

Felling Techniques

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Review of Chainsaw Safety

Tree felling requires training, knowledge and experience in safe chainsaw operation and in felling techniques. Never operate a chainsaw or attempt to fell a tree alone. Always wear the appropriate personal protective equipment, which includes a hard hat, eye protection, hearing protection and approved work boots. Leg protection, such as chaps or chainsaw pants, is strongly recommended and required in some jurisdictions.

Be aware of the reactive forces that result when running a chainsaw. When you cut with the bottom part of the bar, the saw tends to pull away from you and into the cut. When you cut with the top of the bar, the saw tends to push back toward you and out of the cut. Anytime the front, upper quadrant (kickback quadrant) of the tip of the chainsaw bar contacts an object, the chainsaw reacts by rotating back toward you. Kickback occurs at a rate seven times faster than a human can react. Dodging the saw's reaction is not an option.

When operating a chainsaw, stand with your feet firmly planted. ALWAYS operate the chainsaw with both hands. Your left hand should be on the upper handle with your thumb wrapped around the handle bar. Use your body to brace against the back of the saw when practical. Always engage the chain brake if you must take one hand off the saw to move a limb, or when taking more than two steps with the saw running.

5 Step Felling Plan

1. Identify hazards – Check for electrical conductors. Identify any tree defects, decay or characteristics of the tree that may affect the felling plan. Consider obstacles within the site such as structures, pavement and outdoor furnishings. Some can be moved if necessary, others will have to be avoided. Assess the strength and direction of the wind.
2. Assess the lean – Determine forward/back lean and side to side lean. This determines the “bad” and “good” sides of the tree for felling. Decide on the felling direction.
3. Escape route – Always think about your escape route before you begin the felling operation. The escape route should be at a 45 degree angle opposite the felling direction.
4. Hinge plan – The face notch and hinge are critical to safe and accurate tree felling. Plan the size, depth, and placement of notch. Determine the desired thickness and length of the hinge.
5. Back cut technique – The back cut is often taken for granted, yet is often the cause of misdirected falls. Decide what kind of back cut to use: the straight back cut or the bore cut. Remember that the length of your chainsaw bar will affect the back cutting technique used. Determine your desired position for finishing the felling cut.

Equipment

Decide what equipment will be needed and have it in place and ready. Will a pull rope be required? Will you be needing any rigging equipment such as a block and tackle assembly? Which chainsaws will you be using? Are they sharp? Are the saws fueled up? It is usually a good idea to have felling wedges handy before beginning the cuts. Be sure that everything is ready to go BEFORE beginning to cut.

Using a Pull Line

Using a pull line provides extra assurance that the tree will be felled in the desired direction. If a pull line is used, it must be set high enough in the tree to provide the needed leverage. If there is a defect or weakness in the tree lower than the pull line, pulling on the line may cause the top to break out before the tree is felled.

Avoid putting too much tension on the pull line (such as by pulling with a ten ton truck) as this can put the fibers under increased tension, increasing the potential for a barber chair to occur. Remember, the main function of the pull line is to bring the tree past center so that gravity will bring it to the ground and the hinge will do the steering. Avoid creating a pull that can twist or torque the tree causing the hinge to break and the tree to fall in the wrong direction.

It may be possible to install the pull line without climbing the tree. Use a throwline to set a line then install the larger pull rope. A running bowline can be tied from the ground and pulled up the line.

You can increase the pull on the line by rigging a block and tackle system. (Readers who completed the Mechanical Advantage CEU article should have a good understanding of the advantages of a system like this.) Using a camming device as the last part of this rigging system will hold the tension in the line as the slack is taken up. NOTE: These camming devices are not designed to withstand shock loading, which can be created in other rigging situations. Maintaining tension on the line will help prevent the tree from rocking back. It will also help prevent binding of the saw in the back cut.

Estimation of Height

Anybody who fells trees should be able to estimate the height (and thus the position of the tree when felled). Accurate height estimation will help you avoid hitting obstacles. Remember that the height of the felling cut will affect the distance that the top of the tree reaches when it is felled.

