B-1409

SAFE CHAIN SAW OPERATION

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A chain saw is a portable power cutting machine. Used properly, it will trim or cut down trees, clear land or cut fireplace wood. Improperly used, a chain saw can inflict serious injury.

A chain saw operator who takes shortcuts and ignores recommended procedures cannot escape injury for long. Approximately 23;000 persons annually require emergency room treatment for chain saw injuries. Studies estimate 35 percent of woodland accidental injuries involve chain saws.

Read Your Owner's Manual Carefully

Study the owner's manual until you are thoroughly familiar with all aspects of safe operation and maintenance before using the saw (Figure 1). Ask your dealer or service shop about any details you do not understand.

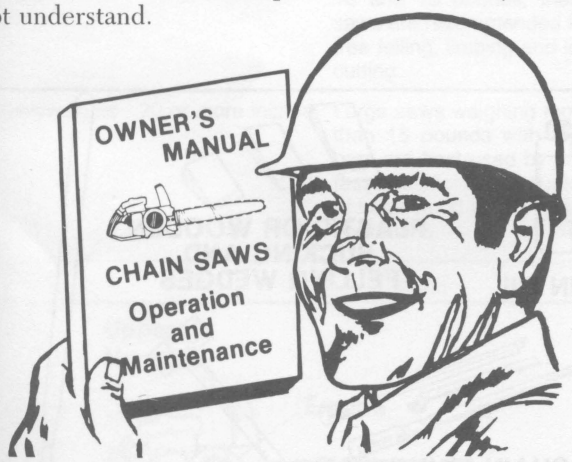

Figure 1. The owner's manual is your best source of information on safe operation and maintenance.

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Primary Hazards

No one would intentionally risk contact with a moving chain saw blade. Yet, because of operators' failure to follow recommended operating procedures, two of every three serious chain saw injuries entail inadvertent direct contact with the blade. These accidents may involve an operator reaching across or holding work near the moving saw, losing saw control through loss of footing, turning suddenly, climbing above ground level, losing balance, shifting chain saw weight while cutting at or above waist level or experiencing chain saw *kickback*. Often, loss of balance causes an operator to reach into the running saw blade as he grabs to steady himself.

Other chain saw hazards include falling trees and limbs, springing limbs, trees slipping off stumps, operator falls, particles in the eyes, contact with hot chain saw parts and fire.

Weather Conditions

Sudden gusts or changes in wind direction can cause a tree to fall in an unexpected way. Avoid *felling* (cutting down) large trees on windy days. Use these days for *limbing* (removing limbs from the trunk) or *bucking* (cutting the trunk into desired lengths).

Rain, snow or ice can lead to slips and falls. Work cautiously under these conditions to maintain good footing. If possible, postpone the job until the weather improves.

Preparation and Practice

Experience

Inexperienced operators should not start by felling trees. Make trial cuts to become accustomed to a chain saw's cutting and handling characteristics. Keep

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unnecessary helpers or bystanders away from saw operations. Cut small logs supported off the ground so the chain will not strike the ground. Let the chain do the cutting. Extra pressure does not need to be applied. Do not try to cut wood with a diameter greater than the length of the chain saw guide bar. This can cause a kickback. Felling trees of larger diameter than the chain saw guide bar requires special techniques and should only be attempted by professionals.

Fatigue

Felling and cutting trees is hard work. Operators should be in good physical condition and able to withstand heavy work periods. Persons who fatigue easily may be potential accident victims. Frequent rest breaks for all operators are recommended.

Protective Equipment and Clothing

Wear warm, comfortable, trim-fitting clothing that allows easy movement without causing you to perspire. Protective clothing and equipment includes light nonslip gloves, heavy nonslip work boots (preferably steel-toed), protective leggings and protective eyewear (Figure 2).

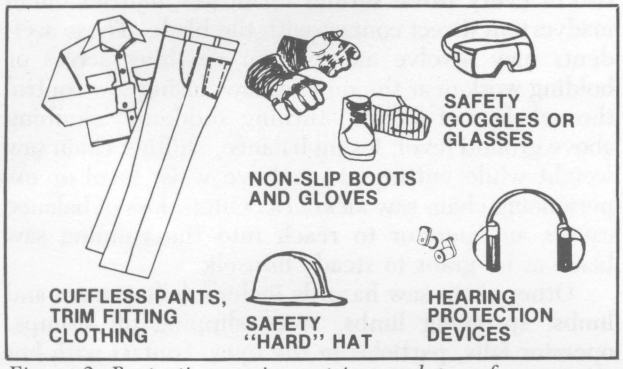

Figure 2. Protective equipment is mandatory for operator safety.

Additional recommended protective equipment includes a safety bump cap or hard hat to prevent head injury from falling branches or limbs and earmuffs or inserts to protect ears from long periods of noise exposure.

Saw Related Back-up Equipment

Shovels and fire extinguishers are recommended near chain saw operations and in some areas required by law. A full 2- to 5-gallon pressure-type garden water sprayer with a medium spray pattern makes a good extinguisher for most conditions. A 2- to 5-pound, class AB, chemical extinguisher also provides the necessary protection. Other back-up tools include wedges (made of either wood, plastic or aluminum) an ax and a sledgehammer (Figure 3).

Choosing a Chain Saw

Gasoline-Powered Saws

Gasoline saws are powerful and available in a range of engine and guide bar sizes. Driven by two-cycle engines, they burn a gasoline-oil mixture which must be prepared by the operator. Gasoline saws are not restricted by electric cords, so they can be used anywhere.

Electric-Powered Saws

Electric-powered saws start instantly, are relatively quiet, have no exhaust fumes or hot muffler, carry no fuel and are generally less expensive than gasoline saws. However, electric saws are limited in size (usually under 14-inch bars) and reach only the length of an extension cord. If you choose an electric saw, select one that has the Underwriters' Laboratory (UL) label, indicating that it has been tested and meets minimum electrical safety standards.

