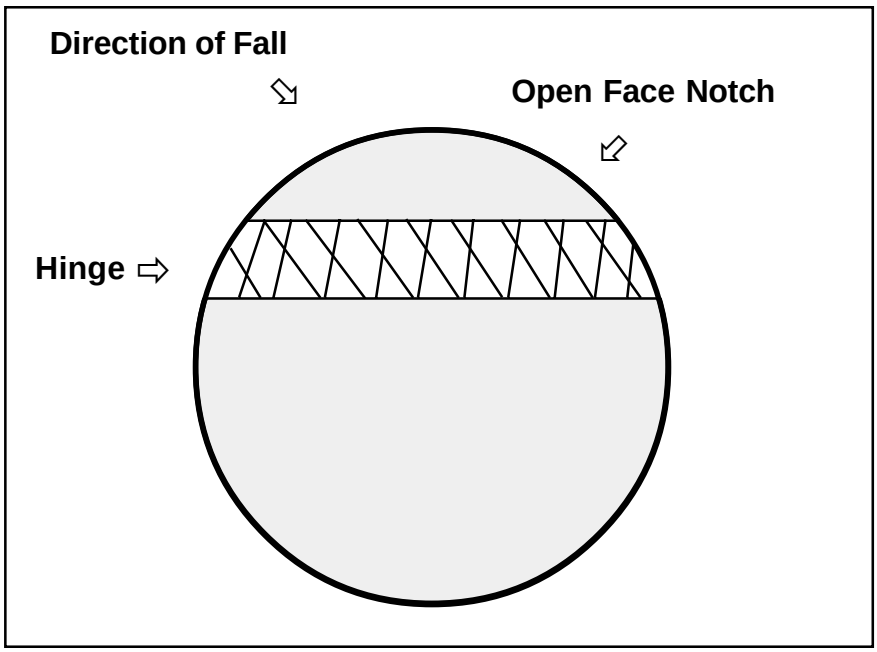


The sight line on the saw can be used like a gun sight to determine an exact falling direction for the tree.

The Hinge

The hinge is the single most important part of the felling cut. It controls the felling direction, reduces the chance for hang-ups, and can increase productivity. If a proper notch has been formed, the hinge will control the fall of the tree all the way to the ground.

Hinges should be the same thickness all the way across the stump. If the hinge is faced in the proper direction, using the site line of the saw, the tree will fall correctly.



Loggers often attempt to swing trees into openings by cutting the hinge off on one side. Efforts to swing trees into openings often result in hung trees. This is because it is difficult to guess how much of the hinge should be cut off to swing a tree. It is much more accurate to aim or sight the tree and have it fall exactly in the intended direction.

It should also be noted that the fibers of the hinge tend to break from the back. As the tree falls, fibers along the back of the hinge will break first. After the tree reaches a certain point in its fall, only the fibers at the front of the hinge are left to finish steering the tree. Therefore, making a hinge thin on one side will not accomplish any steering function.

Cutting off all or any part of the hinge is considered a safety violation. The only time a hinge can be cut is if the tree becomes hung up. It may become desirable to cut off one side or all of the hinge so the tree will roll out.

The Back Cut

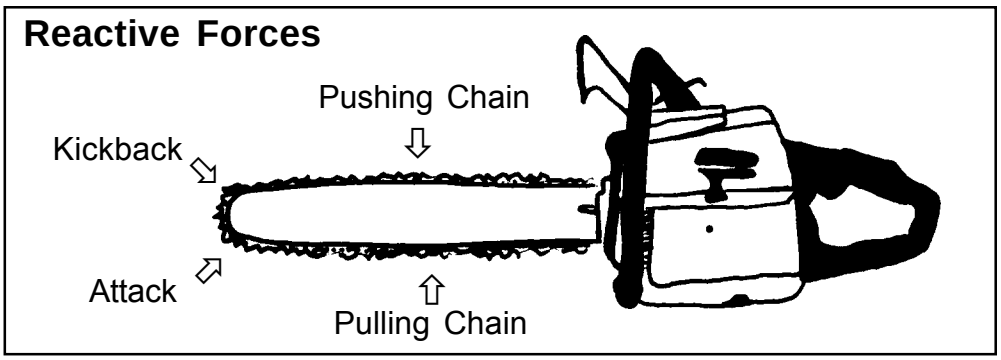
The back cut is important because the execution of this cut determines the proper formation of the hinge and releases the tree for falling. Before determining the proper technique for the back cut, the chain saw operator must determine if the tree has forward or backward lean. This process is actually number five in the information gathered before felling.

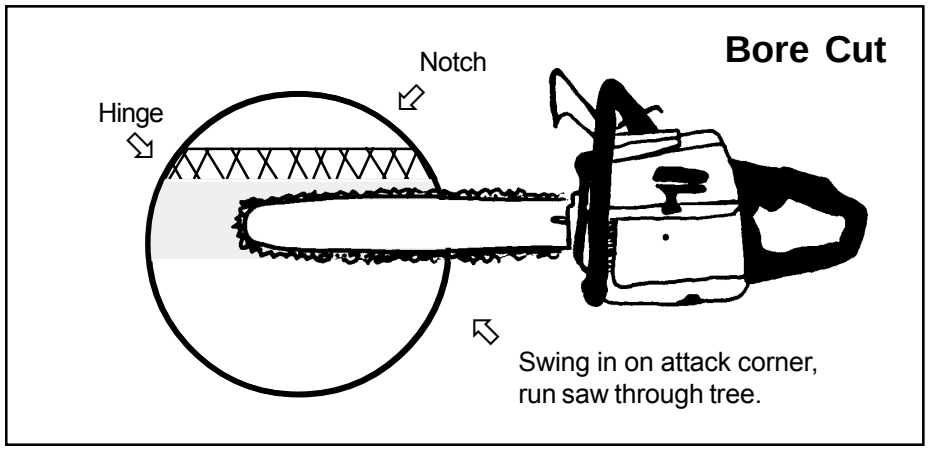
1. Small trees and trees with little or no forward lean - Loggers often cut small merchantable trees or trees with little or no forward lean that do not need wedging. The best way to cut these trees is to make the open face notch and cut straight in from the back. Make sure sufficient hinge is left to control these trees.

Some trees may need a push by hand to get them falling. If the tree is big enough, a wedge can be inserted behind the saw.

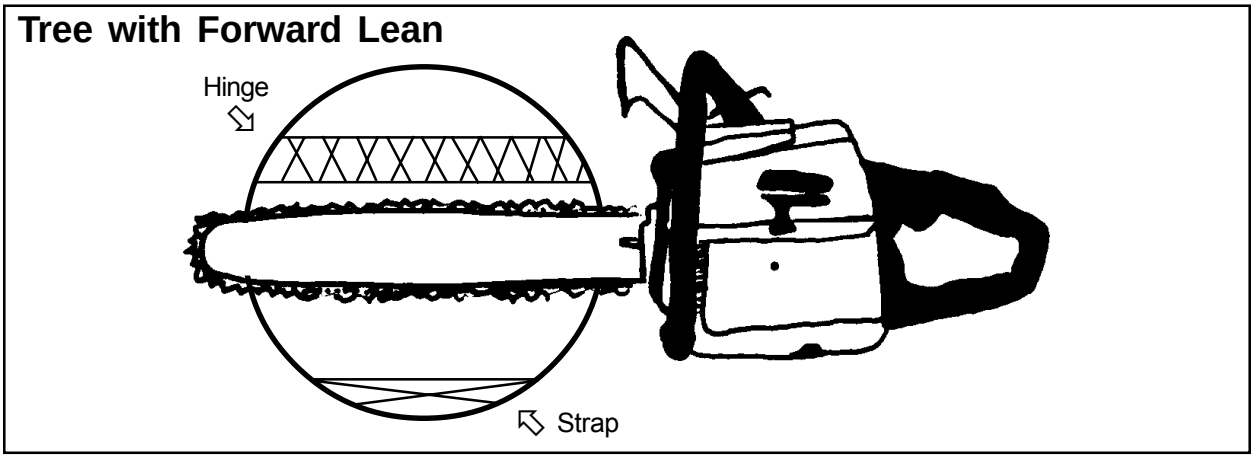
2. The bore cut - Trees with backward or forward lean pose some difficulty and generally require the formation of a proper hinge prior to completing the back cut. On these trees it is recommended that the logger use the bore or plunge cut as the first step in making a back cut.

When attempting a bore cut, it is very important to always use the attack corner of the chain saw bar. The attack corner is the bottom corner of the bar. Never use the kickback or top corner as kickback might result. It is also very important for the teeth to be properly filed as discussed earlier and that the saw be running at maxi mum RPM.





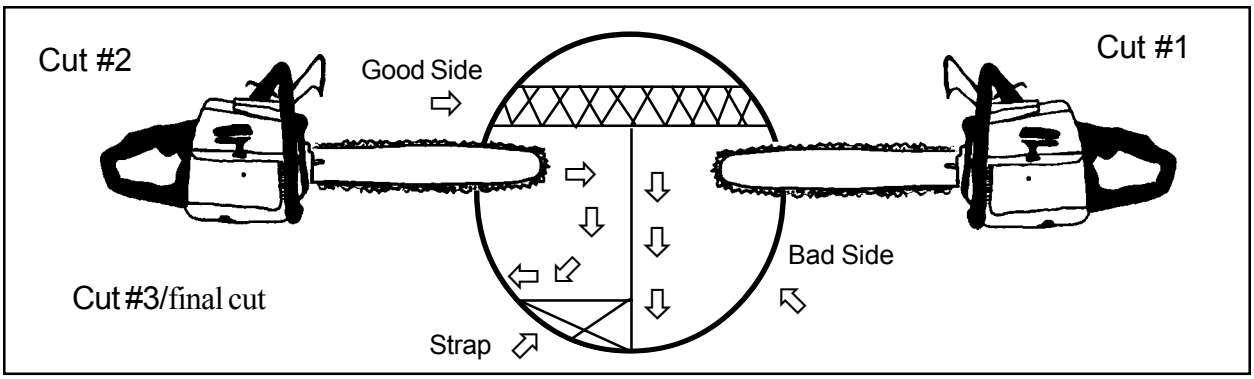
3. Trees with forward lean - Trees with forward lean can easily split, pull splinters, or barber chair. Therefore, it is important on these trees to use the bore cut, form the desired hinge thickness, and then complete the back cut leaving a strap of uncut wood at the back of the tree. This strap of wood and the hinge will hold the tree in place and prevent it from falling until you are ready to release it.



