Working the Five-Step Felling Plan

By Ralph (Rip) Tompkins

LEARNING OBJECTIVES

The arborist will be able to

- explain the five-step planning process for felling a tree
- discuss techniques for estimating the height of a tree for felling
- explain the reactive forces that can result when using a chain saw
- plan the notch, hinge, and back cut technique for felling a tree with lean

CEUs for this article apply to Certified Arborist, Utility Specialist, Municipal Specialist, Tree/Worker Climber, and the BCMA practice category.

A good definition of an accident is "an unplanned event." Most people don't wake up in the morning and say, "I'm going to go out today and get into an accident," or "I think I'll drop a tree across some power lines." But these things happen every day. Why? Because people sometimes fail to properly plan their tasks.

It is especially important to use proper planning and procedures when felling trees. In its most basic sense, a tree felling plan is nothing more than taking information about the tree, the site, and any surrounding hazards and obstacles, and then applying cutting skills and other tools (e.g., pull lines, wedges, pulleys) to bring the tree safely to the ground. However, many people fail to take the time to look closely at the information available, which results in far too many "unplanned events."

Felling a tree as a whole may be the quickest and most profitable way to get the job done, but it may not always be the *best* way to get the job done. Before any cutting begins, it is important to develop a thorough plan and decide whether the tree can be safely felled at all. This article discusses a five-step plan for tree felling.

Step #1: Checking for Hazards

The five-step plan begins with an assessment of hazards in, on, and around the tree. A *hazard* is defined in ISA's *Glossary of Arboricultural Terms* as "a situation or condition that may result in personal injury, property damage, or disruption of human activities." Hazards can include site hazards, such as power lines. They can also include tree hazards, such as deadwood, hangers, decayed wood, vines, or animals in trees.

Any tree can pose a variety of hazards for a tree crew, including power lines, deadwood, hangers, decayed wood, vines, and animals.

Obstacles are considered to be anything you can hurt or damage in the process of felling a tree. Obstacles may include other trees, people, houses, vehicles, or other personal property. It may be necessary to determine the height of a tree before felling it to make sure no obstacles will be damaged.

Determining a tree's height helps to answer several important questions when creating a plan: Is it possible to fell the tree at all? Is there enough room for it to fit? Would it fit if part of the top were removed? There are several techniques that can be used to determine tree height. Most techniques for height estimation are based upon a geometric principle of similar right triangles. There are devices available to assist workers with height estimation, such as the hypsometer and the rangefinder.

Another technique for estimating tree height employs nothing more than a straight stick. Hold the stick so 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 backward until the distance from your hand to the top of the stick is proportional (visually equal) to the distance from the felling cut to the top of the tree. You can then estimate the height based on the distance you are standing from the tree.

There are some limitations to this last method. The estimation technique assumes that the tree is vertical, the ground is level, and the top of the tree can be seen. Also, it may be necessary to adjust for the difference between your height and the height of the felling cut.

Another good reason to determine the height of the tree is to establish a danger zone around the tree. Don't assume the tree will go exactly where you want it. One good rule of thumb is to establish a circular danger zone around the tree

with a radius (distance from the tree base to the perimeter of the circle) that is at least 1.5 times the tree's height. Everyone present, except the sawyer, should be outside of this zone when a tree is being felled.

All hazards present should be considered before continuing with a felling plan. For example, the tree may be surrounded by houses and may not have solid wood where the hinge needs to be. Identifying such issues may be reason to abandon the plan at the start and seek another means of tree removal. Once you have determined that all identified hazards can be managed, you may move on to the next step of the plan.

Devices for determining tree height generally use the principles of geometric triangulation.

Using a straight stick can also achieve an estimate of tree height using a geometric principle of similar right triangles.

Find the position at which the distance from your hand to the top of the stick visually equals the height of the tree from the cut.

Step #2: Determining the Lean of the Tree

The lean or weight of the tree is key for several reasons. Looking for the way a tree leans depends on the direction from which you are looking at the tree. It is important to put yourself in the correct position to get the correct information.

There are two types of potential leans in relation to the direction of fall. The tree may have forward or backward lean, or it may have side lean. It is important when determining lean to take into account the entire crown of the tree, not just the trunk. Frame the tree with your hands on both sides of the crown, find a center spot, and drop a plumb line down. Where the plumb line hits the ground in relationship to the base of the tree will tell you where the lean is.