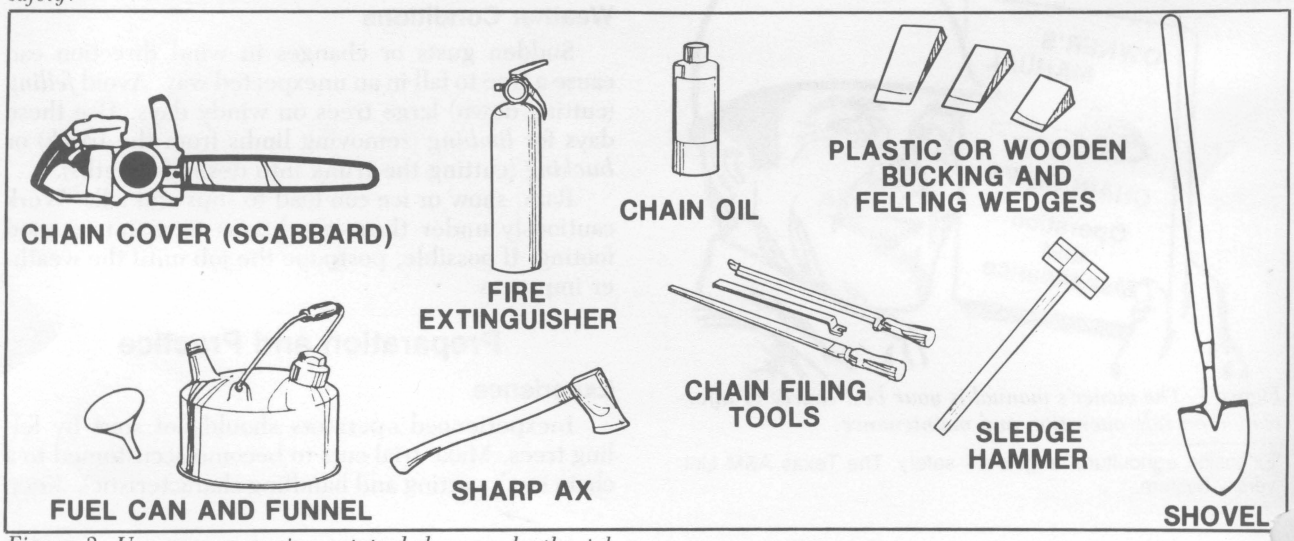

Figure 3. Use proper equipment to help you do the job safely.

Special cautions: Electrically-powered chain saws require special safety precautions. If the saw is not double insulated, use only three-wire extension cords of the proper size with three-pronged plugs and a grounded three-wire outlet. Also, a *ground fault interrupter* in the power line will help prevent fatal shocks.

Also, the soil in the work area should be dry. Avoid working in areas where foliage or the ground is wet. Take care to place the cord where it will not interfere with work, be inadvertently cut or trip someone. Be sure the saw switch is *off* before completing the electrical connection. The saw should always be unplugged before making adjustments and when it is not in use.

Fit the Saw Size to the Job

Lightweight saws require less strength and endurance and cause less strain. However, if too small a saw is used continuously for tough jobs, the operator could lose control by applying excessive force. Similarly, light work with a heavy saw could result in fatigue. These conditions increase risk of injury. Use Table 1 and Figure 4 as a guide to choosing a chain saw.

Table 1. Guide to choosing a chain saw

Type	Guide Bar Length	Recommended Use
Minisaws	6 to 8 inches	Light cutting and pruning.
Lightweights	10 to 12 inches	Usually weighing less than 10 pounds, these saws are best suited for limbing, small-log cutting, pruning and occasionally felling small trees.
Midweights	14 to 18 inches	Usually weighing between 10 and 15 pounds, these saws are recommended for tree felling, limbing and log cutting.
Heavyweights	20 or more inches	Large saws weighing more than 15 pounds with long bars are best used by professionals for heavy cutting of large wood and in felling operations.

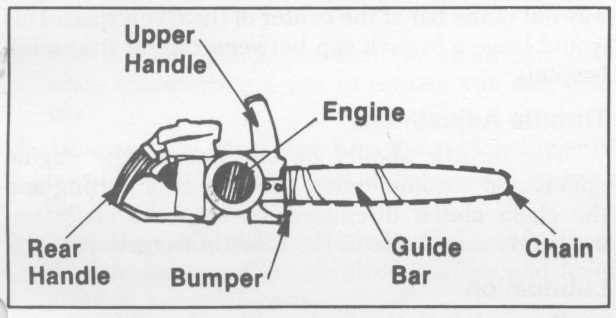

Figure 4. Basic parts of a chain saw.

Check for these safety features:

- Automatic clutch: The saw chain should stop immediately when the throttle is released.
- Balance: Even a heavier, well balanced saw may be more comfortable and less fatiguing than a lighter one which does not balance well.
- Throttle lock: Contributes to safer starting by eliminating the necessity of using one hand to hold the throttle.
- Grip: A soft, nonslip material reduces the chance of losing control of saw.
- Nose guard and antikickback guide bar: Attached to the tip of the guide bar, a nose guard helps prevent kickback. An antikickback guide bar has a smaller radius tip, reducing the area where tip kickback can occur.
- Chain brake: Serving also as a hand guard for the upper chain, the chain brake is designed to help stop the chain in the event of a kickback.
- Spark arrestor: Your saw should be equipped with a muffler directed away from the operator and a spark arrestor, if required by law or for use in dry conditions.
- Step-through handle: This allows you to hold the saw firmly on the ground with your foot for easy, safe starts.
- Vibration-damping handle: Usually consisting of rubber bushings between the handle and the saw body, this feature reduces vibration and prevents fatigue during long cutting sessions. Excessive vibration can cause hands to swell.

