Chapter 3—Chain Saw Tasks and Techniques (Suggested time: 2 hours)

In this chapter:

- Students will learn the importance of a thorough sizeup for felling, limbing, and bucking operations.

- Students will acquire the skills to operate a chain saw safely and efficiently.

Safe Chain Saw Use

Proper Use of Bumper Spikes (Dogs)

Learn to use the saw's bumper spikes (dogs) as a pivot point when felling or bucking. This technique will enhance your control of the saw and improve the saw's efficiency while reducing fatigue.

Cutting with the bottom of the bar pulls the chain saw away from the sawyer. Cutting with the top of the bar pushes the saw back at the sawyer. Cutting with the bottom of the bar increases efficiency and decreases the sawyer's fatigue.

Always protect the saw chain from becoming dull. This will reduce unnecessary fatigue and lessen chances of kickbacks and barber chairs. Barber chairs will be addressed later. Keep the chain out of the dirt and rocks. When cutting uprooted trees with dirt and rocks in the bark, use an ax to trim the bark away from the area to be cut.

Bucking

Situational Awareness

- Never buck a tree that exceeds your ability.
- Consider overhead hazards.
- Is the guide bar long enough for the tree that is being bucked?
- Establish good footing.
- Swamp out bucking areas and escape routes. Anticipate what will happen when the log is cut.
- Plan the bucking cut carefully after considering:
  —Slope: People and property in the cutting zone.
  —Tension: Spring poles.
  —Compression: Falling or rolling root wads.
  —Rocks and foreign objects on the log: The log's tendency to roll, slide, or bind.
  —Pivot points: Broken off limbs hidden underneath the log that can roll up and grab the sawyer.

The Forest Service *Health and Safety Code Handbook* emphasizes the following points.

- Assess the area for overhead hazards before beginning bucking.
- Size up the log for possible reaction after the release cut has been completed.
- Establish escape routes and clear any obstacles that might inhibit your escape.
- Cut slowly and observe the kerf for movement that will indicate where the bind is. A log can have different types of binds at different places.

Safe and Efficient Bucking Techniques

In most situations it is safest to buck logs from the uphill side unless the log may move uphill when bucked. This could occur because of the log's position, weight distribution, and pivot points. Always consider binds and pivot points. Consult another sawyer if you have questions.

Begin bucking by cutting the offside first. This is the side the log might move to when it is cut, normally the downhill side. Cut straight down until you have space for a wedge.

Insert a wedge or wedges to prevent the cut (kerf) from closing tightly and pinching your bar.

Understanding directional pressures—or binds—is important for safe and efficient cutting. These binds determine bucking techniques and procedures. Look for landforms, stumps, blowdown, and other obstacles that prevent a log from lying flat, causing binds. When a bind occurs, different pressure areas result. The tension area is the portion of the log where the wood fibers are being stretched apart. In this portion of the log, the chain saw's cut (kerf) opens as the cut is made. The other pressure area is called the compression area. Here the wood fibers push together. In this portion of the log, the kerf closes as the cut is made (figure 3-1).

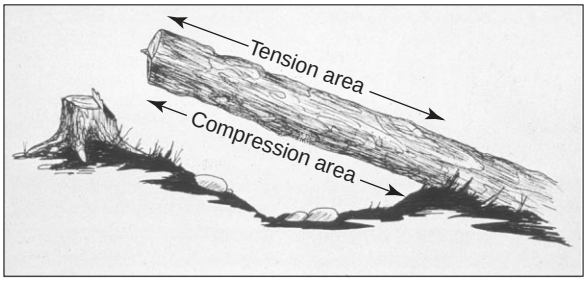

Figure 3-1—When a bind occurs, pressure areas result. These areas are called tension (pulling apart) and compression (pushing together) areas.

It is extremely important to determine what will happen to the log when it is cut. Inspect the log for all binds, pivot points, and natural skids. Various bucking techniques can be used to lower a suspended tree to the ground.

Determining Bind

The four types of bind are: top, bottom, side, and end. There may be a combination of binds. Normally, logs have a combination of two or more binds (figure 3-2).

- Top bind—The tension area is on the bottom of the log. The compression area is on the top.
- Bottom bind—The tension area is on the top of the log. The compression area is on the bottom.
- Side bind—Pressure is exerted sideways on the log.
- End bind—Weight compresses the log's entire cross section.

It is best to start bucking at the top of the log and work toward the butt end, removing the binds in smaller material first. Look for broken limbs and tops above the working area. Never stand under an overhead hazard while bucking.

Look for small trees and limbs (spring poles) bent under the log being bucked. They may spring up as the log rolls away. If you can safely do so, cut these hazards before the log is bucked (figure 3-3). Otherwise, move to a new cutting location and flag the hazard.

Determine the offside. It is the side the log might move to when it is cut—normally the downhill side. Watch out for possible pivots. Clear the work area and escape paths. Allow more than 8 feet of room to escape when the final cut is made. Establish solid footing and remove debris that may hinder your escape (figure 3-4).

Cut the offside first. If possible, make a cut about one-third the diameter of log. This allows the sawyer to step back from the log on the final cut. Do not let the tip of the bar hit any object.

Watch the kerf to detect log movement. Position yourself so you can detect a slight opening or closing of the kerf. There is no better indicator of the log's reaction on the release cut. If the bind cannot be determined, proceed with caution. It may be necessary to move the saw back and forth slowly in the kerf