If you stand away from the tree at some distance in the intended direction of fall, you can't accurately tell whether the tree leans toward you or away from you, but you can see whether the tree has lean to one side or the other. This is important, because it tells you what the good and bad sides of the tree are. The bad side is the side where the lean is. If possible, you should finish your cutting from the good side of the tree. That way, if something goes wrong, the tree is more likely to fall away from you rather than toward you. It may also be necessary to adjust your felling aim to account for side lean.

To determine forward or backward lean, stand to one side of the tree at 90 degrees to the fall. If the tree is straight up or has backward lean, you will need something, such as a pull line or wedges, to lift the tree over center and let gravity do the rest. If there is a lot of back weight, you may want to add some mechanical advantage to help pull the tree over. Generally, a forward-leaning tree does not need a pull line because it's already obvious which way the tree wants to fall. If one is installed, as many company policies dictate, there is no need to pull with excessive force. It is important that pull lines are used properly. Excessive pre-tensioning of pull lines can create a more dangerous cutting situation for the sawyer.

Side lean is often one of the greatest challenges in precision tree felling. The hinge wood is strongest from front to back and weakest from end to end. As a tree falls, the hinge begins weakening, with the tension fibers at the back of the hinge pulling apart, and the fibers at the front of the hinge compressing. Depending on the strength of the wood fibers of a particular species of tree and the amount of side lean, it may be hard for the hinge to work all the way to the ground.

A tree with side lean can be challenging to fell, because tree species with weak wood fiber may not hold the hinge all the way to the ground.

►

Know the characteristics of different species of wood. Some trees, like hickory (*Carya* spp.), white oak (*Quercus alba*), and ponderosa pine (*Pinus ponderosa*), have strong wood fiber and can hold the hinge even with a heavy side lean. Others, like Tree of Heaven (*Ailanthus altissima*), white pine (*Pinus strobus*), and many types of eucalyptus (*Eucalyptus* spp.), may not fare so well with a heavy lean. If you have more than one option of which direction to fell a tree, it is advised that you go with the direction that has the least side lean, because this may be the hardest factor to control.

Step #3: Establishing an Escape Route

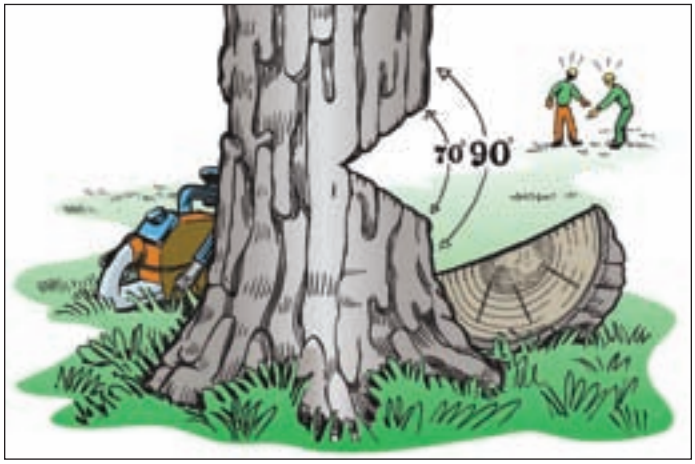
The third step in the plan is to establish an escape route away from the base of the tree for when the tree begins to fall. Eighty to ninety percent of the accidents in tree felling occur within a 15-foot (4.5 m) radius of the tree base. Therefore, staying at the base of the tree as it falls can increase the likelihood of an accident. The safest option for the sawyer is to leave this area before the tree begins to fall.

Statistics show that the best escape route (path of egress) is opposite the direction of fall at a 45-degree angle. If possible, retreat on the good side of the tree. If this is not possible, choose the next safest direction, taking into account all hazards and obstacles. If the desired path is obstructed (e.g., by a brush pile), clear a path before you begin to cut.

If the information you have gathered during the first three steps, coupled with your experience as a tree feller, signals a high degree of probable success, then it is time to move on to the final two steps: the notch/hinge and the back cut. If the degree of probable success is not high, then it may be best to find another way to remove the tree or to mitigate some of the challenges.