Maintenance

Proper maintenance is essential to safe saw operation. This includes sharp saw teeth, correct chain tension, proper lubrication and a well-tuned engine.

For routine maintenance, follow the owner's manual recommendations. Unless you are mechanically inclined, consult the saw dealer or repair shop when mechanical problems arise.

Maintenance Tools

Tools and equipment to help assure continued operation of a chain saw (Figure 3) include:

- Owner's manual in plastic bag
- Gasoline-oil fuel mixture stored in approved container
- Chain oil
- Round file and guide for dressing (sharpening) chain
- Flat file and depth gauge to file the depth guides
- Wrenches to fit all nuts and lugs on the saw
- Screwdriver
- Small brush to clean away sawdust and wood chips from around gas cap and cooling fins

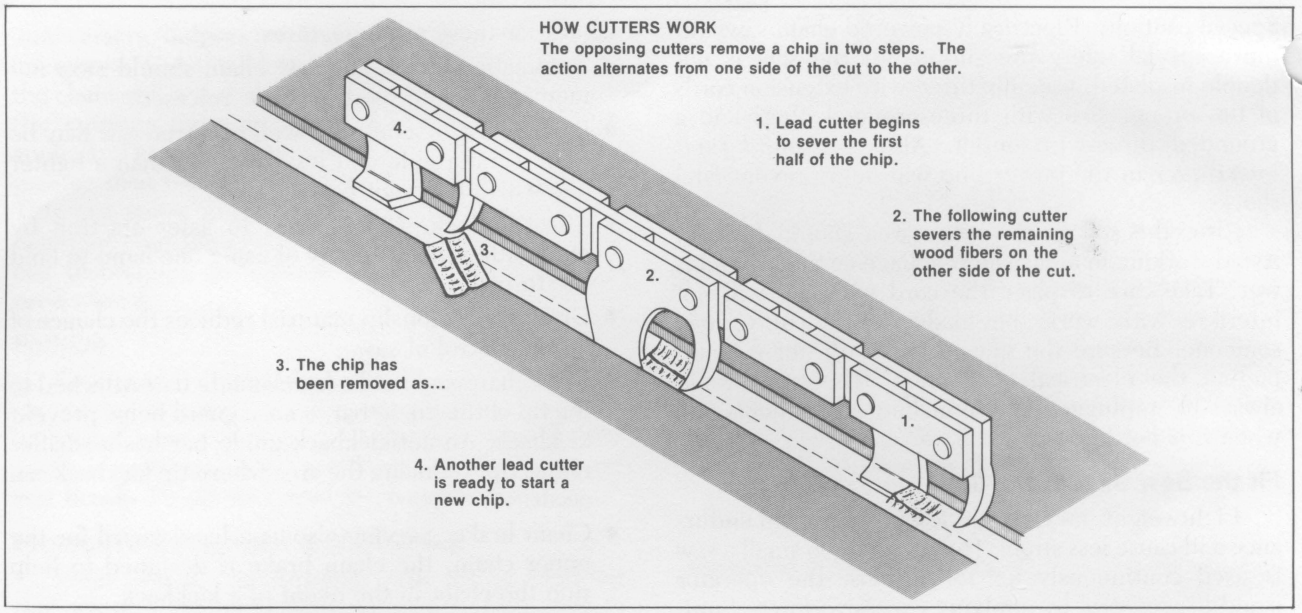

Figure 5. How cutters work.

- Extra spark plug
- Cleaning rags

If you are going to cut a lot of wood, take a spare chain. Alternating chains every day will prolong the life of the sprocket upon which they run.

When to Sharpen a Chain

When a chain saw is properly sharpened, opposing cutters remove a single chip in two steps. The cutting action alternates from one side of the cut and chain to the other (Figure 5). A properly sharpened saw will produce wood chips, not sawdust (Figure 6).

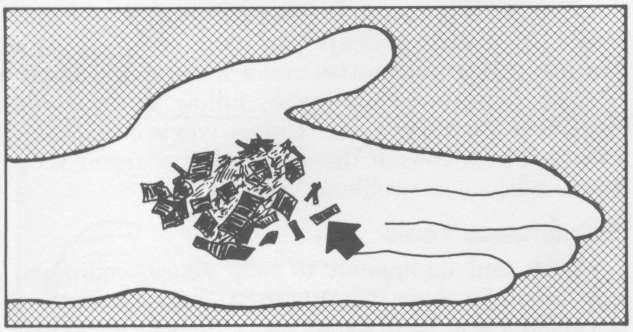

Figure 6. Chainsaw wood chips should be about the size of the chain teeth (arrow). If they are small or powdery, get the chain sharpened.

If the chain cuts a wide groove, walks sideways while cutting or the cut produces fine sawdust, your saw needs sharpening. When chain teeth are dull, you must use more pressure to cut through a piece of wood, increasing the risk of injury to yourself and the saw. Smoke or the smell of burnt wood indicates the chain is dull. If sharpening the chain does not correct a saw that cuts a circular path instead of a straight line, the guide bar track could be worn on one side and should be taken to a repair shop for possible filing and regrooving.

Sharpening a chain is an easy task with proper tools and the owner's instruction manual. Using the proper size file and depth guides specified for the particular chain will assure the proper angle on the cutters and the correct depth filed on the depth gauges. When you sharpen a chain, wear gloves and place a rag over the chain to protect yourself from the sharpened cutters along the length of the chain.

Chain Tension

Too loose a chain will derail with potentially disastrous results. Too tight a chain will bind. Chain tension should be adjusted to insure quick, smooth cutting action and prolong chain life. Follow your owner's manual instructions to adjust chain tension.