Standing along the escape route, the logger may now cut the last of the strap about 1/2 to 1 inch below the level of the back cut. The strapping wood will split, releasing the tree and allow it to fall in the desired direction while the logger is retreating on the escape route and out of danger.

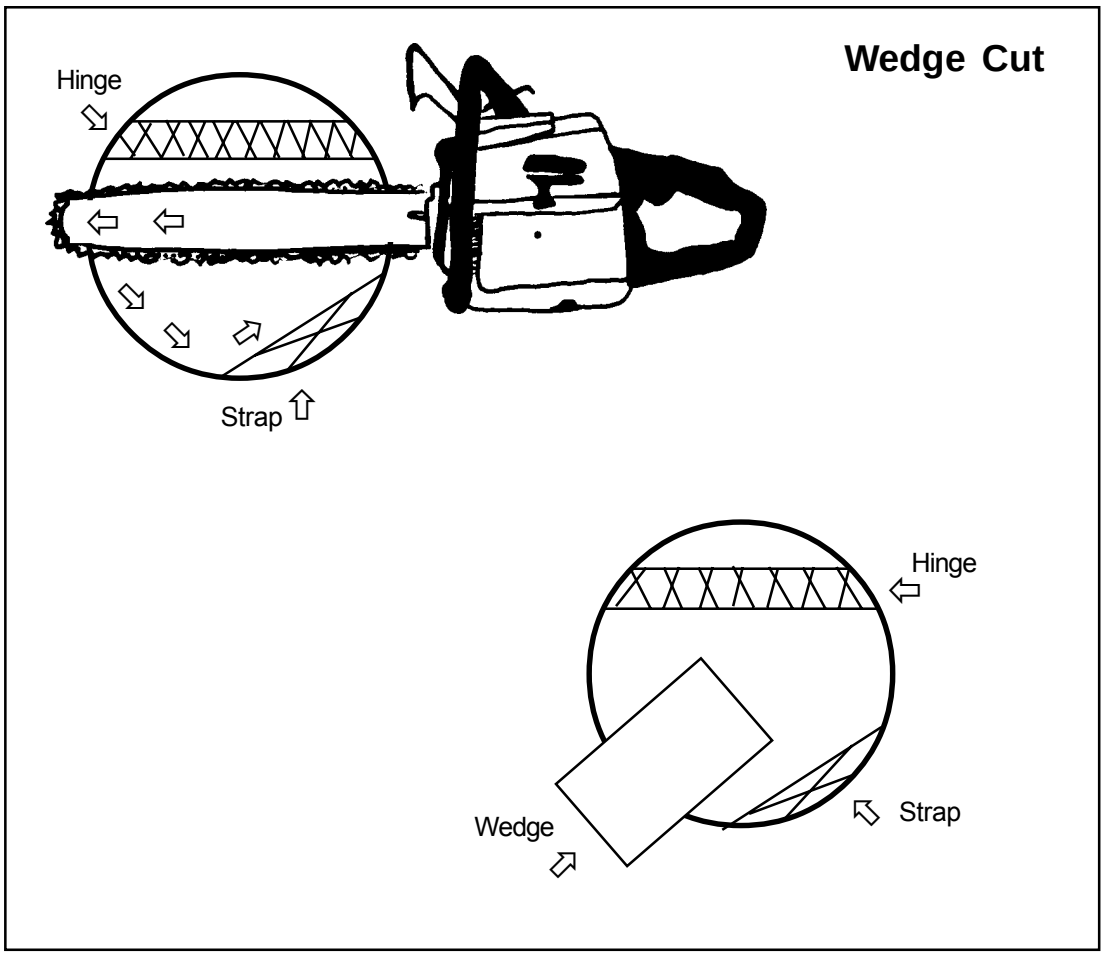
Sometimes if a tree has very little forward lean, the logger may elect to just cut straight back out of the tree without leaving a strap.

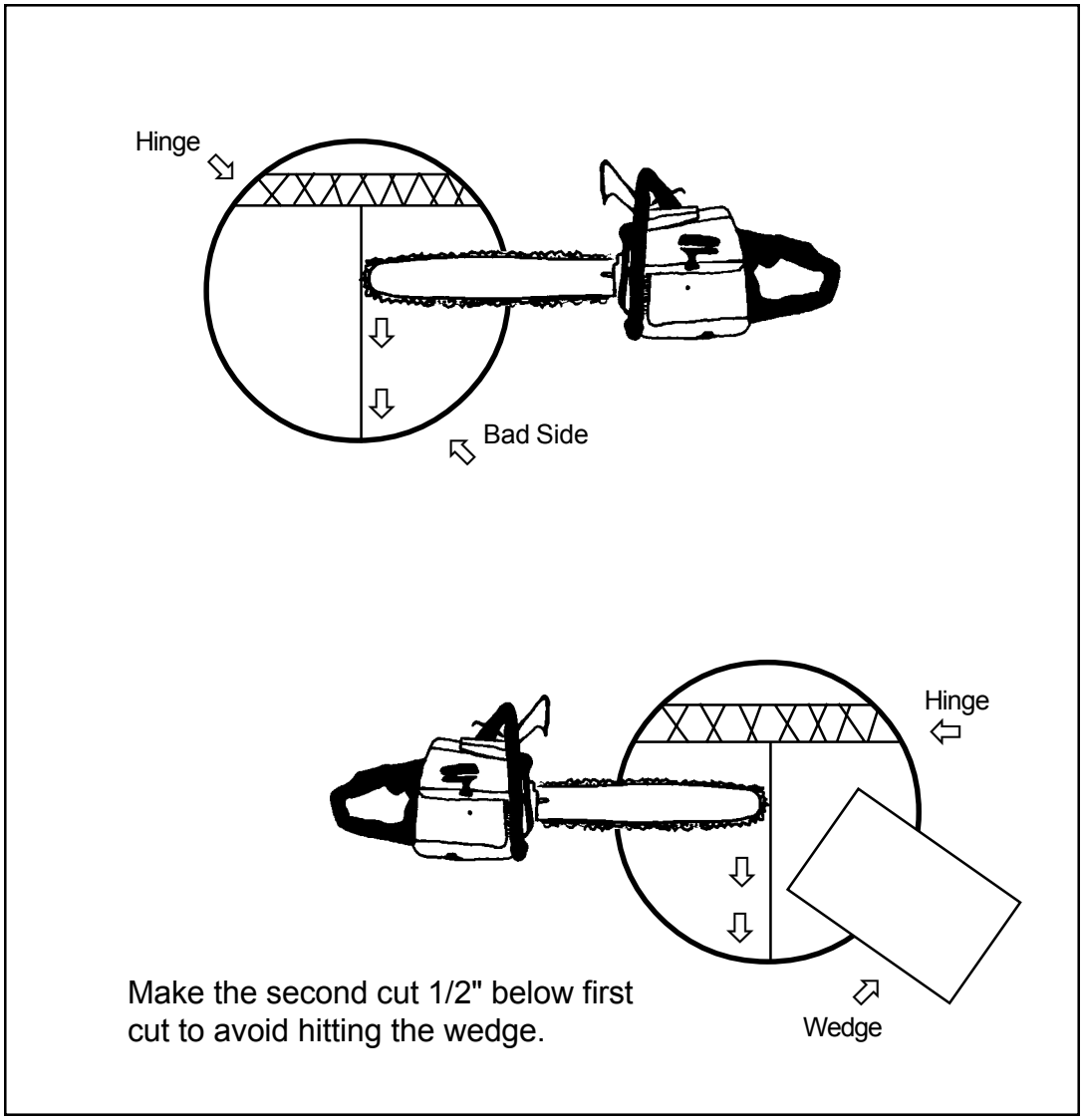
If the tree diameter is too big for the chain saw bar to reach all the way through, the tree can be bore cut from both sides. Using the corner of the notch to guide the start of each bore cut will ensure the cuts are fairly level. It is important to bore cut from the bad side first reaching no more than half way through the tree. The logger may then cut back out of the tree on the bad side, move himself to the good side of the tree and bore cut through to meet the first cut. He then cuts back out on the good side leaving a strap which can be released from the escape route. With experience, the bore cuts will meet exactly, or almost exactly, forming a level precise stump.



4. Trees with back lean - Trees with back lean present special problems in that they may sit back on the saw while making the back cut. We recommend the use of a wedge on all trees with back lean.

If the tree is small enough for the bar to reach all the way through, the simplest method is to bore cut the tree from the good side forming a precise hinge. Swing the tip of the bar towards the rear of the tree leaving a strap of wood to prevent the tree from sitting back. Insert a wedge between the hinge wood and the strap. Cut the strap and drive the wedge with an ax. This is illustrated below.