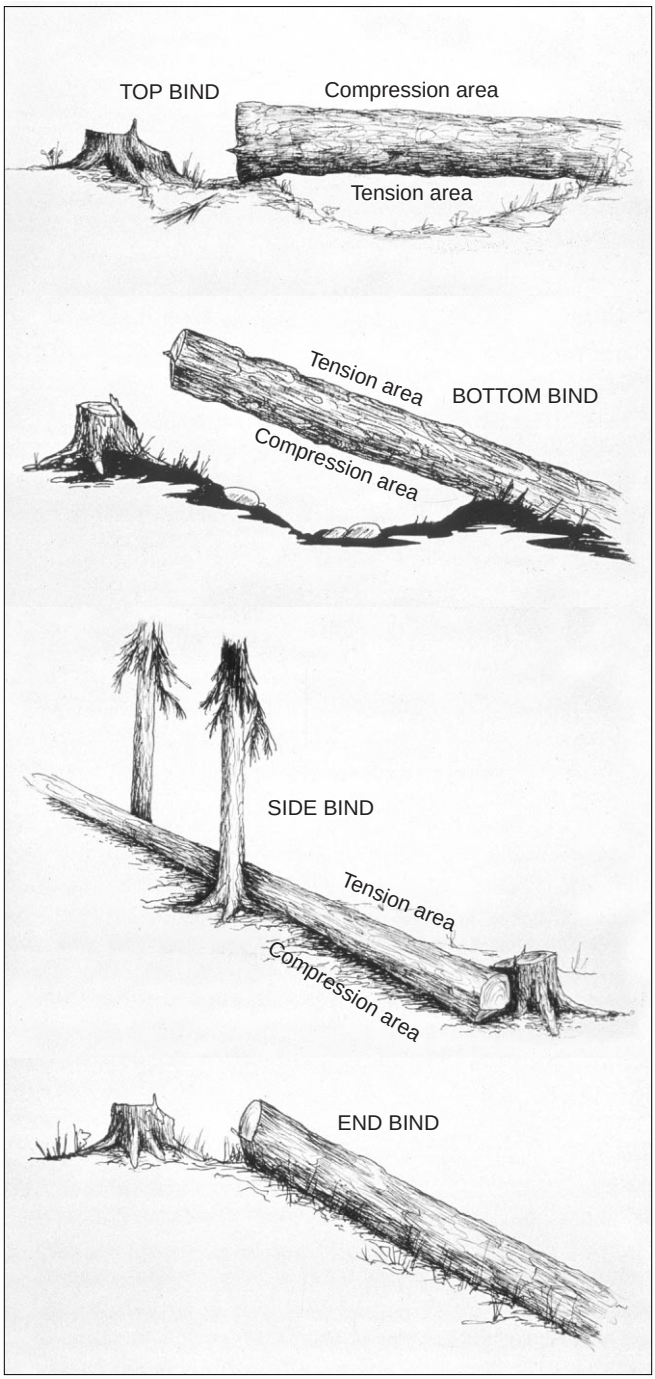

Figure 3-2–There are four types of binds. A log can have a combination of two or more binds.

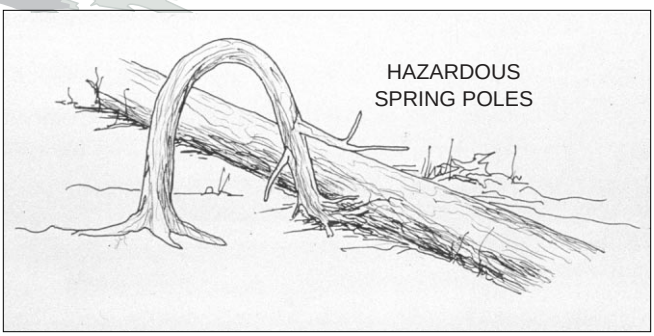

Figure 3-3—Look for spring poles. They can release and cause accidents.

Figure 3-4—Determine and stay clear of the offside (downhill side) when you are bucking.

(about 3 seconds for each chain revolution) to prevent the saw from getting bound as the kerf closes behind the guide bar. Cut only deep enough to place a wedge. Continue cutting. Watch the kerf (figure 3-5). If the kerf starts to open, there is a bottom bind; if the kerf starts to close, there is a top bind.

Figure 3-5—Watch the kerf for movement that will indicate a bottom bind (kerf opens) or top bind (kerf closes).

Reduce remaining wood. Visually project the kerf's location to the bottom of the log. Reduce the amount of wood for the final cut by cutting a short distance into the log along this line. Be prepared for kickback.

Determine the cutting sequences (figure 3-6).

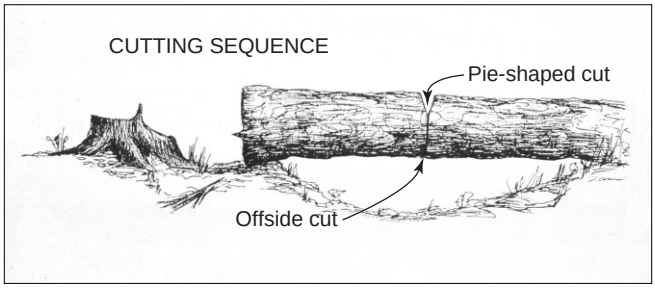

Figure 3-6—Determine the cutting sequence before beginning to cut.

The sequence of the remaining cuts depends on the type of bind. Generally the next cut will be a small, less than 1½ inches, pie-shaped cut removed from the compression area. The log can settle slowly into this space, preventing dangerous slabbing and splintering. This practice is extremely important when cutting large logs.

The final cut, or release cut, will be made through the tension area. Because the offside has been cut, the sawyer only has to use enough bar to finish cutting the remaining wood. This allows the sawyer to stand back, away from the danger. The location of the pie-shaped section and the release cut vary depending on the type of bind.

Top Bind: Remove the pie-shaped section from the top, then make the release cut from the bottom.

Bottom Bind: Remove the pie-shaped section from the bottom, then make the release cut from the top.

Side Bind: If you are not certain the job is safe, do not make the cut. Normally, the offside is the side with tension; the tension side is usually bowed out (convex). Look for solid trees with no overhead hazards or other objects that you can stand behind for protection while cutting. Remove a pie-shaped section from the compression area, then make the release cut in the tension area.

End Bind: Cut from the top down, inserting a wedge as soon as possible. Finish by cutting down from the top. Watch the wood chips to make sure that the chain is not cutting in the dirt (look for dark chips).

Pay special attention when bucking in blowdown. Blowdown is a result of strong winds that have uprooted the trees. At any time while the bucking cuts are made, the roots can drop back into place or roll. Consider the following points when bucking blowdown.

Small trees growing on the roots of blowdown could be forced into the sawyer's position if the roots drop or roll. Cut the small trees off first. Limbs may be preventing the roots from rolling. Don't cut those limbs.

The roots can move in any direction. Avoid standing directly behind or downhill from them.

The following example shows the importance of following proper procedures when bucking blowdown.

A 30-inch d.b.h. fir tree was lying across a steep slope; the butt end was still anchored by a few roots. About 30 feet from the roots, the tree was balanced on a small stump. This stump supported the small end of the tree above some log chunks and debris.

The first step in proper bucking procedure is to inspect the log for all binds, pivot points, and skids. The sawyer failed to properly estimate the log's reaction when the log was cut. He chose downhill as his offside, expecting both the tree and roots to roll down the slope. He stood 12 feet from the roots and to the left of his saw.

When the sawyer made his release cut, the log rolled slightly uphill, off the small stump. The tree's top came to rest on the log chunks and debris, then slid rapidly downhill on these natural skids. With the stump as a pivot, the butt end swung uphill, killing the sawyer.

If the small log had been inspected thoroughly, the sawyer could have:
- **Bucked the tree at or near the pivot.**
- **Started bucking at the small end of the tree first, leaving the roots for last.**
- **Stood to the right of his saw so he would be in the clear.**

Safe Bucking Practices

Warn workers that are working in and below an active cutting area. Allow workers time to move to a safe location. Verify their safety visually and verbally. Announce when a bucking operation has been completed.