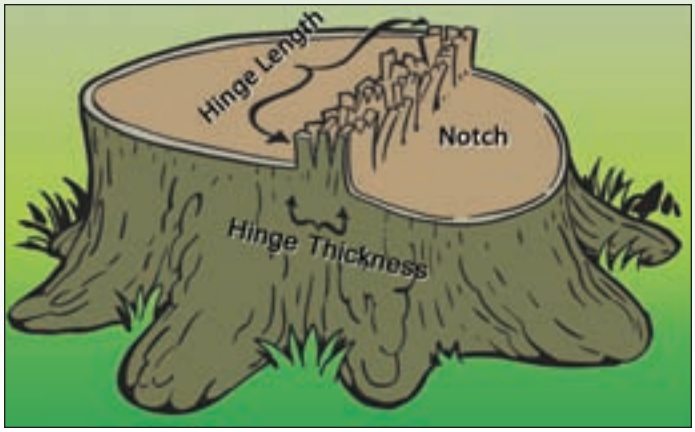
Step #4: The Notch/Hinge

This step involves determining which type of face notch to use and how thick and how long to make the hinge. Contrasted with the conventional notch or the Humboldt notch, the open-face notch of 70 degrees or greater gives you more control because it allows the hinge to work longer. Remember, how much you want to open up the face notch will depend on the plan for that given tree. In some situations, such as working on a grade or felling over a sidewalk, it may be desirable to keep the tree attached to the stump when it is on the ground. For other situations, a larger notch opening that never closes might be necessary, and may only be possible when working with more fibrous wood.



An open-face notch of 70 to 90 degrees provides more control by allowing the hinge to work longer.

The rules of thumb for the hinge is that the hinge length should to be at least 80 percent of the diameter of the tree, and the hinge thickness should be no more than 10 percent (generally 7 to 10 percent) of the diameter of the tree. Again, remember that these are not hard and fast rules and may need to be modified depending on the situation. Is the wood fibrous, dead, or frozen? Generally, the hinge thickness will be reduced as trees get larger and when dealing with very dry or frozen wood.



Generally speaking, the hinge thickness should be no more than 10 percent of the tree's diameter.

Step #5: The Back Cut

The final step in the felling plan is the back cut. How do you finish off the cut? Remember: Face Notch + Back Cut = Hinge. It is very important that a proper back cut is made to set up the correct hinge. Do you use a bore cut, or cut in from the back of the tree? Do you make the back cut level with the apex of the notch, or must you step the back cut? Any face notch less than 70 degrees will require a stepped back cut. A stepped back cut may be warranted even with an open-face notch if there is a chance the tree will get hung up in another tree.

The bore cut is the best option when dealing with trees with forward lean/weight. Use the end of the saw to bore through the tree from the side, leaving strong holding wood (commonly known as a strap) in the back. This will alleviate the potential for barber chair, which is a dangerous situation that occurs when a forward-leaning tree splits vertically up from the back cut. The bore cut will also allow you to set up the hinge without any worry that the tree will move. Once the hinge is set, perform a final safety check, make sure everyone is clear of the tree, and then cut the strap, allowing the tree to fall.

Bore cutting is a technique that can only be learned once you understand the reactive forces of the chain saw. Cutting with the top of the bar will cause the saw to push back towards the operator. Cutting with the bottom of the bar will pull the saw away from the operator. If the front, upper corner of the tip of the bar comes in contact with an object, it will cause the saw to kick back. Kickback is a potentially dangerous reactive force that can happen seven times faster than a human can react. It is always important to be aware of the location of the upper quadrant of the tip of the bar.

The bottom corner of the tip of the bar is used to initiate a bore cut. Starting with this corner will help pull the saw into the wood. The bore cut technique needs to be learned through proper, supervised training and practiced in low-risk situations.

Straight or back-leaning trees can be finished with a back cut, cutting in from the rear of the tree, as long as there is proper use of the pull line. Wedges can be a big help to keep the tree from sitting down on your saw or to help lift the tree over center.

Dangerous kickback occurs when the front, upper corner of the tip of the bar on the chain saw comes in contact with an object.

CONCLUSION

Felling an entire tree can be a quick and profitable way to remove a tree, but if things go wrong, it can be quite costly. The margin for error in an urban environment is often very small. The importance of a thorough, well-devised felling plan can't be understated. Always think through all the steps of the plan before beginning to cut. Sometimes it may be best to remove the tree with an alternative method. The well-prepared arborist not only uses planning procedures to fell a tree, but also uses planning procedures to determine when a tree should not be felled. Felling situations that are too dangerous or have too many undefined circumstances should not be attempted. Safety needs to remain the top priority.

Rip Tompkins is an ISA Certified Arborist, Massachusetts Certified Arborist, and vice president of ArborMaster Training, Inc. (Little Compton, RI). He also is an alternate member of the ANSI Accredited Standards Committee Z133, past chairman of the ITCC Committee, and the 1996 International Tree Climbing Championship Master's Champion.

Illustrations courtesy of Brian Kotwica.