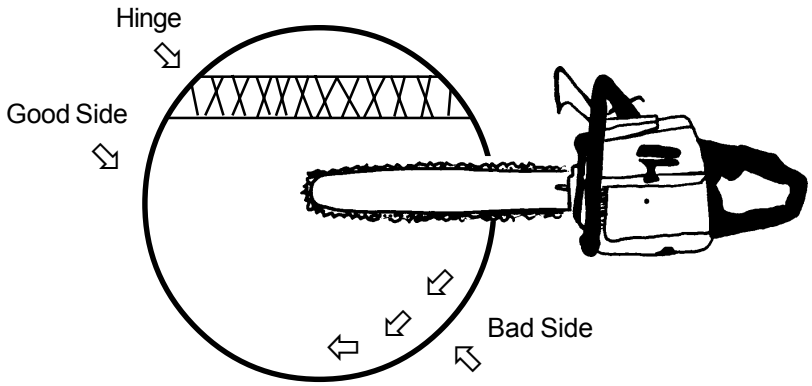


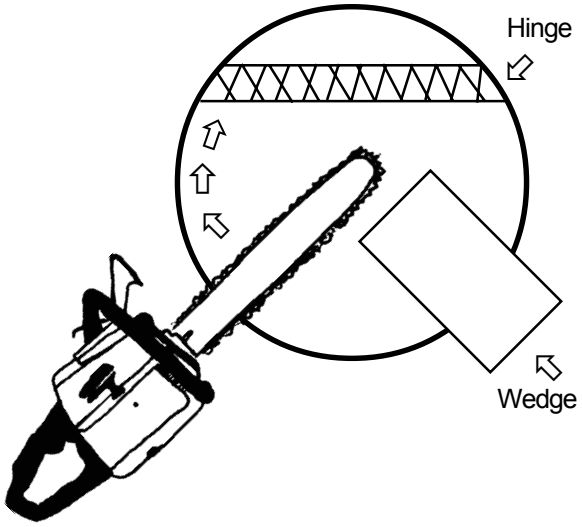


If the tree is too big for the bar to reach all the way through, bore from the bad side first, remembering not to bore more than half way through the tree. Bring the saw straight to the back of the tree on the bad side. Insert a wedge in this opening. The next step is to bore from the good side slightly below the first bore cut and cut back through the tree about 1/2 inch below the wedge. Hitting the wedge a couple of times with an ax will split the holding wood and force the tree over. Refer to the illustrations above. Care must be taken to never saw the supporting wood under the wedge.

Another method to use on trees that are bigger than the bar is to first bore half way through the tree on the bad side, start cutting out towards the back of the tree and then swing the saw around the tree towards the good side. When the saw is approximately 1/2 to 2/3 around, insert a wedge behind it and continue cutting toward the good side until the hinge is completely formed. Take the saw out and drive the wedge until the tree begins to fall. Please refer to the illustrations below.

Cutting Around the Back





5. Segments - Loggers must know if trees with back lean can be successfully felled using wedges. In the workshop we use the concept of segments. A segment is a square with sides that are equal to the distance measured on the stump of the tree, from the front of the hinge, to the back of the tree. This distance, measured in feet, forms the sides of the square for a segment in that tree. To calculate the total number of segments, divide the total height of the tree by the dimension of one segment. For example, a tree with a base of 1 foot that is 70 feet tall has 70 segments (70' divided by 1').

We know that lifting the bottom of a segment one inch moves the top of that same segment one inch over. Therefore, a tree with 70 segments will move 70 inches with one inch of lift at the stump.

Trees of the same height with narrower diameters will have more segments and therefore, can be wedged further than a larger diameter tree of the same height. For example, a tree with a 6 inch base that is 70 feet tall would have 140 segments (70' divided by 1/2') and a tree that is 1 1/2 feet in diameter and 70 feet tall would have 46 segments (70' divided by 1.5').

Trees Averaging 70' Tall

Tree Diameter	Approximate back lean that can be handled using a felling wedge
10"	63" or 5.25'
12"	52" or 4.33'
14"	45" or 3.75'
16"	39" or 3.33'
18"	35" or 3'
20"	31" or 2.5'

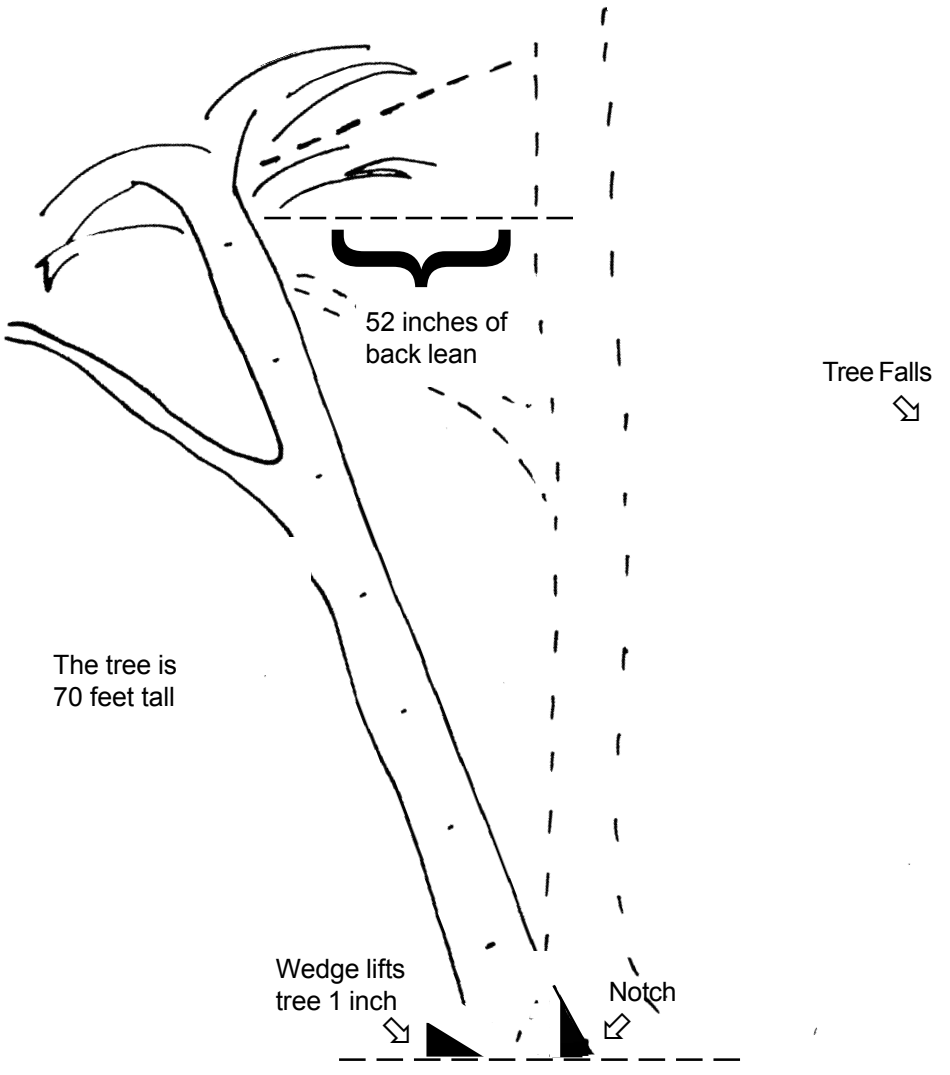
Trees Averaging 50' Tall

Tree Diameter	
10"	45" or 3.75'
12"	36" or 3'
14"	32" or 2.66'
16"	28" or 2.5'
18"	25" or 2'
20"	22" or 1.75'

RULE OF THUMB:

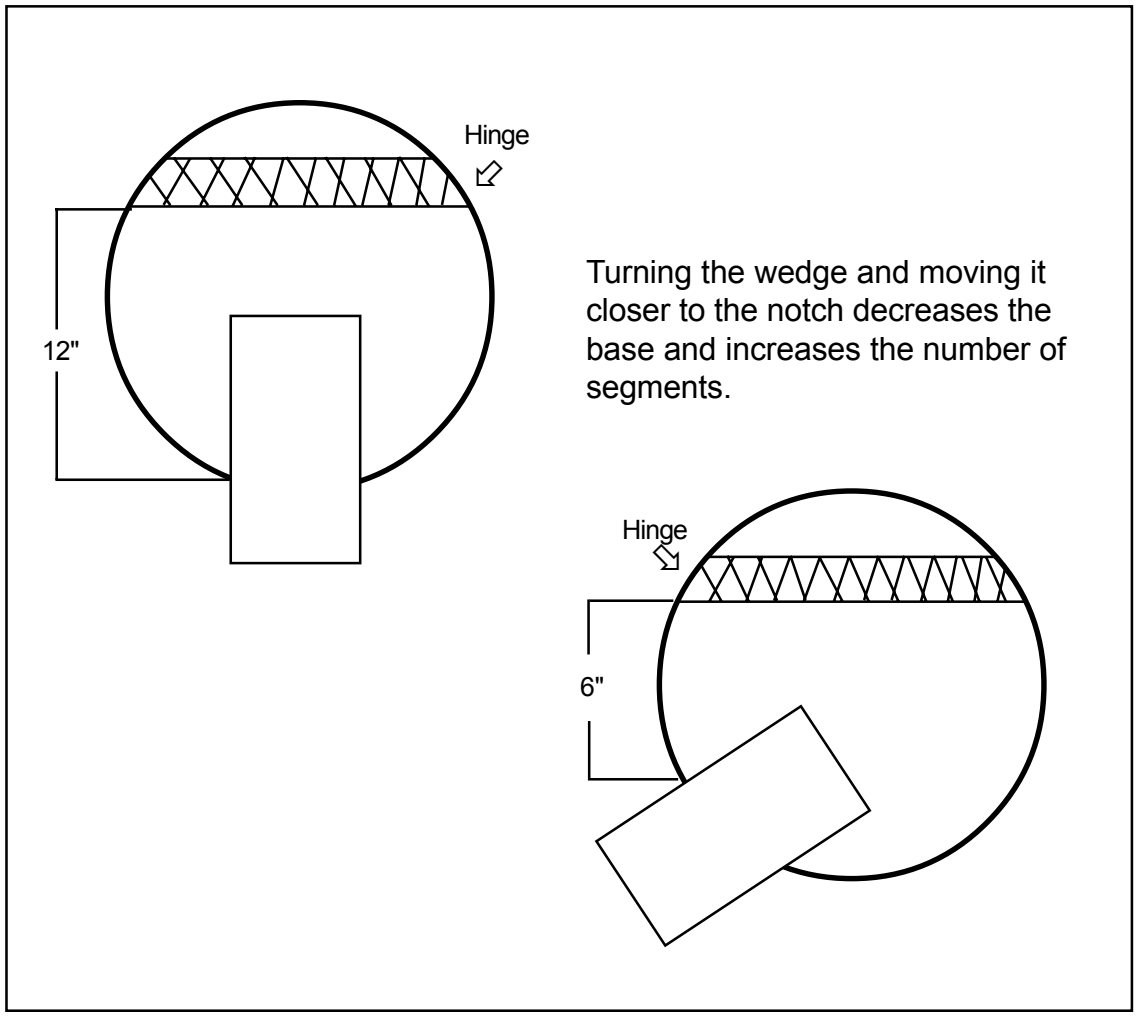
A simple rule-of-thumb method is to divide the height of the tree by the diameter breast high (DBH). Therefore, a one inch DBH tree with a height of 70 feet has 70 segments.