A chain stretches with use. Most of this stretch will occur during the first half hour of operation. A cold chain should be tightened so the chain tie straps hang away from the bar rails approximately 1/32 inch at the center of the chain span (Figure 7). A warm chain should be adjusted so the chain hangs about half way out of the bar at the center of the chain span. This would leave a ⅛-inch gap between the tie straps and bar rails.

Throttle Adjustment

The throttle should be adjusted so the engine operates at recommended speed during cutting and the chain clutch disengages to stop the chain immediately on release of the throttle trigger.

Lubrication

Proper lubrication will prolong chain life. During operation, pump the oiler frequently. Also, periodi-

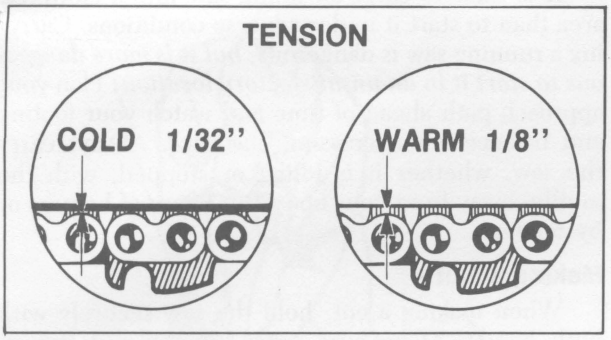

Figure 7. Correct chain tension is very important to insure good cutting action and long chain life.

cally stop the engine and pump the oiler while pulling the saw chain around with a gloved hand. This will insure even oiling of the chain. Unplug electric saws and disconnect the gasoline saw spark plug wire when doing this.

On saws with automatic chain oilers, adjust the oiler properly so it does not over oil and run dry between refueling stops. Even automatic oilers need an extra squirt occasionally to insure proper chain lubrication. Smoke while the chain is operating indicates not enough oil.

Occasionally, the oiling mechanism plugs up and causes serious damage to the saw if not corrected. To check for chain oiling, hold the saw tip above a light colored, dry surface and rev the engine. Oil should spatter on the surface if the oiler is operating properly. If it does not, remove the guide bar and check the chain oil discharge slot.

During cold weather, you can dilute the oil with kerosene to insure even lubrication. You will need to lubricate the chain twice as often when using this mixture. When the chain is not being used, keep it soaking in a can of oil.

Additional tips for chain saw care are:

1) Proper tension and lubrication are crucial when a new chain is being broken in. Never break in a saw chain under a heavy cutting load. Improper break-in procedures can quickly ruin a new chain. To insure long chain life, carefully follow the manufacturer's recommendations for proper break-in procedures.
2) Use a chain guard, scabbard or chain saw case when transporting a saw to protect you and your saw.
3) After each full day of use, turn the guidebar over (if possible with your saw design) to equalize wear on the bar rails.
4) Keep the entire unit well oiled and cleaned. Clean the bar grooves, fins, air filter, muffler and hand grips on a regular basis.
5) Inspect the entire unit regularly. Replace damaged or worn parts.

Operating Techniques

Fire Precautions

Fire hazards with chain saws are numerous. Periods of hot, dry weather make leaves and grass a serious fire hazard. Working where fire danger is high demands extreme caution. Take care when mixing or handling fuel and during refueling to prevent spillage.

Keep the engine head and muffler from coming in contact with dry leaves, needles or sawdust. Brush sawdust from the engine regularly. Oily sawdust accumulations can easily ignite. Hot exhaust sparks directed into dry tinder can start a fire, as can sparks caused by the chain striking a stone or piece of metal.

Figure 8. Refuel on bare ground to reduce the fire hazard.

Refueling

Mix fuel according to instructions in your owner's manual. Store and transport fuel in a properly labeled, approved fuel container. Wait a few minutes after the saw is stopped to allow it to cool before refueling. Use this time for a rest break. Take the saw to a clear area away from combustibles (Figure 8). Gradually release any pressure buildup in the tank as you slowly open the filler cap. Use proper funnels and spouts to prevent spills and pour from a small, easily handled fuel can. Leave a small fuel expansion space in the saw tank. If fuel is spilled, thoroughly clean the engine before starting. Gasoline vapor cannot be seen, but is easily ignited. Never smoke while refueling or refuel a saw near sources of ignition, such as in an enclosed area where a pilot light might exist.

Before starting the engine, fill chain oil reservoir and check the chain oiler, air filter and cooling mechanism for possible blockage. Check the chain tension and adjust if necessary. Recheck chain tension between refuelings. In addition, check tightness of all bolts, nuts and screws because they often loosen during operation.

Starting the Engine

Move at least 10 feet away from refueling location before starting saw. Ideally, choose a clear, level surface as close to the work area as possible. The safest way to start a saw is to place the saw on the ground and hold it firmly with one foot placed through the rear handle, if space allows. Grip the front handle at the top of the saw with your thumb wrapped under the handle and pull the starter rope with the other hand after starting controls have been properly set (Figure 9). Starting a saw while holding it with one hand from a standing position does not allow proper control and should be attempted only upon recommendation of the manufacturer. Never permit another person to assist in starting. If the saw shifts or either person slips or lets go, someone could be injured.