Buck small sections that will be easy to control when they begin moving. Removing a single section of log may require that other binds be eliminated first. Angle bucking cuts, wide on top and made on the offside, allow a single section of log to be removed. Angled cuts will permit the bucked section of log to be rolled away from the remaining log.

All logs must be completely severed when bucked. Flagging should be used to mark an incompletely bucked log as a hazard.

Never approach a cutting operation from below until the saw has stopped running, you have established communication with the sawyer, and the sawyer has granted permission to proceed.

Points to Remember

- Do a complete sizeup. Identify the hazards, and establish your escape routes and safety zones.

- Use objects such as rocks, stumps (if they are tall enough), and sound standing trees with no overhead hazards for protection in the event the tree springs sideways toward the sawyer when the release cut is made.

- Binds change with log movement. Reevaluate as necessary.

Limbing

Any of the following situations could result in a fatality or serious injury.

- Check for overhead hazards before ***any*** limbing begins. If a specific portion of the tree you are limbing has any overhead hazards, leave that portion of the tree unlimbed.

- Check for objects on the ground such as stumps, logs, and spring poles that may be hidden by the limbs of the felled tree. If the tip of the bar unintentionally strikes an object, the saw may kick back.

- Maintain a firm grip on the saw with your thumb wrapped around the handlebar during all limbing activities, regardless the direction the saw is turned.

- Be sure you have firm footing as you walk down the tree that you are limbing. Calked boots are strongly recommended for walking on felled trees.

- Do not attempt to cut limbs that are supporting a tree off the ground if there's a chance the tree could roll on the sawyer. Always plan and clear an escape route.

- When limbing on top of a log, right-handed sawyers should limb the right side out to the top before turning around and limbing the other side on their way back. Another option is to limb a tree out in sections. It is not advisable for a right-handed sawyer to limb on the left side (or for a left-handed sawyer to limb on the right side). Crossing over when limbing could result in an injury.
  - —The bar length should be appropriate for the sawyer's height. Proper bar length reduces bending at the waist, decreasing back strain.
  - —To increase the distance between the saw chain and your leg, bend at the waist and reach out with the saw to cut the limb. This increased distance allows you more reaction time if a kickback occurs.

- Overreaching kickbacks occur when too much bar is used when cutting a limb and the bar tip contacts an object, propelling the bar up and back (figure 3-7).

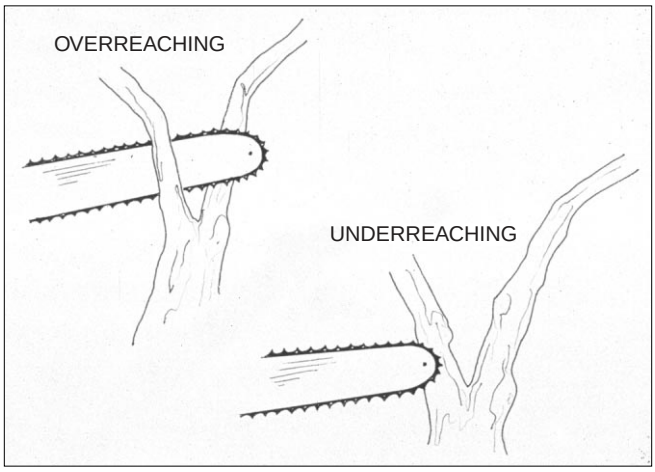

Figure 3-7—Avoid overreaching and underreaching kickbacks by using the bar properly.

- Underreaching kickbacks occur when too little of the bar tip is used and the tip contacts any object, propelling the bar back and down.

- Spring poles are limbs or small trees that are bent over and under extreme tension. Spring poles are encountered frequently when limbing. They can cause serious injury. If spring poles are not cut properly, they can spring back and strike the sawyer or throw the chain saw back into the sawyer. Sawyers must recognize spring poles and use the proper technique when cutting them. Stand back at a safe distance and make a series of shallow cuts on the portion of the spring pole that is being compressed. Make your release cut in the top side of the portion of the spring pole that will fall to the ground.

• Sometimes a tree is suspended off the ground by the limbs underneath or by uneven terrain. The sawyer must decide whether or not to limb the tree after considering the potential that the sawyer might fall or that the tree may roll or collapse. Consider footwear and environmental conditions such as rain, snow, fog, or darkness, and the ability and experience of the sawyer. Carefully select the appropriate technique, such as limbing from the ground, limbing on top, or lowering the tree by bucking (figure 3-8).

Figure 3-8—The top side of suspended logs should be limbed on the top side while you are standing on the ground or lower the log to the ground by bucking.

Brushing and Slashing

Sizeup and Safety Considerations

Many sawyers have cut their chaps or their legs when they took a step toward the next tree. Be sure the chain has stopped before moving to the next tree. Engage the chain brake when moving short distances.

Shut the saw off when moving farther than from tree to tree, when hazardous conditions exist (slippery surfaces or heavy underbrush), and whenever moving more than 50 feet.

When slashing (felling) trees smaller than 5 inches in diameter, an undercut may not be needed. Instead, a single horizontal cut (kerf face) one-third the diameter of the tree may be used to fell it. When directional felling is necessary, use a normal face cut (consisting of a horizontal and sloping cut or two sloping cuts). Situations when directional felling should be used include:

• A potential barber-chair situation.
• A closed canopy.
• Tree defects.
• Side binds.
• Environmental damage.

Other Mitigating Circumstances—Always escape the stump quickly even when felling small-diameter trees. They can cause serious injuries and fatalities.

Trees should be pushed over only by the sawyer, only when the sawyer can do so safely, and only after the sawyer has looked up for overhead debris that could become dislodged.

Safe and Efficient Brushing and Slashing Techniques

In dense fuel accumulations, the tip of the guide bar may accidentally bump (stub) into a limb. The sawyer must continually be alert for kickback.

The sawyer normally will have a hand piler working nearby helping to remove cut debris. The piler's safety must be taken into consideration.

Proper stance and saw handling is imperative. In addition, the following steps should be taken.

• ***LOOK UP*** for widow makers and other loose debris. Don't cut under a hazard. Remove the hazard or move the cutting location.

• If possible, stay on top of logs while limbing. Doing so reduces the chance that the log will roll over on the sawyer if the sawyer cuts a supporting limb.

• Watch out for whipping limbs and branches when cutting smaller material. Cut close to the stem. Begin and complete cuts with a sharp chain and high chain speed. Use eye protection.

• Cut limbs and stems flush with the trunk or close to the ground. Do not leave pointed stems that could cause injury during a fall or cause the sawyer to trip.