Most techniques for height estimation are based upon a simple geometric principle (see figure *):

If $a=b$ and they form a right triangle, and

if d and h also form a right triangle,

when you stand at the point where b is proportional to h , then $d=h$. That is, you will be standing at the approximate point where the top of the tree will reach. (See Limitations)

One common technique is the sick method. Hold the stick such that the distance from your eye to your hand equals the distance from your hand to the top of the stick. Hold your arm horizontally and the stick vertically. Walk forward or back until the distance from your hand to the top of the stick is proportional to the distance from the felling cut to the top of the tree. This will be the approximate point where the top of the tree will land.

Limitations – These estimation techniques make the following assumptions:

- The tree is vertical.
- The ground is level. Adjustments will be needed for sloping grades.
- You can see the true top of the tree.
- You may have to adjust for the difference between your height and the height of the felling cut.

The Face Cut (Notch)

The traditional, 45-degree notch has been used to fell trees for many years. It consists of a flat cut on the bottom and an angled cut down into it. A possible limitation of this notch is that the tree or section may still be at 45 degrees when the notch closes and the hinge breaks, causing a loss of control.

Many arborists are now using an open face, 70-90 degree notch. This open face notch allows the worker to take full advantage of the hinge, with a greater degree of control because the hinge doesn't break until the tree is almost on the ground. The back cut can be made level with the apex of the open face notch.

The traditional rule of thumb for the depth of the notch is one-third the depth of the tree (section) being cut. Another technique to set the depth of the notch is the percent of diameter method. The length of the hinge should be approximately 80% of the diameter of the section being cut. This will vary since many trees are not round in cross section. The length of the hinge determines the depth of the notch. In most circumstances, avoid cutting the notch deeper than 33% of the diameter of the section. Some conditions, notably severe side lean or internal decay, may warrant the hinge length to be 100% of diameter.

Make the top cut first when making the face notch. Line up the top cut while bracing your body against the tree and facing the desired felling direction. Avoid placing the notch where there are cracks or decay, if possible. Use the upper cut as a sight through which to line up the lower cut and avoid sawing too far and creating a bypass. It is very easy to bypass the apex of the notch when making the cuts. Bypassing cuts into the crucial fibers of the hinge and should be avoided. Bypass cuts can reduce the effectiveness of the hinge, or render it useless. Avoid bypass cuts in the notch by sighting through the top cut and checking both ends of the notch frequently while cutting.

The Hinge

The hinge "steers" the tree in the desired direction of fall. If the hinge is the proper thickness then the wood fibers will break when the face notch closes. The rule of thumb for felling trees is to allow a hinge that has a thickness of 10% of the tree's diameter. Flexibility in this guideline is in order. For example, when cutting short sections, a 10% hinge may be too much for a climber to break off with limited leverage. In this case a 5% hinge thickness may be better.

A skilled operator will use the hinge to his or her advantage depending on the felling conditions.

Allow a thicker hinge on trees with significant internal decay. Trees with forward lean may not require the full 10% thickness. Avoid cutting into the hinge when making the back cut, as this can result in a loss of control.

The Back Cut

The traditional back cut is made by cutting from the back of the tree toward the notch. The hinge is formed as the back cut approaches the notch. Be careful as you approach the notch since it is easy to cut through the hinge while making the back cut, especially if you are looking toward the top of the tree. If you cut through the hinge on one side or the other, you may lose some control of the felling direction. When using a 45-degree notch, it is important to make the back cut slightly higher than the apex of the notch to reduce the tendency of the tree to kick back off the stump toward the operator when the hinge breaks.

The Bore Cut

The bore cut is another way of making the back cut when felling a tree. Although it requires some additional training, it does present some advantages. One advantage is that it virtually eliminates the possibility of creating a "barber chair." A barber chair happens when a tree splits vertically upward from the back cut, before the cut is completed. The tree will then pivot from the split, causing the back section to split back toward the person felling the tree. Obviously, this can be very hazardous. It is more likely to happen on trees with forward lean.