Some lifting capacity of the felling wedge is lost because the wedge must first fill the thickness of the saw kerf before it can begin to lift the tree. The chart on the precedeing page takes this into account. Notice that smaller diameter trees can be wedged farther than larger diameter trees of the same height.



1 foot base measured from front of hinge.

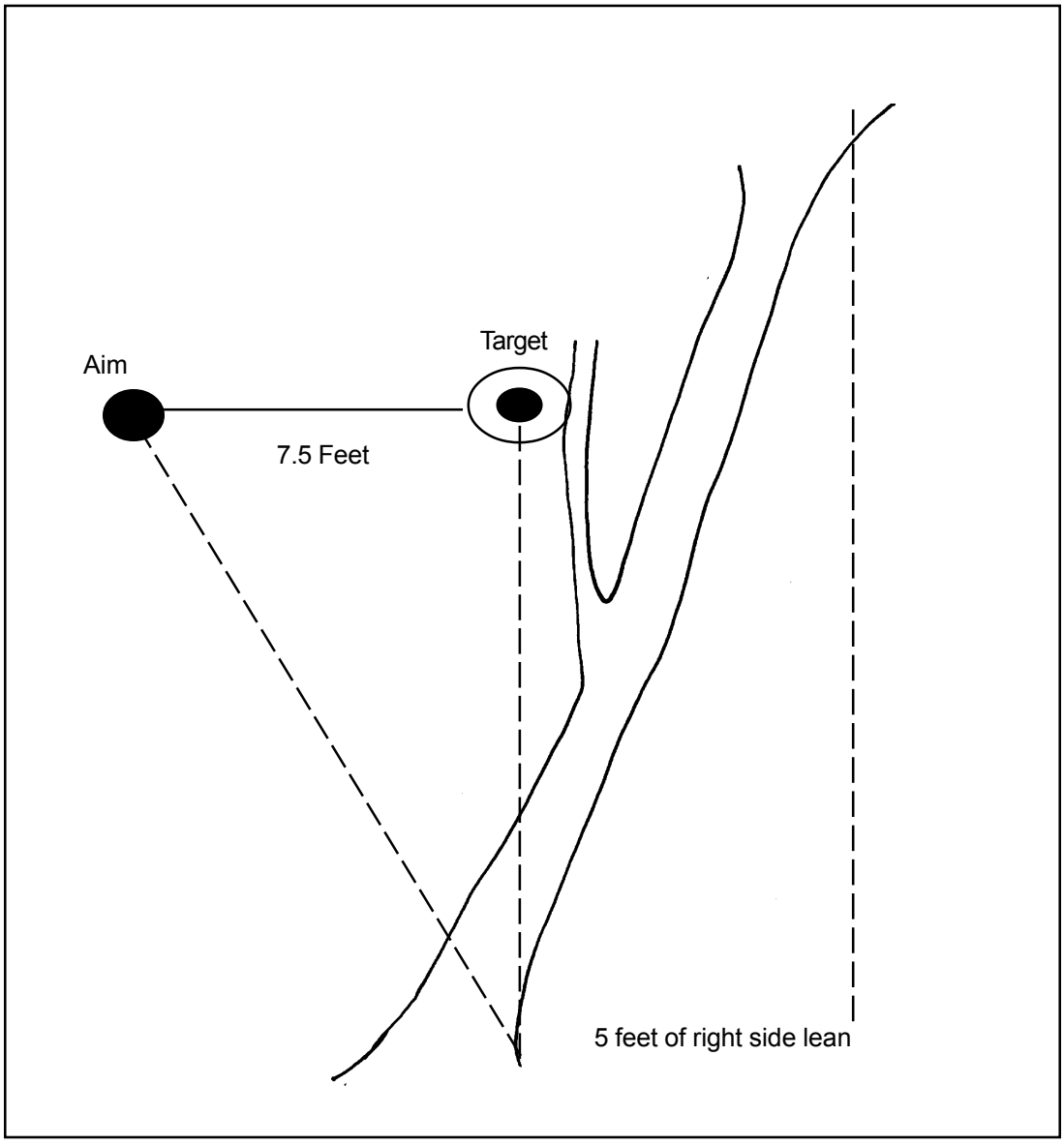
Turning the wedge sideways and moving it closer to the hinge will make the base of the tree smaller by moving the lifting point closer to the hinge. Therefore, it is easy to increase the number of segments in a tree. However, this also makes it harder to drive the wedge as there is more weight on it. Heavy trees may make it difficult to drive the wedge. Be careful not to place the wedge too close to the hinge as this may cause the hinge to lift and break. Please refer to the diagram below for further explanation.



With this knowledge, a logger can make an estimation if a tree can be wedged over and will know that placing a wedge closer to the hinge will provide more lift.

6. Side lean - Trees with side lean pose a special problem. In addition to creating a good and bad side of the tree as discussed earlier, side lean can make it difficult to place a tree exactly where the logger would like it to go. For example, a tree with five feet of right side lean will actually land five feet to the right of where the base of the tree is aimed. This may be enough to cause a tree to hang up or create skidding problems. Therefore, trees with side lean should actually be aimed in the other direction.

For example, a tree with five feet of right side lean should be aimed at least five feet to the left of the intended target. However, it has been observed that the hinge weakens as the tree falls and at some point the side lean weight of the tree tends to pull it in that direction. Therefore, a rule of thumb has been developed that says: "aim the tree an additional 50 percent of the side lean in the opposite direction." For example, our tree with five feet of right side lean must be aimed seven and a half feet to the left of the intended target.



LIMBING AND TOPPING

As a tree falls, it will often brush other trees and leave 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:

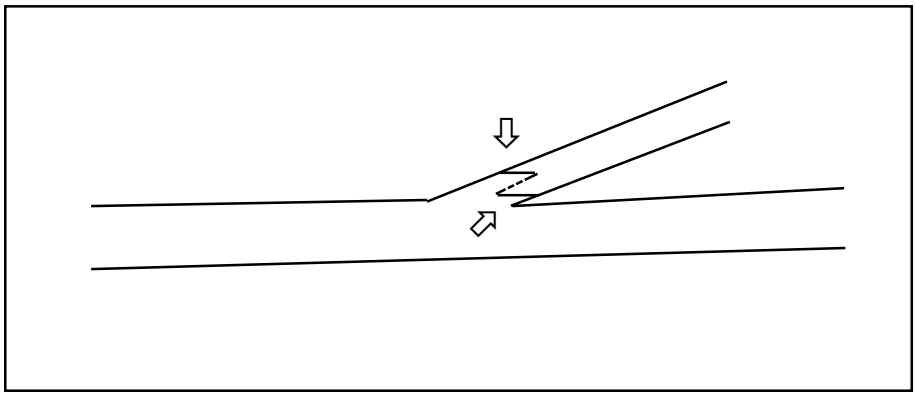
1. Overhead hazards
2. Spring poles
3. Butt movement forward or backward (creates back pressure on limbs)
4. Butt twist (creates sideways pressure on limbs and possibility for log to roll when limbs are removed)
5. Butt off the ground (creates tension on the tree stem)

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 top side 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.

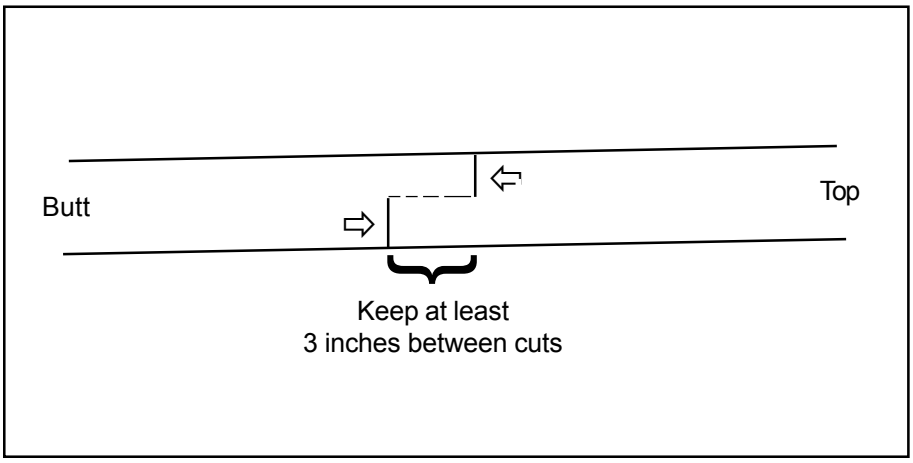
The cut on the top of the limb is made closer to the trunk of the tree and the cut on the bottom is made further out on the limb. It is important that the two cuts by-pass so that all fiber is severed. This will create a step in the limb which will prevent the limb from kicking back and hitting the logger.



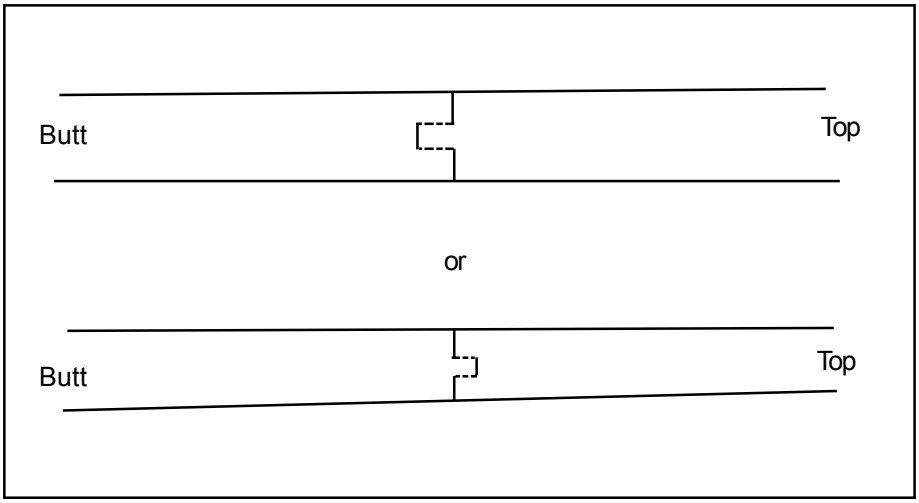
Top Lock:

Twisting of trees and butts off the ground creates 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.