• Don't cross the chain saw in front of your legs. Keep some distance between your legs and the guide bar. Bend down to maintain distance. Cut on one side, then the other to avoid crossing the chain saw in front of you.

• Never cut with the chain saw above shoulder height (figure 3-9). Control is difficult when the saw's weight is above your shoulders. A thrown chain could strike you in the face or upper body.

Figure 3-9—Do not cut with the chain saw above shoulder height. Keep the chain saw below your shoulders to maintain control when cutting.

• Clear debris from the cutting location to prevent the guide bar tip from stubbing it accidentally. When you are removing debris, engage the chain brake or turn off the ignition.

• Watch out for spring poles. Do not cut spring poles if you can avoid doing so. If you must cut a spring pole, make your release cut in the top side of the portion of the spring pole that will fall to the ground. Be careful not to stand in the path of the pole when tension is released.

• When cutting a heavy limb, consider using a small cut opposite the final cut to prevent the material from slabbing or peeling off.

• Pay special attention if you are working in close quarters with other workers in an area with steep slopes and thick brush or logging slash. First, stop and size up the situation. Make a plan and talk it over with all workers in the area. A well thought-out plan saves time and reduces the risk of accidents. After you've discussed the plan, work systematically from the outside in and from downhill up. This reduces the chance that material will hang up. Maintain a space between workers that is at least two-and-one-half times the height of the tallest tree.

• You need one or more escape routes, even when felling small trees.

• Begin to develop a felling and bucking pattern as you work into the area. As you down more material, be increasingly careful of your footing and continually identify new escape routes.

• Special hazards like leaners and snags need to be taken care of right away. Get hazard trees on the ground so no one has to work under them (figure 3-10).

Figure 3-10—Hazard trees, such as leaners, need to be removed to prevent anyone from working under them.

• Double stumps (figure 3-11) are hazardous because they have a high potential for causing kickback. Watch that bar tip!

• When felling small trees, cut the stumps as close to the ground as possible without hitting the dirt with your chain. Stumps are cut low so they will not be as noticeable and will present fewer hazards for people and wildlife.

Figure 3-11—Double stumps have a high potential to cause kickback.

• Small trees can be limbed while they are standing. Don't cut with the chain saw above shoulder height. Limbing the bottom of small trees allows the sawyer to move in closer to the bole when felling it and will help the sawyer watch the tip of the bar to prevent kickbacks.

• The chain is more likely to be thrown when you are working with small material. Check your chain tension often. Sawing close to the ground increases the chances of kickback and damage to the chain. Watch out for rocks and other debris.

• Remember, when you saw up from the bottom (using the top of the bar) the saw will push back rather than pull away. This increases the risk of kickback and loss of control. Be aware of signs of fatigue like more frequent kickbacks, bar pinches, and near misses. Take a break when you show signs of fatigue.

• Cut pieces small enough so they are easy to lift and handle. Lift properly using the legs and keeping the back straight. Hand pilers must be aware of their footing and watch out for flying debris.

Basic Felling

Situational Awareness

Analyze the felling job by considering:

- Species (live or dead).
- Size and length.
- Soundness or defects.
- Twin tops.
- Widow makers and or hangups.
- Frozen wood.
- Rusty (discolored) knots.
- Punky (swollen and sunken) knots.
- Frozen wood.
- Footing.
- Damage by lightning or fire.
- Spike top.
- Heavy snow loading.
- Bark soundness.
- Direction of lean.
- Degree of lean (slight or great).
- Head lean or side lean.
- Nesting or feeding holes.
- Splits and frost cracks.
- Deformities, such as those caused by mistletoe.
- Heavy branches or uneven weight distribution.

Analyze the base of the tree for:

- Thud (hollow) sound when struck.
- Conks and mushrooms.
- Rot and cankers.
- Shelf fungi or "bracket".
- Wounds or scars.
- Split trunk.
- Insect activity.
- Feeding holes.
- Bark soundness.
- Resin flow on bark.
- Unstable root system or root protrusions.

Examine surrounding terrain for:

- Steepness.
- Irregularities in the ground.
- Draws and ridges.
- Rocks.
- Stumps.
- Loose logs.
- Ground debris that can fly or kick up at the sawyer.

Examine immediate work area for:

- People, roads, or vehicles.
- Powerlines.
- Hang ups and widow makers.
- Other trees that may be affected.
- Fire-weakened trees.
- Hazards such as trees, rocks, brush, low-hanging limbs.
- Reserve trees.
- Structures.
- Openings to fall trees.
- Snags.
- Other trees that may have to be felled first.

Walk out and thoroughly check the intended lay or bed where the tree is supposed to fall. Look for dead treetops, snags, and widow makers that may cause kickbacks, allow the tree to roll, or result in another tree or limb becoming a hazard. The escape route and alternate routes must be predetermined paths where the sawyer can escape once the tree is committed to fall or has been bucked. Safe zones should be no less than 20 feet from the stump, preferably behind another tree that is sound and large enough to provide protection. Escape routes and safe zones should be 90 to 135 degrees from the direction of fall. Sawyers must select and prepare the work area and clear escape routes and alternate routes before starting the first cut.

Sizeup

Before starting the saw, the chain saw operator must be able to evaluate if a tree is safe to cut. Other options are always available. ***IF FELLING A PARTICULAR TREE IS DANGEROUS, DON'T DO IT!***

Debris falling from above causes most accidents. Practice watching overhead while cutting, with occasional glances at the saw, the kerf, and the top of the tree.

Observe the Top—When you approach the tree to be felled, observe the top. Check for all overhead hazards that may come down during felling.

Look at the limbs. Are they heavy enough on one side to affect the desired felling direction? Do the limbs have heavy accumulations of ice and snow?

Are the limbs entangled with the limbs of other trees? If so, they will snap off or prevent the tree from falling after it has been cut.

Is the wind blowing strong enough to affect the tree's fall? Wind speeds higher than 15 miles per hour may require that felling be stopped. Strong winds could also blow over other trees and snags in the area. Switching or erratic winds require special safety considerations.

Check For Snags—Check all snags in the immediate area for soundness. A gust of wind may cause snags to fall at any time, as may the vibration of a tree fall. If it is safe to do so, begin by falling any snag in the cutting area that poses a threat.

Swamp Out the Base—Clear small trees, brush, and debris from the base of the tree. Remove all material that could cause you to trip or lose your balance. Also remove material that will interfere with the saw, wedges, and ax. Look for small trees and brush that could accidentally stub the guide bar. Be careful not to fatigue yourself with unnecessary swamping. Remove only what is needed to work safely around the base of the tree.