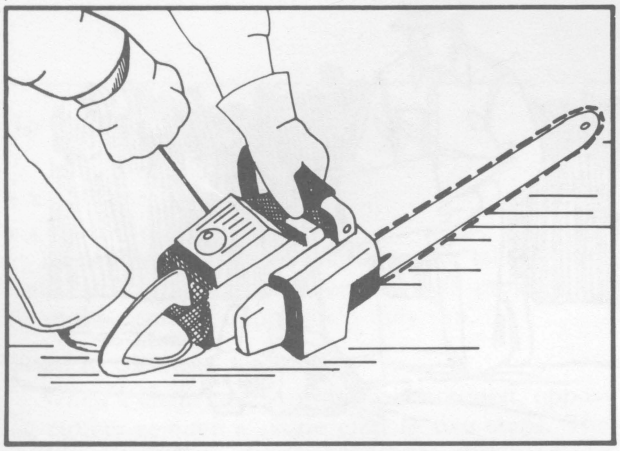

Figure 9A. When starting a medium or large chain saw, make sure that one foot is firmly placed in the handle. Grasp the saw handle firmly with one hand, making sure the starter rope is pulled firmly straight backward.

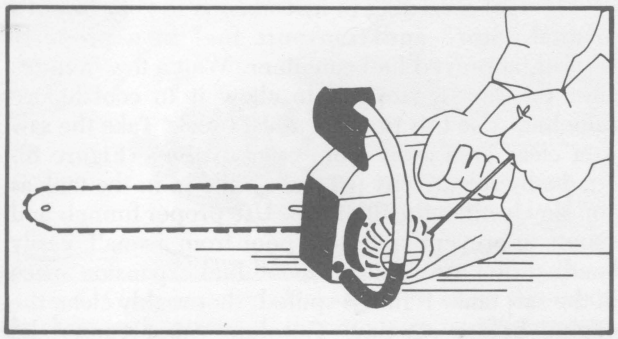

Figure 9B. Hold small chain saws firmly on the ground with one hand when starting. Pull the starter rope straight back with a firm, short pull. Do not jerk. This could cause the saw to turn sideways, especially on a wet or slippery surface.

Pull the starter rope as briskly as you can to give the engine a rapid spin. Do not yank the cord to the end because this could damage the starter mechanism. Also, hold the cord grip and let the starter cord rewind evenly instead of letting it snap back.

It is safer to carry an idling saw into a cluttered area than to start it under adverse conditions. Carrying a running saw is dangerous, *but it is more dangerous to start it in an unsatisfactory location*. Plan your approach path ahead of time and watch your footing and balance when crossing obstacles. Always carry the saw, whether it is idling or stopped, with the muffler away from your body. Be aware of helpers or bystanders.

Making a Cut

When making a cut, hold the saw securely with both hands. Make sure your thumbs and fingers encircle the saw handles. Wrap your thumb under the top handle to keep your hand from slipping into the chain (Figure 10).

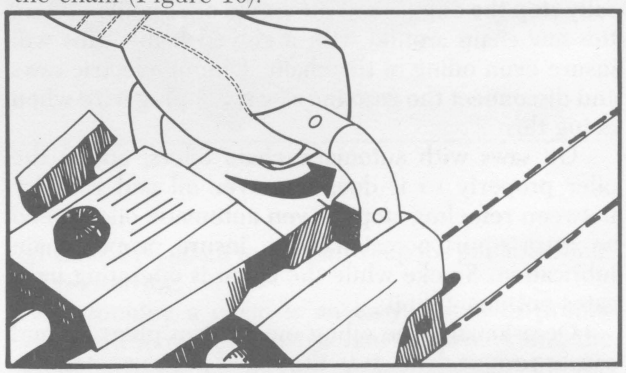

Figure 10. Keep your thumb (arrow) wrapped around the bottom side of the chain saw handle at all times. This will prevent your hand from possibly slipping onto the blade during operation.

While cutting, hold the saw as close to your body as possible to provide maximum control. Try not to work with arms extended. Place one foot comfortably behind the other to provide a firm footing for maximum balance. Quick or controlled movements are difficult with locked knees and elbows, so work with knees flexed and elbows bent whenever possible.

Operate the saw to the side of your body so it will not swing into you if it suddenly kicks back, comes out of the cut or cuts through unexpectedly. Correct cutting position is illustrated in Figure 11. Avoid cutting at chest height or above as you can easily lose control upon completion of the cut and risk the saw swinging into your body.

Cut with the lower part of the saw blade. This is the safest and least tiring position. If you cut with the top of the saw, the risk of kickback is greatly increased. Keep the bumper against the wood when cutting with the lower side of the saw. Guide or rotate the saw into the wood. Do not twist the guide bar. Keep the guide bar in the middle of the cut (kerf), left to right, so cutters on opposite sides of guide bar do not bind.

A wide kerf, fine sawdust instead of chips, or a need to use force indicates sharpening is due. A crooked kerf may be caused by sharper cutters on one side of the chain. Do not allow a running chain to

Figure 11. Keep your body to the left of the cutting plane.

contact the ground or metal; one such contact can dull the chain more than cutting dozens of trees.

Be sure your work area is free of obstacles and tripping hazards.

Beware of Kickback

Causes of Kickback

In kickback, the upper chain or the chain at the nose of the guide bar grabs in the wood, in an obstruction or in an adjacent object, suddenly and forcefully pushing the saw backward toward the operator. This action can cause even an experienced operator to lose control of the saw or lose his balance, resulting in direct body contact with the moving saw blade.

If the upper chain is involved, the saw will be forced straight back at the operator. If the upper part of the guide bar nose is involved, such as when it might contact a hidden limb in front of the saw, the saw will be forced in an upward arc that swings back toward the operator. These and other causes of kickback are illustrated in Figure 12. Kickback is also enhanced by a chain that is misfiled or loose or by a slow chain.

Additional kickback warning signs include the buildup of damp sawdust and abrupt changes in wood characteristics such as the presence of knots or cutting from dry to green wood.

Preventing Kickback

Studies show kickback is responsible for approximately one-third of all serious chain saw injuries each year. To avoid kickback, take these precautions:

- Keep a firm, two-hand grip on the saw.
- Grip the top handle with the thumb under and around it (Figure 10).
- Never stand directly in back of a cut. Stand to the side of the cut as shown in Figure 11. When limbing, stand on the opposite side of the tree trunk from the cut (Figure 13).
- Saw only with the bottom part of the chain, close to the bumper.
- Never cut with the nose of the chain.