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-passes the bore cut, but do not meet. With all fibers severed, the tongue and groove will prevent the tree from rolling.

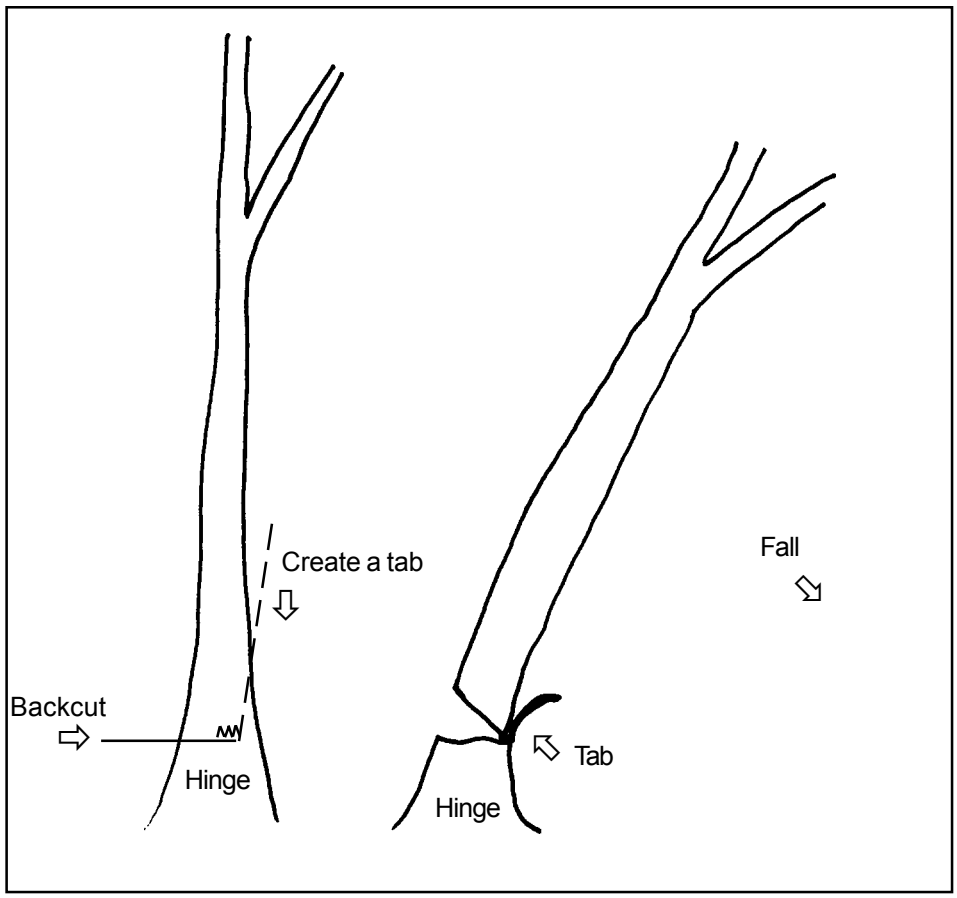


SMALL TREE FELLING

Loggers often assume that small trees are not worth the extra effort for directional felling. However, a small merchantable tree that falls the wrong way, or hangs up, can be very costly to pull down with a skidder.

Even small, brushy trees that are cleared as part of housekeeping chores around the base of the tree or for an escape route can, if felled the wrong way, create additional production problems. For example, a small sapling which is being removed from the base of one tree can fall into the next tree requiring the logger to cut the tree a second time when doing housekeeping around that second tree. Therefore, extra seconds taken to directionally fell a small sapling can save time later.

Directionally felling saplings - It is difficult to put a regular notch in a small sapling as it is easy to cut right through the tree. Creating a tab by making a downward cut through the last few years of growth will make an acceptable notch. A back cut, leaving a hinge, will cause this tree to fall in the direction of the initial undercut. It is important for the logger to use the sight line on the saw to make sure this sapling falls in the intended direction.



Felling small merchantable trees - Small merchantable trees with back lean can be easily felled using a wedge. The process is as follows:

1. Make an open face notch.

2. Bore through the center of the undercut straight through to the back of the tree.

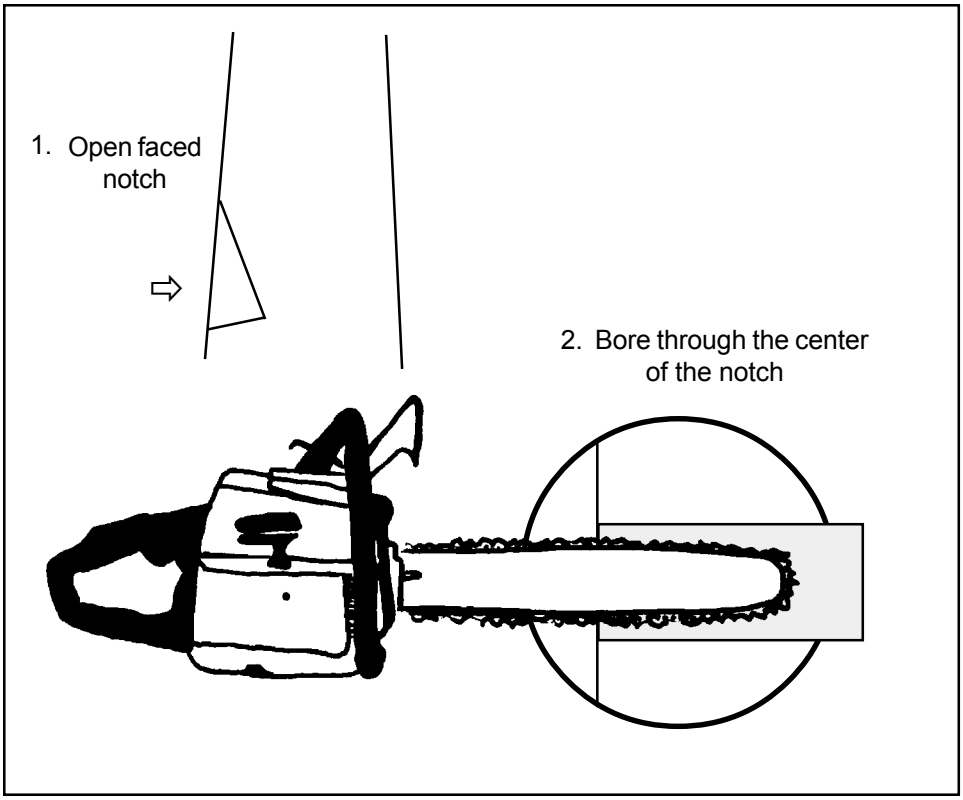
3. A second bore cut must be made in the same location but just above the first. The depth of this second bore cut into the tree will only have to be through the hinge.

4. Drive a wedge into the tree from the back side and snug the wedge.

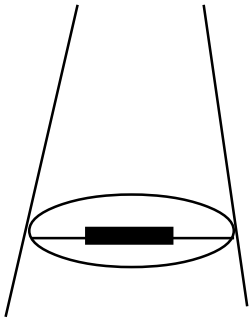
5. Using the attack corner of the saw on the bad side, make a cut about 1/2 inch below the wedge so that a hinge is formed. Cut just past the wedge: care must be taken not to cut the supporting wood under the wedge.

6. Repeat the process on the good side.

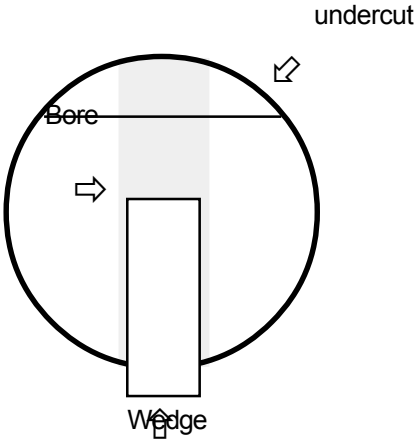
7. Drive the wedge through the tree. Remaining fiber should split allowing the tree to fall in the intended direction.