Assess the Tree's Lean (figure 3-12) and the Soundness of the Holding Wood—Most trees have two natural leans; the predominant head lean and the secondary side lean. The leaning weight of the tree will be a combination of these two leans. Both must be considered when determining the desired felling direction. The desired felling direction can usually be chosen within 45 degrees of the combined lean, provided there is enough sound holding (hinge) wood to work with, especially in the corners of the undercut. Evaluate the tree's lean. With a plumb bob or ax, project a vertical line up from the center of the tree's butt and determine if the tree's top lies to the right or left of the projected line.

A pistol-grip tree may appear to be leaning in one direction while most of the weight is actually in another direction (figure 3-13).

Look at the tree top from at least two different spots at right angles to each other. This will be done again in the sizeup process.

The importance of the holding wood cannot be overemphasized. Determine the condition of the holding wood by sounding it with an ax. Look up for falling debris while doing so.

Boring is an important technique, but it must be done properly because it has the potential for kickback. Using the guide bar tip, bore vertically into the area immediately in front of and behind the holding wood (figure 3-14). Do not weaken the holding wood by boring into or across any of the holding wood. The color of the sawdust and ease with which the saw enters the wood will be your indication of the tree's soundness. Begin the boring cut with the power head lower than the tip of the bar. After the tip is in the tree deep enough to prevent it from kicking back, apply full throttle. The thumb should be wrapped securely around the handlebar. Maintain full throttle throughout the boring cut.

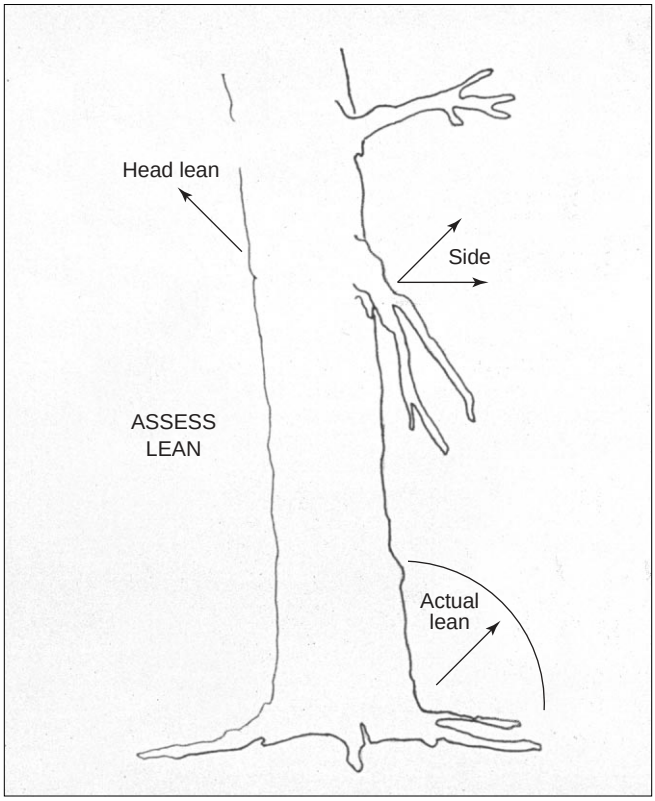

Figure 3-12—Assess the tree for head lean and side lean.

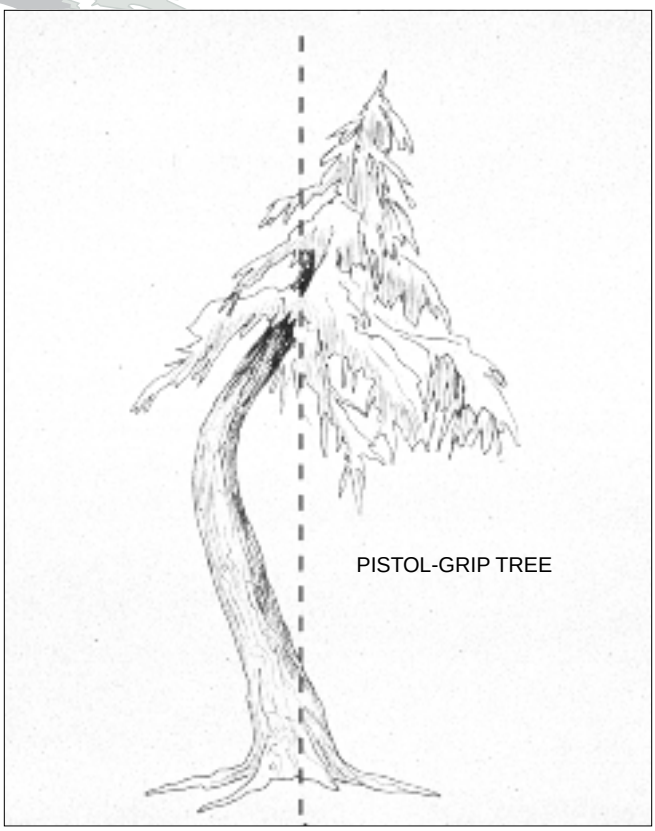

Figure 3-13—The lean of a pistol-grip tree is hard to determine.

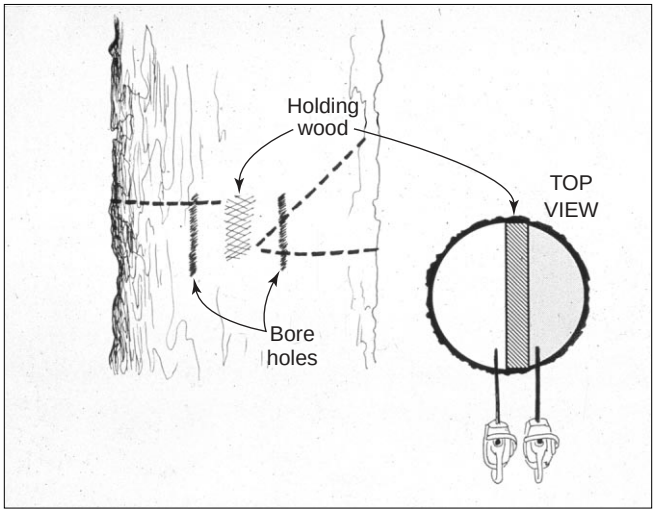

Figure 3-14—Do not weaken the holding wood by boring into or across any of the holding wood.

Check for frost cracks or other weak areas in the holding wood. The desired felling direction can be adjusted to eliminate weaknesses in the holding wood. The depth of the undercut can also be adjusted (less than one-third the tree's diameter or greater than one-third) so that the holding area takes advantage of the soundest wood available.

Escape Routes

With the desired felling direction in mind, determine your escape route (figure 3-15). Consider which side of the tree you will be making your final cut on and select a path that will take you at least 20 feet behind the stump when the tree begins to fall. Don't choose a path directly behind the tree. It is best to prepare two escape routes in case you switch your location on the final cut.