Another advantage of the bore cut technique is that the hinge can be established to the desired thickness without being compromised by the back cut. Thus the integrity of the hinge is not in question as the tree is felled. Also, the back cut can

be formed leaving a small tab of holding wood in back. This allows you the opportunity to make any final adjustments before releasing it, and felling the tree.

Before practicing the bore cut, you must first understand the concept of the "starting corner" of the chainsaw. The starting corner is the bottom of the tip of the bar. When making a bore cut, always start cutting into the wood with this part of the bar to avoid kickback. Start cutting with the saw at full throttle. The trick is to avoid contacting the tree with the kickback corner, or upper quadrant of the tip of the chainsaw bar, when beginning the cut.

Reassess the side lean of the tree. The side toward which the tree leans will be considered the "bad" side of the tree. If you are cutting a tree that is thicker than the length of your bar, you will want to cut from the bad side first (no more than 50%) so that you can finish the cut on the good side.

Bore into the tree (several inches) behind the apex of the notch. Be sure to start the cut at the starting corner of the chainsaw bar. Start the cut well behind the desired position of the hinge then, once in, carefully cut to the desired thickness of hinge. If the tree is larger in diameter than the length of your chainsaw bar, saw less than 50% through from the bad side of the tree. Then, saw the remainder of the way through from the good side. If the tree is more than twice as big as your chainsaw bar, you can remove some of the center of the tree by boring into the center of the face notch. Be sure to leave plenty of holding wood on both ends of the hinge.

Establish the entire hinge to the desired thickness behind the apex of the notch. Cut back from the hinge on both sides of the tree leaving a strap of wood in the back as holding wood. Cut the "bad" side first, taking care to cut less than 50% of the diameter. Then cut the good side, meeting the cut from the other side. Finally, with the hinge established and most of the back cut formed, release the holding strap of wood in the back. Remember to move away from the tree in your established escape route, at a 45-degree angle opposite the felling direction. It may be necessary to clear a path for your escape route.

Felling Wedges

An often-overlooked tool for felling trees is the felling wedge. It is a good idea to have a couple of good wedges available whenever felling trees. Placed appropriately, a wedge can prevent the chainsaw bar from becoming pinched in the back cut. This can be a problem on a tree that is leaning, particularly if there is a back lean. A wedge can even eliminate a minor back lean. Lifting the bottom of a tree one-inch at the back cut can move the top of the tree several feet. The amount that the tree top can be moved depends on the height and girth of the tree.

Summary

Having a carefully determined felling plan helps assure a safe and efficient felling operation.

It is important to plan the entire felling operation before beginning to cut. Always check for hazards and obstacles that may affect the felling operation. Consider the height, spread and lean of the tree when deciding how to fell the tree, and in which direction.

Extensive training in the use and operation of chainsaws is essential for all operators. Tree felling can be a rather precise chainsaw operation, with little room for error. Sawing and operating techniques must be practiced before felling any trees. Understanding the reactive forces is an important part of handling a chainsaw safely.

Using pull ropes and establishing a mechanical advantage can make the difference between a routine and a difficult felling operation. The intricacies of installing ropes and setting up rigging for mechanical advantage were not within the scope of this article, but do merit more in-depth training. In addition, felling wedges can create an advantage and reduce the chances of getting the saw bar pinched.

Learn how to estimate the height of a tree to determine how far it will reach when it falls. This can make a big difference between a clear "drop" scenario, and having to climb and rig out the tree in sections.

The size, angle and placement of the felling notch are critical in determining the felling plan. The hinge controls the fall of the tree and the back cut sets up the hinge. If you have always used the common, 45-degree notch, give the open face notch a try. It has many advantages primarily increasing control and safety in the felling operation. And, do not dismiss the bore cut as a logger's technique. Once mastered, the bore cut's many benefits will become evident.

As always, the overriding consideration when felling trees is safety. Although this is an operation that can be inherently dangerous, proper training and adherence to safety regulations can all but eliminate the risk. Communication is a key ingredient. Every worker on the job must have a clear understanding of his or her role. Each member of the crew must communicate with the others, so that everybody knows what is happening.