3. Clean bore all the way through tree

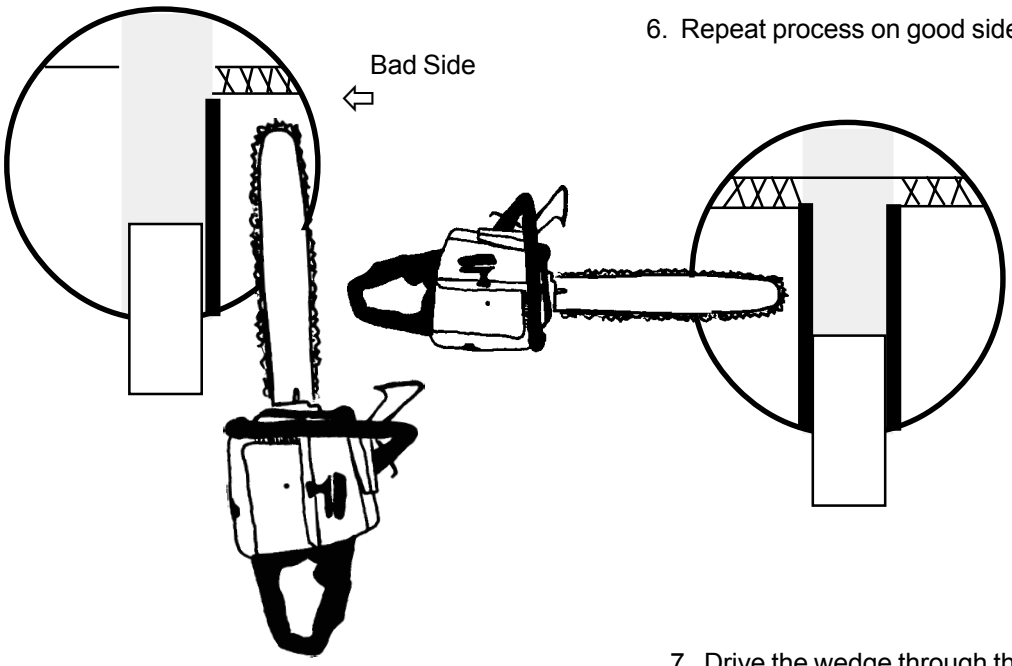


4. Drive a wedge into tree from backside

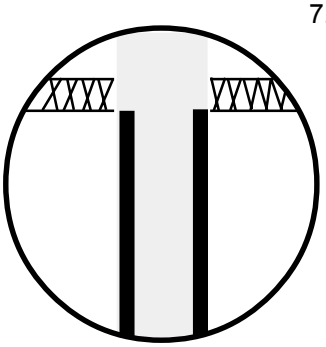


5. Enter on bad side

6. Repeat process on good side



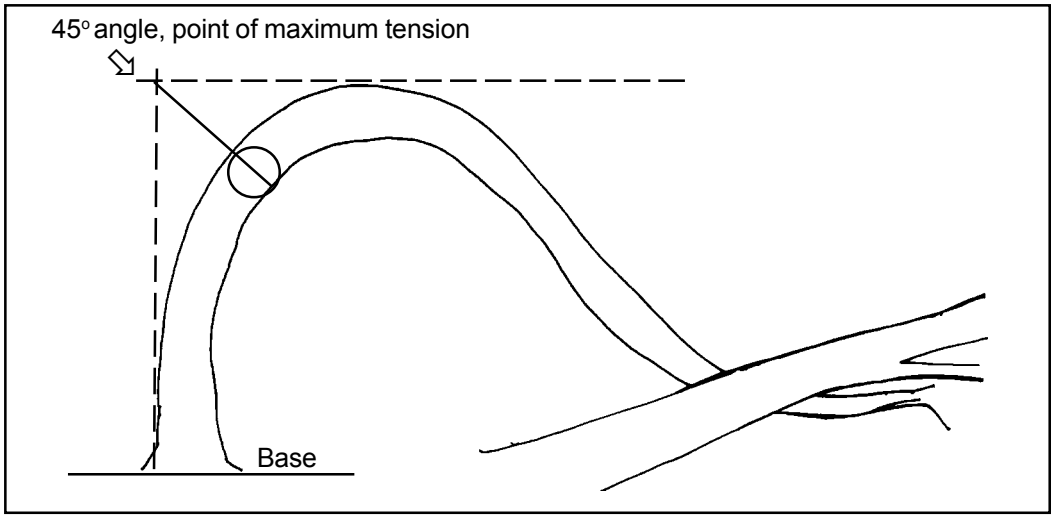
7. Drive the wedge through the tree



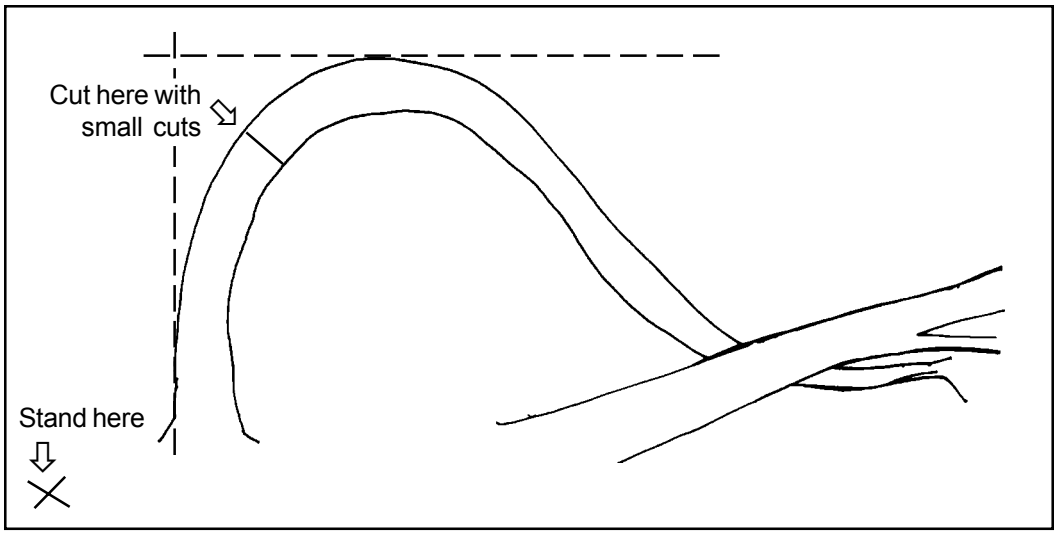
SPRING POLES

The best way to manage spring poles is to avoid them. However, if a spring pole must be cut it should be done in a safe manner. The best way is to release the tension slowly at the maximum point of tension.

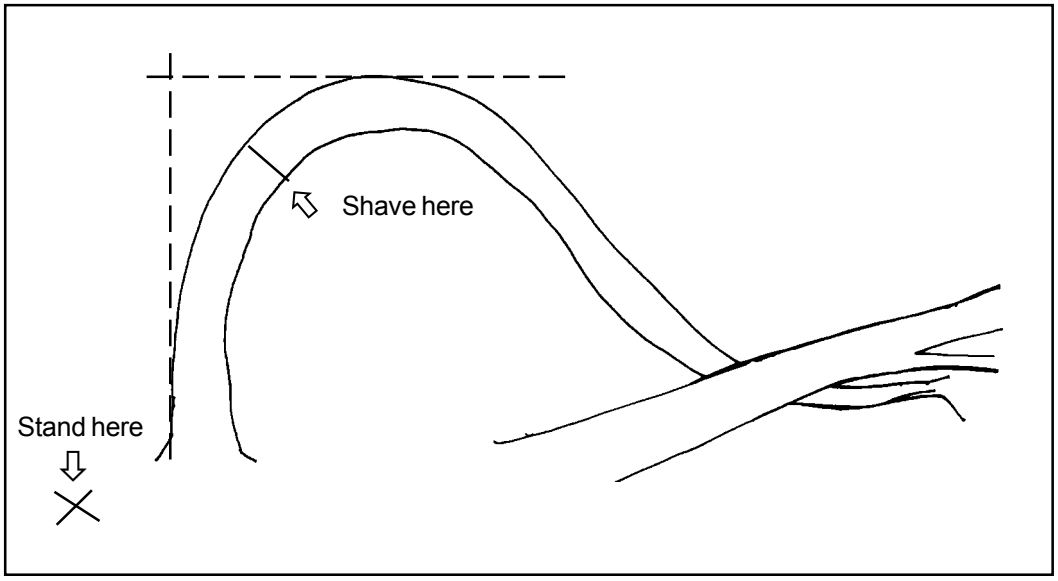
To locate the maximum point of tension, imagine extending a vertical line from the base of the tree and a horizontal from the highest point of the spring pole. From the intersection of these two lines, imagine a 45 degree angle to the spring pole. It is this point which will have the maximum amount of tension.



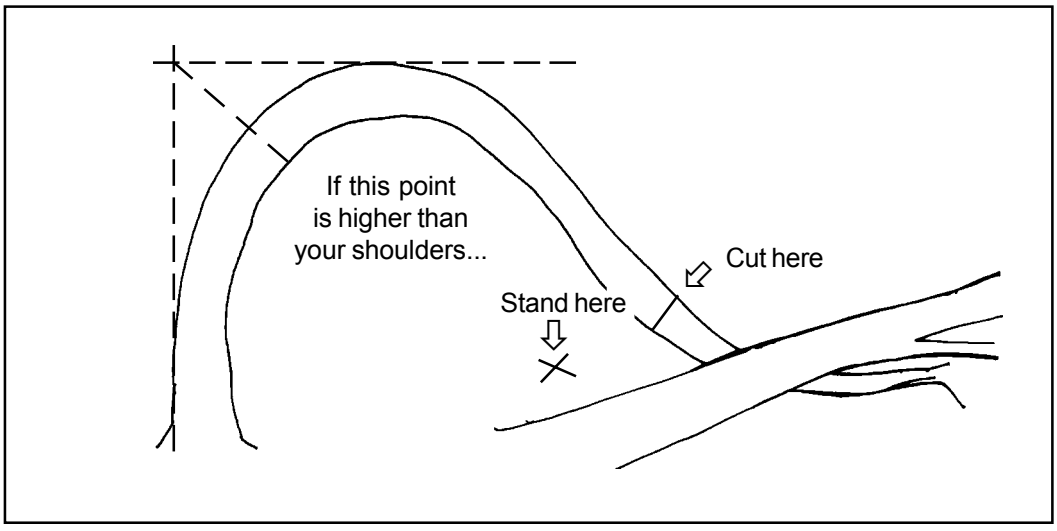
Spring poles may be cut from underneath or from the top. If you choose to cut a spring pole from the top, you must stand at 45 degrees to avoid being hit by the spring pole if the tension is released suddenly. From this position, the chain saw can be used to make a succession of small cuts at the maximum point of tension until the fibers begin to break by themselves. This cut must be made with the saw at maximum RPM with a slow rate of feed. At this time the logger should move away from the tree and let the pressure release itself. The spring pole can then be cut off.



Spring poles may also be released from underneath. To do this the logger should stand at 45 degrees to the spring pole and use the chain saw to shave wood off the underside of the spring pole at the maximum point of tension. Do not cut into the spring pole as the compression of the wood will pinch the saw. After enough wood is shaved the fibers will begin to break by themselves and the logger can stand aside and let the spring pole release its tension naturally.