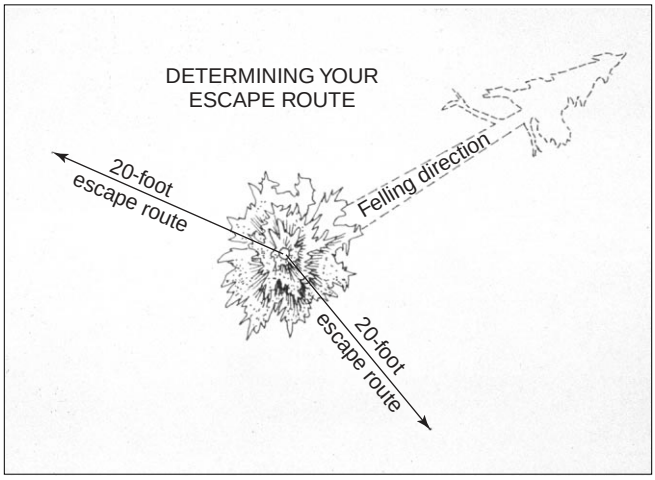

Figure 3-15—Keep the felling direction in mind when planning escape routes.

Look for a large solid tree or rock for protection. The tree or rock must be at least 20 feet away from the stump and not be directly behind it. Make sure that debris that could trip you is cleared from the escape route. Practice the escape.

Walk out the intended lay of the tree (figure 3-16). Look for any obstacles that could cause the tree to kick back over the stump or cause the butt to jump or pivot as the tree hits the ground. Look for any small trees or snags that could be thrown into your escape route. Check to be sure the cutting area is clear of people.

Figure 3-16—Check the intended lay of the tree for unwanted obstacles.

Using the observations you made walking out the lay, reexamine the escape route. Be sure that your chosen route will be the safest escape—before you begin to cut.

Felling the Tree

"Face" the tree (figure 3-17). The face is made in the direction you want the tree to fall. Estimate one-third of the tree's diameter, shout a warning if necessary, and proceed with the undercut. When finished, check the direction the tree is faced. If the face is not in the desired felling direction, correct the cut.

Figure 3-17—Check the direction the tree is faced.

Shout a warning (figure 3-18). Shut off the saw and shout to be sure that the cutting area is secure. Reexamine your primary and secondary escape routes before beginning the backcut.

Figure 3-18—Shout a warning to make sure the cutting area is secure.

Complete the backcut (figure 3-19). Remembering the importance of holding wood, stump shot (see glossary), and wedging, complete the backcut.

Escape the stump. When the tree commits to the fall, rapidly follow your escape route. Do not hesitate at the stump. If your saw becomes stuck, leave it. If carrying the saw prevents you from escaping quickly enough, drop it!

Keep your eyes on your predetermined escape route. If the felled tree strikes other trees, they may still be moving after the tree has fallen. Watch for flying limbs and tops. Remain in your safety zone until it is safe to approach the stump.

Figure 3-19—Complete the backcut.

Analyze the operation (figure 3-20). The stump gives the best critique of the felling operation. Before approaching the stump, look in the tops of the surrounding trees for new overhead hazards.

Take a moment or two to look at the stump. Does the tree have the desired lay? How much holding wood is left on each corner? Is the stump shot sufficient? Were the cuts level? Take time to analyze the felling operation. Check stump height and look for stump or root pull and dutchman cuts.

Figure 3-20—Look at the stump when critiquing a felling operation.

Felling Details

Proper evaluation of a felling operation requires a thorough understanding of the mechanics of the undercut, holding wood, backcut, and the felling procedure. In addition, the sawyer needs to consider the various tree problems. Every tree should be evaluated or sized up using techniques discussed in *Situational Awareness—Evaluating the Complexity of the Assignment* in chapter 1.

The Undercut, Holding Wood, and Backcut

The three basic cuts are the conventional undercut, the Humboldt, and the open face. We are only going to discuss the conventional undercut because of its broad application for all timber types and because it provides a solid foundation from which to learn additional cutting techniques.

It takes three cuts to fell a tree. Two cuts form the undercut (or face cut) and the third forms the backcut (figure 3-21). The correct relationship of these cuts results in safe and effective tree felling. Before discussing the felling procedure we will analyze the mechanics of the felling cuts. Undercutting and

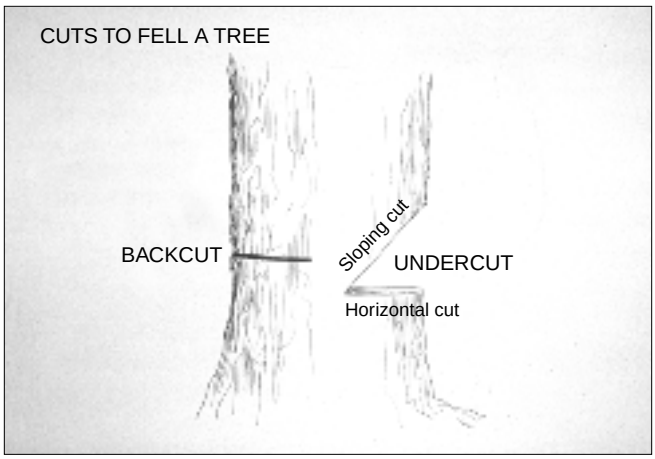

Figure 3-21—An undercut and a backcut are required to fell a tree. A horizontal cut and a sloping cut make up the undercut. The backcut is the third cut needed to fell a tree.

backcutting construct the hinge that controls the direction and fall of the tree.

The undercut serves three purposes. First, it allows the tree to fall in the chosen direction by removing the tree's support in the direction of the face. Second, it enables control because the tree slips off the stump, rather than jumping off. Third, when the tree is breaking the holding wood, the undercut prevents the tree from kicking back.

The undercut consists of two cuts, a horizontal cut and a sloping cut. Observe overhead hazards and look up often during the undercut. You should either be down on one knee or standing all the way up.

The tree is faced in the general direction of the tree's lean. Ideally, the undercut is made in the same direction as the tree's lean, but because of structures, roads, other trees, or trails, the desired felling direction may be to one side or the other of the lean. Normally, the desired direction is less than 45 degrees from the lean.

The horizontal cut is a level cut. This cut is made close to the ground unless a snag is being felled or another factor creates special hazards for the sawyer. The horizontal cut dictates the direction of fall if the relationships of the three cuts are maintained. If there is any danger from above, such as snags, the cutting should be done while standing so the sawyer can watch the top and escape more quickly. After selecting the desired felling direction, estimate one-third the tree's diameter, set the saw's bumper spikes at this point, and begin the horizontal cut.