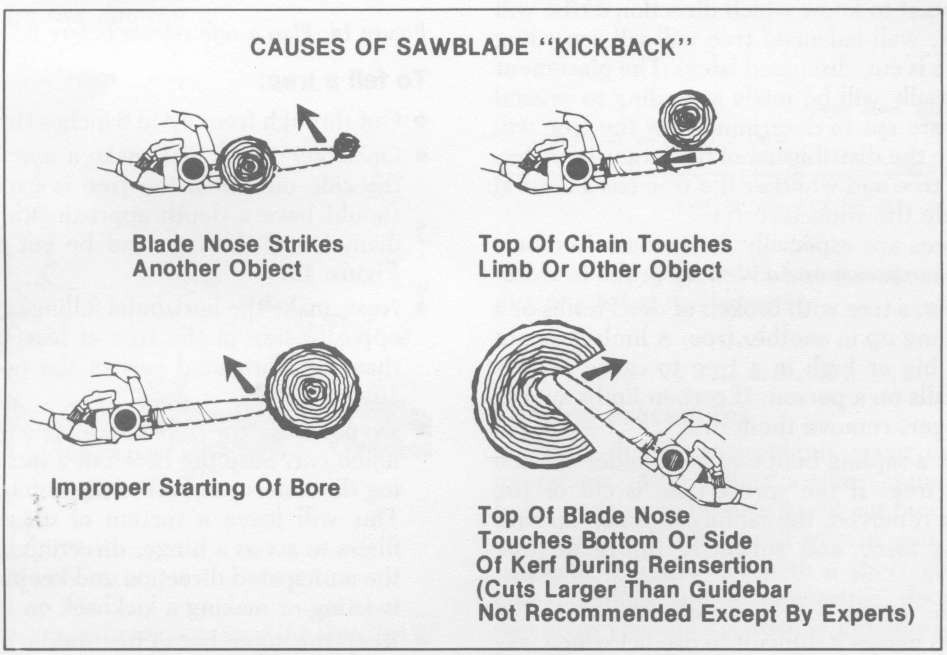

Figure 12.

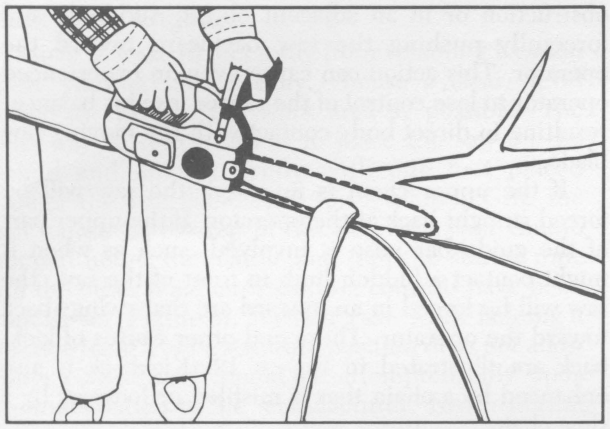

Figure 13. Whenever possible, keep the tree trunk or similar barrier between yourself and the saw blade. This precaution may prevent an accident should the saw strike an object that causes it to jump or suddenly slip.

- Watch for obstructions, limbs or twigs that could inadvertently catch the upper chain or the nose of the saw.
- Maintain high saw speed when entering or leaving a cut.
- Do not allow the bar to be pinched in a cut or twist the bar while cutting.
- Saw only at waist level and below. Do not cut at chest level or above.
- Keep the chain properly sharpened and tensioned.
- Choose a saw with a chain brake, nose guard, antikickback chain and guide bar and other antikickback devices.

Evaluating or "Sizing-up" Trees

It is important to know which direction a tree will fall. A straight, well-balanced tree will fall according to how the tree is cut (discussed later). The placement of saw cuts usually will be made according to several factors which are apt to determine how the tree will fall. First, note the distribution of the larger branches or bulk of the tree and whether the tree has a natural lean. Also, note the wind direction.

Certain trees are especially dangerous. Lumberjacks use these expressions to identify problem trees:

- Widowmaker: a tree with broken or dead limbs or a dead tree hung up in another tree. A limb does not have to be big or high in a tree to cause serious injury if it falls on a person. If certain limbs appear to be a danger, remove them first.
- Spring pole: a sapling bent and held under tension by another tree. If the spring pole is cut or the other tree is removed, the sapling can snap up with tremendous force and seriously injure anyone nearby.
- Schoolmarm: a tree with a prominent fork in the trunk, which makes it difficult to predict which way it will fall.

Felling trees

Only after you have mastered steady, even cutting should you attempt to fell a tree.

Be sure you have a clear area around the tree in which to work and an open pathway for an escape route. Remove underbrush and other obstructions. Clear nearby timber from the exhaust discharge area. Remove low, interfering branches and any loose or dead limbs. These precautions provide clear vision, unrestricted movement and an unhampered escape route when the tree begins to fall.

Plan your escape to the side and to the rear, depending on the anticipated direction of fall (Figure 14). Plan to shut the saw off and place it on the ground in a safe place when the tree starts to fall, allowing you to escape freely.

Also, check the saw fuel and oil supply before starting a felling operation requiring a long running period.