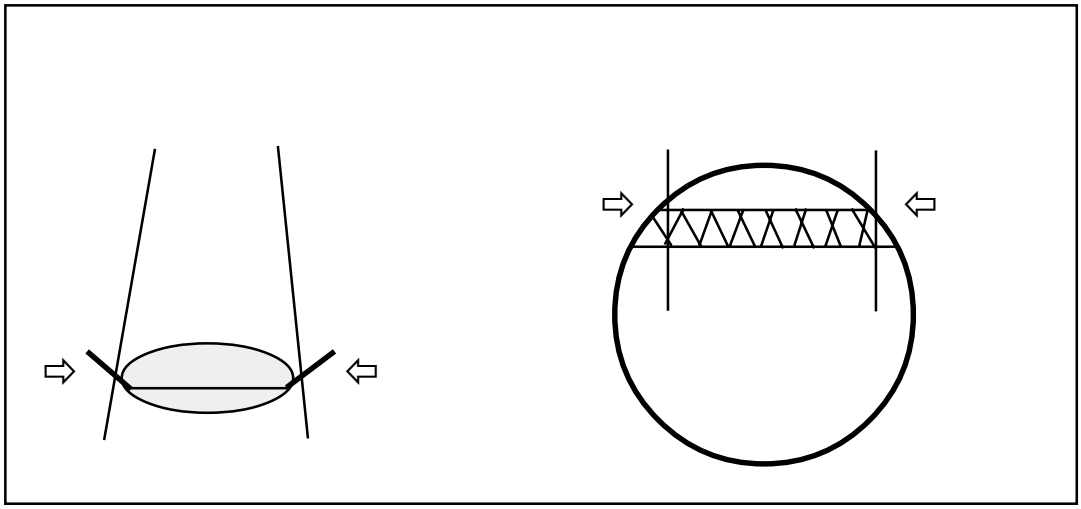


If the point of maximum tension on the spring pole is higher than the shoulders, the spring pole should be released from the top. The logger can stand under the spring pole, trim any branches that may be in the way and then release the spring pole by cutting off the top. The spring pole should fly harmlessly above the logger and not cause injury.

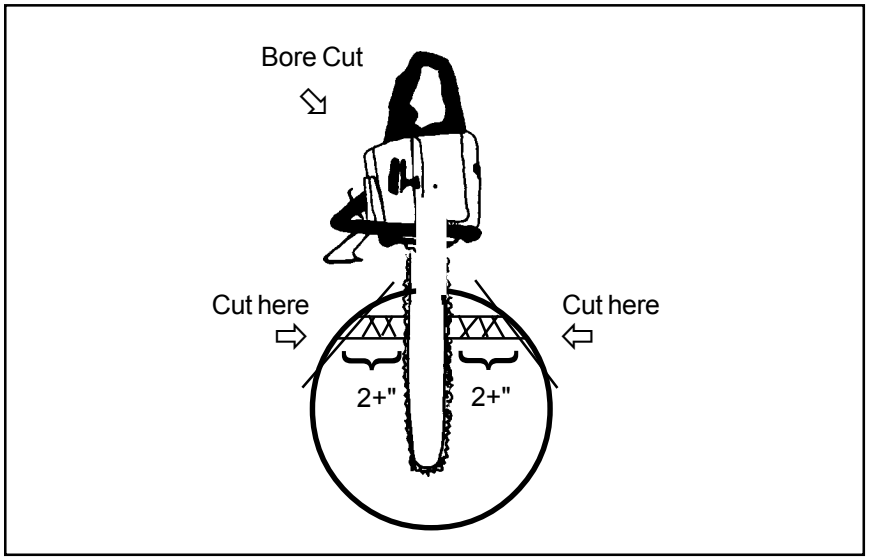


FIBER PULL AND SPLITTING

Some trees pull fiber from the sides while they're falling. An easy way to reduce this damage is to make side cuts on either side of the notch immediately after completing the open face notch. A properly formed hinge will be strong enough to control the tree where it is intended to go and weak enough to break rather than split the tree when stressed. Cut the last five to seven years of growth rings as they are the most likely to split.

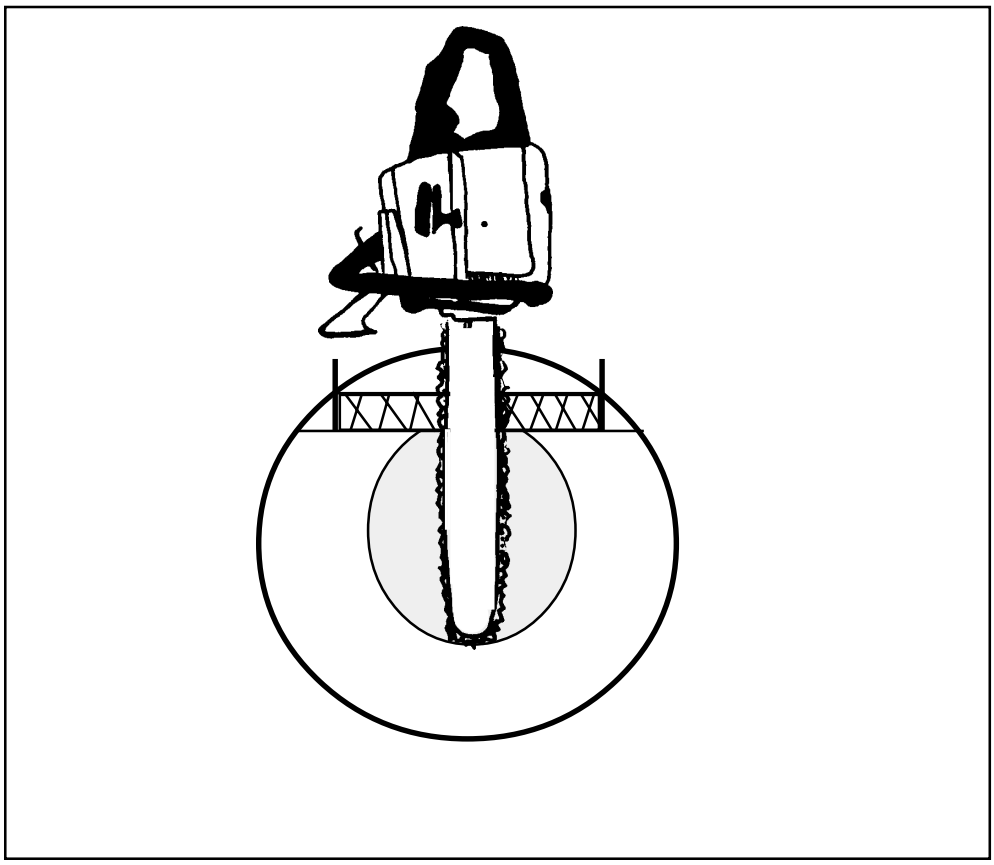


Other trees slab easily. This means that while they are falling they may split a piece of wood off the front of the tree. Some other trees may split or pull fibers easily. The easiest way to reduce these types of damage is to cut the sides of the hinge and bore out the center of the hinge. This leaves a felling hinge that more closely resembles a door hinge.



The previous technique can also be used for trees that may get hung up on the way down because of the dense forest. By boring out the center of the hinge and creating approximately a two-inch hinge on each side. The tree can break off one of these hinges and allow it to roll, finding its own way to the ground.

The same technique of boring through the hinge can also be used on trees which are very large. By boring through the hinge and sweeping the center of the tree, it allows a short saw bar to effectively fell large trees.



Game of Logging – Level 1

Instructor_____
Class Location_____
Date _____

Name	Reactive Forces 4 points	Bore Cut 10 points	Information 10 points	Stump 10 points	Saw Tooth 10 points	Bonus	Safety violations 5 points	Totals

Game of Logging – Level 1

Reactive Forces (1 point each)
1. Pushing chain
2. Pulling chain
3. Hazard corner
4. Attack corner

Bore Cut
Measure bar and chain width, add ¼”
4 ½” width measured from face of boring station
Deduct 1 point for each 1/8” beyond guide width
Deduct 10 points for cutting out of face

Information (2 points each)
1. Hazards
2. Lean (Side/Side & Forward/Backward)
3. Escape route
4. Hinge size
5. Cutting plan

Stump (2 points each)
1. Notch: 70 degrees or more
2. Bypass: none greater than 3/8”
3. Backcut level: within 1- ½” of notch
4. Hinge size: within ½” of stated thickness
5. Fiber pull: less than 3” from log

Saw Tooth (2 points each)
1. Depth gauge: height & angle
2. Working point: no chrome damage
3. Side plate: 0-10 degrees
4. Top plate: 20-30 degrees
5. Chisel angle: 40-50 degrees

Safety Violations (5 points each)
1. Hearing protection before starting saw
2. Eye protection when cutting
3. Brake on while starting saw
4. Brake on while doing work with one hand
5. Brake on while walking with saw
6. Proper starting technique
7. Boring more than ½ way through from bad side
8. Not using escape route
9. Wedging without eye protection
10. Not following cutting plan
11. Changing cutting plan after starting backcut
12. Starting a bore cut with the hazard corner

Game of Logging – Level 2

Instructor_____
Class Location_____
Date _____

Name	PPE 10 pts.	Saw 30 pts.	Bore Cut 30 pts.	Info. 10 pts.	Stump 10 pts.	Target 10 pts.	Height 10 pts.	Saw Tooth 10 pts.	Carb. 10 pts.	Spring Pole 10 pts.	Bonus 10 pts.	Safety Violation 10 pts.	Totals

Game of Logging – Level 2

PPE (2 points each)
1. Eye protection
2. Hearing protection
3. Hard hat
4. Leg protection
5. Foot protection

Saw (10 points each)
1. Chainbrake
2. Throttle lock
3. Chain catcher

Carburetor (2 points each)
1. Clean air filter
2. Balance settings
3. Start, warm & set idle speed
4. High speed to a flutter
5. Wait 30 sec. test for: 1. Rollover
   2. Acceleration
   3. No chain movement

Bore Cut
1. Level: within 3/8" of notch corner (10 points)
2. Cut width: (score both sides) lose 1 point for each 1/8" beyond guide width (20 pts)

Information (2 points each)
1. Hazards
2. Lean (Side/Side & Forward/Backword)
3. Escape route
4. Hinge size
5. Cutting plan