The specific direction of the undercut is determined by "gunning" the saw. Look down the gunning marks on the saw and align them with the desired felling direction. After the cut has been

made level to at least one-third of the tree's diameter, the horizontal cut is complete. Short snags sometimes require an undercut deeper than one-third the tree's diameter to offset the tree's balance. Felling short snags will be addressed later. Trees with heavy leans may not allow the sawyer to make the horizontal cut as deep as one-third of the tree's diameter without pinching the guide bar.

When the horizontal cut is complete, remove the bark from an area on both sides of the kerf. The bark can be removed with your ax or with the tip of the guide bar (figure 3-22). Watch out in case the ax glances off the bole or the saw kicks back.

Figure 3-22—Bark can be removed with the tip of the bar.

The sloping cut needs to be angled so that when the face closes the tree is fully committed to the planned direction of fall. As the face closes, the holding wood breaks. If this happens and the tree is still standing straight, the tree could fall away from the desired direction.

As a general rule, make the sloping cut at a 45-degree angle (figure 3-23). Remember that it is important that the face not close until the tree is fully committed to the planned direction of fall.

Line up the sloping cut with the horizontal cut so that they meet, but do not cross. When the cuts cross, a "dutchman" (figure 3-24) is formed. If the tree were felled with a dutchman, first the dutchman would close, then the tree would split vertically (barber-chair), or the holding wood would break off. Felling control would be lost. A weak tree might snap off somewhere along the bole or at the top. It is difficult to make the sloping cut and the horizontal cut meet correctly on the opposite side of the tree. This is because the point of intersection is not immediately visible to the sawyer.

Figure 3-23—The sloping cut is a 45-degree angle.

Figure 3-24—When the sloping cut and the horizontal cut cross, a dutchman is formed.

After making a short sloping cut, leave the saw in the cut. Go around to the other side of the tree and see if the guide bar is in the correct plane to intersect the back of the horizontal cut. Keep your hands away from the throttle trigger. Engage the chain brake.

Practicing on high stumps will help you become skilled at lining up these cuts.

The holding wood is the wood immediately behind the undercut. The most important portion of the holding wood is in the very corners of the cut, in the first 4 to 8 inches inside the bark. The horizontal and sloping cuts must not overlap in this region. If they do, the undercut must be cleaned up so no dutchman is

left in these corners. Care must be taken not to cut the undercut too deeply while cleaning up. This reduces the amount of room available for wedges.

If cleaning up the sloping cut will create too deep an undercut, stop the sloping cut directly above the end of the horizontal cut.

The undercut needs to be cleaned out. Any remaining wood will cause the face to close prematurely and the holding wood will be broken behind the closure.

Once the face has been cleaned, recheck the felling direction. Place the saw in the face and check the gunning marks (figure 3-25) or stick an ax head into the face and look down the handle. The back of the undercut should be perpendicular to the desired felling direction.

Figure 3-25—Use the gunning marks to check the felling direction.

If the tree is not aimed in the direction that you want it to fall, extend the horizontal and sloping cuts as needed, maintaining a single plane for each of the two cuts.

Backcut and Wedging Procedures—The third cut needed to fell a tree is the backcut. The relationship of this cut to the face is important for proper tree positioning and the sawyer's safety. The backcut can be made from either side of the tree if the saw has a full-wrap handlebar, as recommended in the *Health and Safety Code Handbook*. Choose the safest side to cut on (figure 3-21).

In the area where you have removed the bark behind the horizontal cut, place the bumper spikes so the chain will cut no closer than 2 inches from the face and 2 to 5 inches, depending on tree size, above the face's horizontal cut. You may place the bumper spikes closer than 2 inches on smaller trees with lightweight tops.

The best way to envision these cuts is by the use of a rectangle (figure 3-26). The bottom corner is the back of the face's horizontal cut. The opposite upper corner will be the back of the backcut.

The height of the rectangle is referred to as the stump shot. It is an antikickback device to prevent the tree from kicking back over the stump if it hits another tree during its fall. This is especially important felling trees through standing timber.

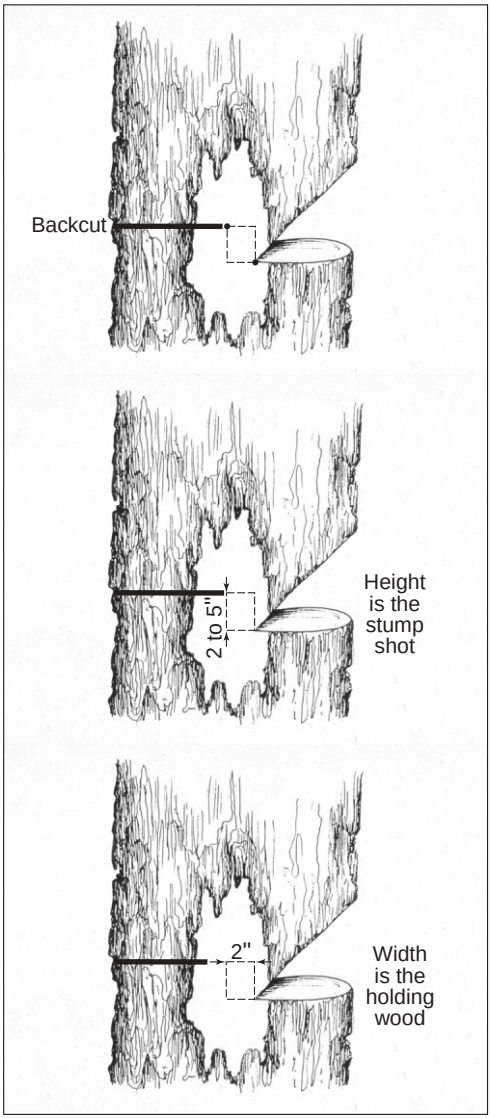

Figure 3-26—An imaginary rectangle can help the sawyer understand the importance of the backcut.

The width of the rectangle is the holding wood. As the backcut is made, the sawyer must be careful not to cut this wood. Maintaining the holding wood is the key to safe and effective felling.

Start the backcut with the bumper spikes placed so the chain will end in the upper corner of the rectangle. Hold the saw level so that the backcut will be level when the cut is complete. You want to be sure that when the cut is finished it will line up with the top corner of the opposite rectangle. If the cut is angled, wedging power and/or the stump shot's height will be altered.

It may be helpful to cut or chop the bark to help level the bar. Do not cut deeper than the bark. Cuts into the wood will eliminate or reduce wedging lift. Once the cut has been made into the wood, do not change the cut's location.

Keep at least three wedges and an ax readily accessible while making the backcut. The wedges should be in a wedge holster worn on the waist or in pants pockets. Keep the ax within arm's reach. The size of the wedge depends on the tree's diameter. For a 24-inch tree, two 10- to 12-inch wedges and one 4- to 6-inch wedge is a good combination.