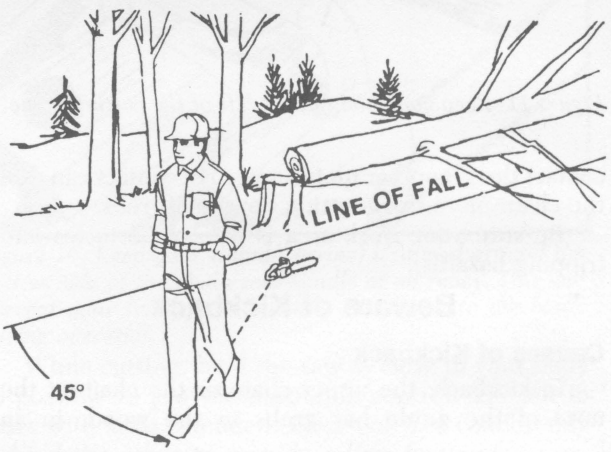

Figure 14. Plan a safe retreat before felling a tree.

To fell a tree:

- Cut through trees up to 6 inches thick with one cut.
- On larger trees, first make a *notch* in the tree on the side on which the tree is expected to fall. It should have a depth approximately one-third the diameter of the tree and be cut as illustrated in Figure 15.
- Next, make the horizontal felling or back cut on the opposite side of the tree at least 2 inches higher than the horizontal part of the notch cut (Figure 15).
- Do not make the back cut deep enough to meet the notch cut. Stop the back cut 2 inches before meeting the innermost part of the notch cut (Figure 15). This will leave a section of uncut vertical wood fibers to act as a hinge, directing the tree to fall in the anticipated direction and keeping the tree from twisting or making a kickback on the stump.
- Keep the guide bar in the middle of the kerf so the cutters moving on the top groove of the guide bar

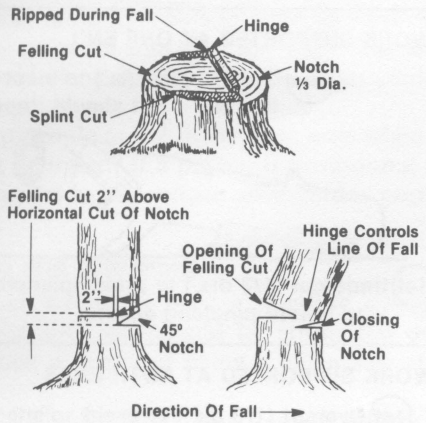

Figure 15. Tree fall direction can be closely controlled with properly made notching and felling cuts. When felling coniferous trees during summer months, it is desirable to make splint cuts about 2 inches deep on both sides of tree at right angles to notch and in same plane as felling cut to prevent splintering.

will not recut the wood. Do not twist the guide bar in the cut. Guide the saw into the tree — do not force it. The rate of feed will depend on the size and type of timber.

- Remove the saw and shut it off before the tree falls. Do not rush, but move deliberately. Do not cut through the hinge because this could cause the tree to fall in any direction, possibly on the retreating operator. Move away from the tree through the previously cleared retreat lane.

A binding saw and closing kerf indicate an error. At the first indication, remove the saw. If the saw cannot be removed, do not struggle with it. Shut the engine off and plan a course of action using wedges to remove the saw. Use only wood, aluminum or plastic wedges to prevent saw damage.

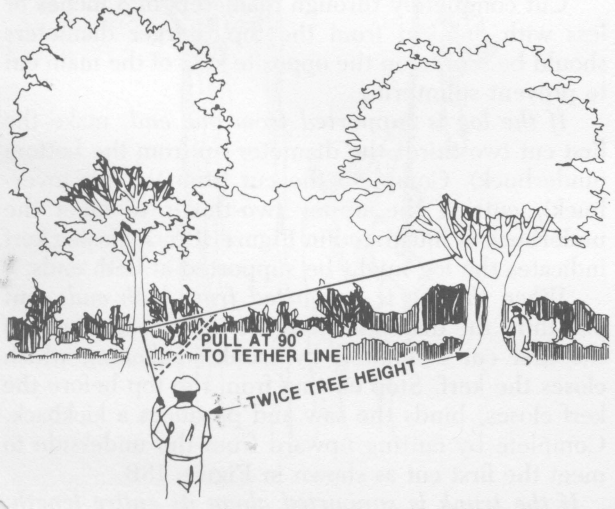

Figure 16. Use a pulley and rope to control the direction of a fall.

Using Wedges and Ropes

A well balanced tree may have to be wedged, pulled or pushed in the desired fall direction. Wedges or ropes also may be required on windy days or for leaning trees where direction of fall is critical.

Wedges are the most dependable means of providing positive tree fall directional control. Ropes are not as practical or dependable for directing fall because they must be very long or rigged through a pulley (Figure 16) and the progress of the tree may start in the wrong direction as rope fibers stretch. Also, continuous tension must be maintained on the rope as the tree falls to prevent the tree from swinging to the left or right of the direction of pull. The helper must be in a safe position, be attentive and skillful at his job and coordinate his every move with the saw operator.

Two wedges should be used to insure the desired directions of tree fall. When the final back cut is made to the proper depth for felling the tree, remove the saw. Shut it off and move it to a safe position. Then place the wedges evenly along the back cut and tap them alternately with a sledge hammer or mall to fell the tree. Strike wedges squarely with firm but not excessively forceful blows. Careless blows could pop wedges out, swinging the tree backward. Never use an axehead as a wedge or driver.

If you place wedges in a cut before sawing is completed, the chain could strike a wedge and hurtle it forcefully enough to cause injury.

A push pole is often useful for directing the fall of small trees. A spike pole, as illustrated in Figure 17, should be used rather than a stick. The helper must be in a position to control the pole when the tree falls, applying continuous pressure until the fall is underway.

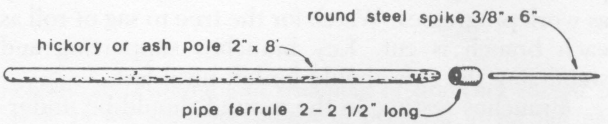

Figure 17. A push pole is very simple to make and useful for directing fall of smaller trees.