Stump (2 points each)
Notch: 70 degrees or more
Bypass: none greater than 3/8"
Backcut level: within 1" of notch
Hinge: within 3/8" of stated thickness
Fiber pull: less than 3" from log

Target
Direct hit (10 points)
1 point off for each foot off

Height
Direct hit (10 points)
1 point off for each foot off

Saw Tooth (2 points each)
1.Depth gauge: height & angle
2. Working point: no chrome damage
3. Side plate: 0-10 degrees
4. Top plate: 20-30 degrees
5. Chisel angle: 40-50 degrees

Spring Pole
Exact match (10 points)
1 point off for each inch off

Safety Violations (10 points each)
1. Hearing protection before starting saw
2. Eye protection when running saw
3. Brake on while starting saw
4. Brake on while doing work with one hand
5. Brake on while walking with saw
6. Proper starting technique
7. Boring more than ½ way through from bad side
8. Not using escape route
9. Wedging without eye protection
10. Not following cutting plan
11. Changing cutting plan after starting backcut
12. Starting a bore cut with the hazard corner

Tree Diameter	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
Hinge Length @ 80%	6.4	7.2	8.0	8.8	9.6	10.4	11.2	12.0	12.8	13.6	14.4	15.2	16.0	16.8	17.6	18.4	19.2	20.0	20.8	21.6	22.4	23.2	24.0

Game of Logging – Level 3

Instructor_____
Class Location_____
Date _____

Name	PPE 10 pts.	Saw 50 pts.	Bore Cut 40 pts.	Information 10 pts per		Stump 10 pts per tree		Hinge Lgth 10 pts per tree		Target 10 pts per tree		Limbing Information 10 pts	Limb Locks 10 pts per tree		Top Locks 10 pts per tree		Bonus	Safety Violation	Totals

Game of Logging – Level 3

PPE (2 points each)
1. Eye protection
2. Hearing protection
3. Hard hat
4. Leg protection
5. Foot protection

Saw (10 points each)
1. Chainbrake
2. Throttle lock
3. Chain catcher
4. Carburation: 1.Max rpm: +/- 500 rpm
2. Rollover
3. Acceleration
4. No chain movement
5. Air filter, if dirty lose all pts.
5. Chain: 1.Depth gauge: height & angle
2. Working point: no chrome damage
3. Side plate: 0-10 degrees
4. Top plate: 20-30 degrees
5. Chisel angle: 40-50 degrees

Bore Cut
1. Level: within 3/8" of notch corner (10 points)
2. Cut width: (score both sides) lose 1 point for each 1/8" beyond guide width (20 pts)
3. Stop board: lose all points if hit (10 points)

Information (2 points each)
1. Hazards
2. Lean (Side/Side & Forward/Backward)
3. Escape route
4. Hinge size
5. Cutting plan

Stump (2 points each)
Notch: 70 degrees or more
Bypass: none greater than 3/8"
Backcut level: within ½ " of notch
Hinge size: within 3/8" of stated thickness
Fiber pull: less than 3" from log

Hinge Length
Must be +/- 1" of estimate

Target
Direct hit (10 points)
1 point off for each foot off

Limbing Information (2 points each)
1. Overhead hazards
2. Spring poles
3. Butt movement forward
4. Butt roll
5. Butt on ground

Limb Locks
Must have 1 on each tree

Top Locks
Must have 1 on each tree

Safety Violations (10 points each)
1. Hearing protection before starting saw
2. Eye protection when cutting
3. Brake on while starting saw
4. Brake on while doing work with one hand
5. Brake on while walking with saw
6. Proper starting technique
7. Boring more than ½ way through from bad side
8. Not using escape route
9. Wedging without eye protection
10. Not following cutting plan
11. Changing cutting plan after starting backcut
12. Starting a bore cut with the hazard corner

Tree Diameter	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
Hinge Length @ 80%	6.4	7.2	8.0	8.8	9.6	10.4	11.2	12.0	12.8	13.6	14.4	15.2	16.0	16.8	17.6	18.4	19.2	20.0	20.8	21.6	22.4	23.2	24.0

Production Felling Through Safety - Score Sheet
Level 4

Date _____

Name	Saw 40 pts	Carb. 10 pts	Information	Segment 10	Target 10	Stump 10 points	Limbing Info. 10	Limb Lock 10 pts	Top Lock 10 pts	Bonus	Violation 10 pts	Totals

Bonus: Can be offered for any issue that needs emphasis (i.e. 10 points for hinge variation less than 1/2")

Carburetor:
1. Idle (no chain movement) (2 points)
2. Rollover test (2 points)
3. Accelerate (2 points)
4. RPM: max for saw +/- 500 rpm (2 points)
5. Air Filter (if dirty lose all points) (2 points)

Information:
1. Hazards (2 points)
2. Lean (2 points – Side/Side & Forward/Backward)
3. Escape route (2 points)
4. Hinge thickness (2 points)
5. Cutting plan (2 points)

Target:
Direct hit (10 points)
1 point off for each foot off

Stump:
1. 70 degrees + notch (2 points)
2. No bypass greater than 3/8" (2 points)
3. Backcut within 1-1/2" of notch (2 points)
4. Fiber pull from log less than 3" (2 points)
5. Hinge with ½" of stated thickness (2 points)

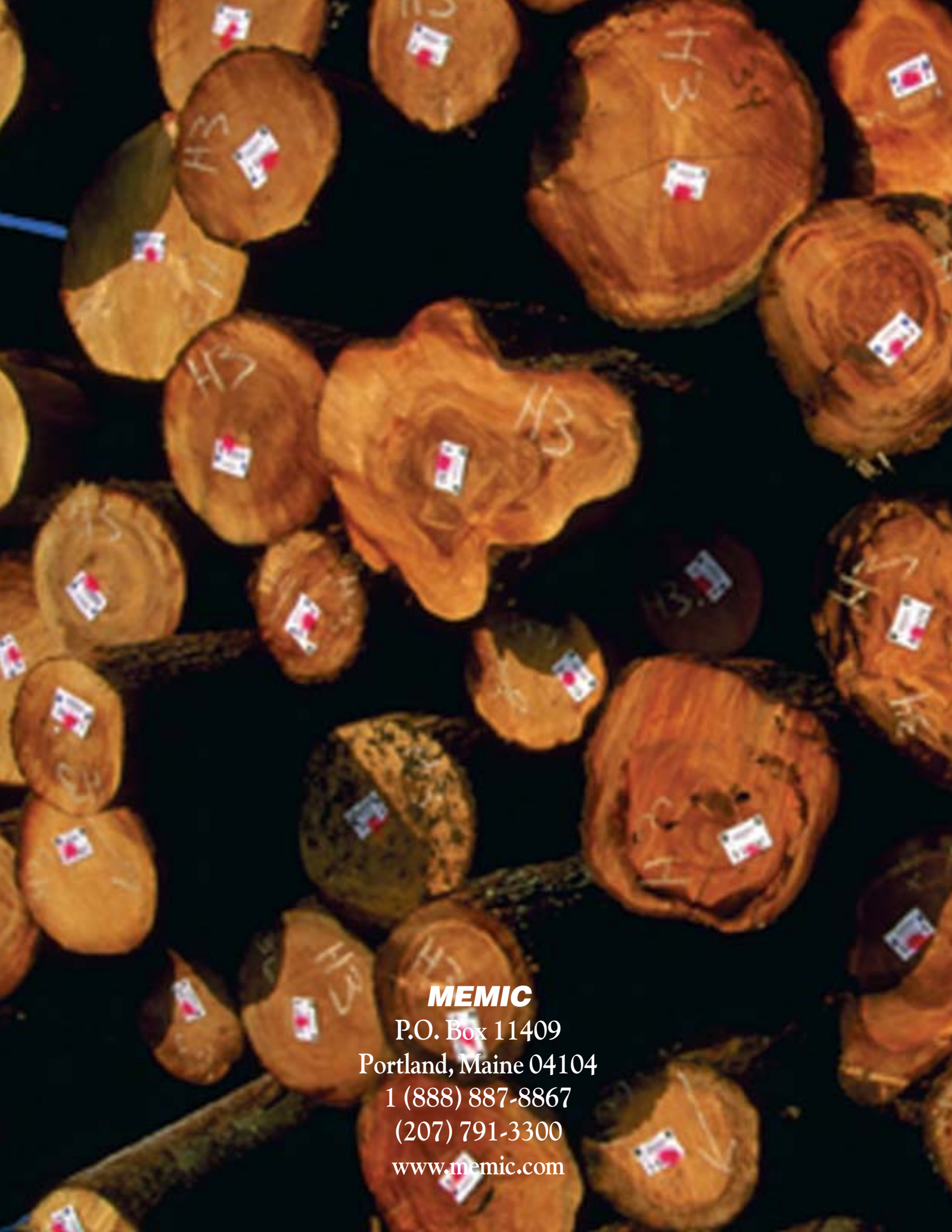
Chain/Saw:
1. Raker (chip thickness) (2 points)
2. Working point (2 points)
3. Top plate-saw kerf – 20-30 degrees (2 points)
4. Side plate: 5 degrees (2 points)
5. Chisel angle: 45 – 55 degrees (2 points)
6. Chain Catcher (10 points)
7. Throttle lock (10 points)
8. Chain brake (full speed; hit brake) (10 points)

Segments:
Correct Estimate (10 points)
1 point off for each segment off
Assume single height for all trees

Limbing Information:
1. Hazards (2 points)
2. Spring poles (2 points)
3. Butt forward movement (2 points)
4. Butt twist (2 points)
5. Butt on ground (2 points0

Violations:
Hearing protection before starting saw
Eye protection when running saw
Brake on when starting saw
Brake on when holding saw with one hand
Proper starting technique
Boring more than ½ way through from the bad side

Tree Diameter	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
Hinge Length @ 80%	6.4	7.2	8.0	8.8	9.6	10.4	11.2	12.0	12.8	13.6	14.4	15.2	16.0	16.8	17.6	18.4	19.2	20.0	20.8	21.6	22.4	23.2	24.0



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