If there is any wind at all, at least two wedges are recommended. The second wedge adds stability. With only one wedge, the tree can set up a rocking action between the holding wood and the wedge. If a strong wind begins to blow, the holding wood can be torn out.

Remove thick bark immediately above and below the backcut's kerf where wedges will be placed. The bark will compress, lessening the lifting power of the wedges. The wedges should be spread to better stabilize the tree in case of erratic winds.

Directional Felling

Place wedges in the kerf in each area as soon as the chain will permit. Place the wedges parallel to the desired felling direction. Do not drive the wedges too hard. They will interfere with the backcut or cause the tree to become a heavy leaner.

Watch for droop in the wedges and occasionally try to push them in with your hands. Retighten them with an ax every 4 to 6 inches of cutting. Be careful not to drive the wedges too hard. The wedges are there in case the lean was incorrectly established, the wind causes the tree to set back, or the sawyer intends to fell the tree in a different direction from the tree's natural lean.

As you cut, continually look above for possible hazards and at the kerf for movement. Do not cut the holding wood.

The gunning sights can be used in reverse to help determine the guide bar's position. With the correct lean established and the proper relationship between the three cuts, the face will begin to close and the tree will fall in the planned direction.

Wedges must be used for all felling operations. Small trees limit the sawyer's use of wedges, even when small wedges are used. A technique can be employed where half of the back cut is made at a time. This allows for wedges to be placed without interfering with the guide bar.

After making the undercut, cut half of the backcut using the guide bar's tip. Make this cut from the tree's offside. Watch out for kickback and be careful not to cut the holding wood. Finish the backcut from the other side. Leave 1 to 1½ inches of holding wood.

After removing the saw, place a small wedge in the kerf an inch or more from the remaining wood to be cut. Remember to keep the wedge tight but do not drive the wedge too hard. Finish the backcut using the tip of the guide bar, being prepared for kickback from the wedge. The wedge will be in position if the tree sits back. If two wedges are needed to lift the tree into the undercut, spread them as wide as possible (figure 3-27). For trees that have a moderate amount of side lean, two wedges may be inserted on the side of the backcut that has been cut first. As with other wedging operations, it is essential to tighten the wedges often, especially on trees that are attempting to sit back.

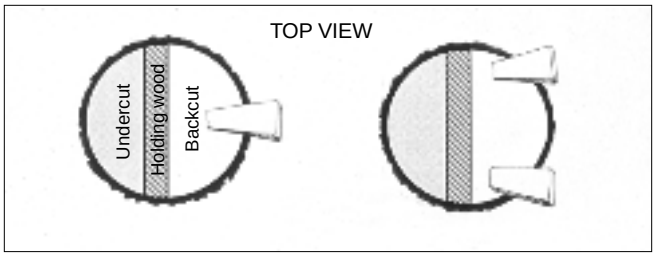

Figure 3-27—Wedges need to be parallel to the desired felling direction.

A sitback is a tree that settles back opposite the intended direction of fall during the backcut. This normally happens because the lean was incorrectly established or the wind changed. If the sawyer has been following the proper felling procedure (there is a wedge in the backcut and the holding wood has been maintained), a sitback can be dealt with readily. If the proper felling procedure has not been followed, the sawyer will need assistance because the tree has probably pinched the bar (figure 3-28).

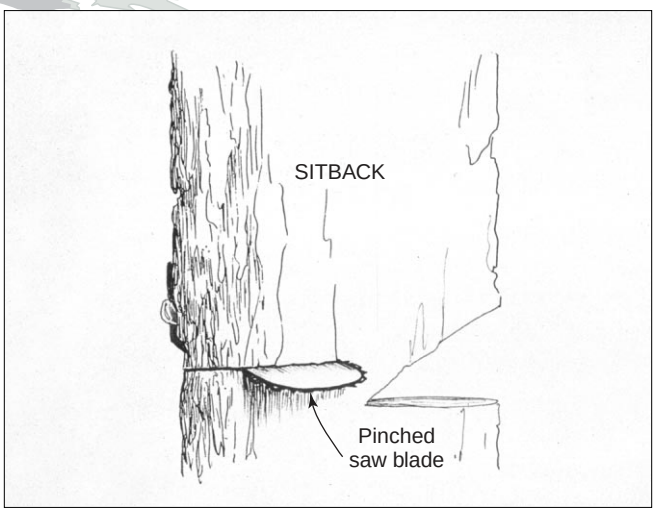

Figure 3-28—A tree settles back opposite the intended direction of fall.

Immediately notify your supervisor in the case of sitbacks and other felling difficulties. Before you leave a hazardous tree, be sure to clearly mark the area with flagging (figure 3-29) or with a written warning. Give a verbal warning to others working in the area.

Figure 3-29—Clearly mark a hazard tree before leaving the area. Notify your supervisor of the hazard.

A snag is a standing dead tree, or portion of a tree, whose wood is decomposing.

Shout a warning. Before working on a snag, everyone in the area must be notified. Remember a snag can fall in any direction at any time.

Observe the top. Pay special attention to overhead hazards, branches, and the snag's top. Upper limbs may be weak and ready to come down at the least vibration. Never cut directly below a hazard. Look up while driving wedges.

Swamp out the base. Carefully check the condition of the bark on the snag. Loose bark can come sliding down the side of the snag and presents an extreme hazard to the sawyer. Standing back with room to escape, remove loose bark at the snag's base by prying it with an ax or a pole. Do not chop the bark, because this would set up vibration in the snag.

Size up. Check the condition of wood by boring into it with the bar tip. Maintain the integrity of the holding wood. When sounding with an ax, look up while striking the tree. Check for frost cracks and other splits in the holding wood.

Determine two escape routes. Since the holding wood is rotten to some degree, you must establish two routes of escape.

Make the undercut. Do not fell a snag against its lean. Make the undercut and the backcut while standing upright. You are in a position where you can easily look up. In addition, you are in a position that allows immediate escape.

When you are cutting the face, be alert for the snag pinching the bar. Previous boring in the undercut area during sizeup should alert you to this possibility. Moving the bar back and forth will minimize the possibility of pinching. If the snag starts to sit on the bar, finish the undercut just to that depth. It is critical that the undercut has a wide opening and that it be cleaned out from corner to corner.

A short snag, with few or no limbs to give it lean, may need a face up to one-half the snag's diameter to offset the balance.

Felling Observers and Spotters

The use of personnel other than swampers in felling operations has been controversial. The *Health and Safety Code Handbook* states that if you choose to have additional personnel (such as during training), justification for the additional personnel and the implementation process shall be documented in the JHA.