Limbing Procedures

Most chain saw accidents occur during limbing operations. After felling a tree, examine each limb before cutting to be sure it will not bind the guide bar or cause the trunk to roll toward you. For limbing, use a lightweight saw with a short guide bar. This eases holding and maneuvering, decreases fatigue and gives you more control in possible kickback situations.

Stand at such an angle when limbing that if the saw suddenly cuts through or slips, it will not swing down and strike your legs. If possible, an operator should saw limbs on the opposite side of the trunk from where he is standing, using the trunk as a barrier between his body and the saw (Figure 13). Avoid reaching to cut. Always maintain good footing and a balanced position. Awkward positions or sawing in front of the body invite disaster.

Make first cuts on limbs closest to the base of the tree and on top of the trunk as it lies on the ground. Limbs should be cut on top of the trunk as much as possible before removing those resting on the ground (Figure 18). Branches should be cut so they fall away from the kerf; that is, the kerf tends to open rather than close, binding the saw. Move with extreme caution while cutting because a saw operator will be surrounded by previously cut limbs which cause poor footing as cutting proceeds.

Removing heavy branches from the top side of the trunk can cause the tree to shift. Removing a heavy side limb also can allow branches below to spring up, turning the tree.

Clear the work area periodically to keep it from becoming cluttered and hazardous. The saw should be shut off and put in a safe place while you are clearing branches. Never attempt to hold the saw with one hand while clearing limbs with the other.

Large and small branches should be removed as work proceeds up the trunk. Leaving small limbs can be hazardous. They obstruct vision, block cutting and can cause kickbacks if inadvertently struck with the top of the chain or nose of the guide bar. Use extra caution when cutting small diameter limbs. The slender material can catch in the saw and whip toward the operator or pull him off balance. Always cut small limbs with the saw at full speed to prevent kickback.

Cutting bottom branches on the ground to improve working conditions underfoot may be necessary as work progresses. Watch for the tree to sag or roll as each branch is cut. Key branches supporting and stabilizing the tree should be left until last.

Branches resting on the ground should be undercut from beneath. Use extreme care when undercutting with the top of the saw blade. Keep a firm two-hand grip, keep engine speed up and watch for a closing kerf which signals probable kickback.

The possibility of the tree rolling increases as branches are removed. Final supporting branches can be saved to facilitate bucking if they stabilize the tree firmly from rolling.

Bucking Procedures

Bucking or cutting the trunk into desired lengths is less hazardous than other saw tasks. However, special hazards of bucking include unexpected log roll, falling wood sections and kickback.

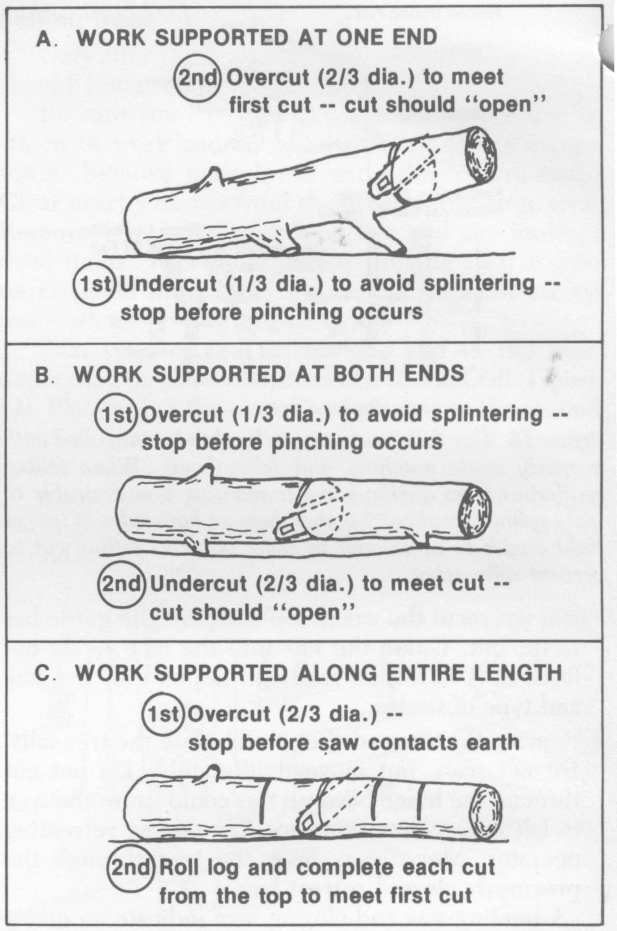

Figure 18. Use these bucking procedures for safety.

First cuts on large trunks should be made on the upper spike, end section, usually freely supported off the ground by the butt end.

Cut completely through diameters of 8 inches or less with one cut from the top. Larger diameters should be *scored* on the opposite side of the main cut to prevent splintering.

If the log is supported from one end, make the first cut two-thirds the diameter up from the bottom (underbuck). Complete the cut from the top (overbuck), cutting the upper two-thirds to meet the underbuck as illustrated in Figure 18A. A closing kerf indicates the log might be supported at both ends.

When the log is supported from both ends, cut one-third the diameter from the top. Here, depth of the first cut is limited by trunk weakening which closes the kerf. Stop cutting from the top before the kerf closes, binds the saw and produces a kickback. Complete by cutting upward from the underside to meet the first cut as shown in Figure 18B.

If the trunk is supported along its entire length make cuts from the top two-thirds the diameter deep along the full length of the log (Figure 18C). Then roll

it over and make final cuts to meet the first cuts. This not only prevents pinching the guide bar and chain but should prevent chain damage from contact with the ground.

Keep people out of the cutting area when the saw is being operated. If a person is positioning wood or removing cut wood, remain aware of his position and activity.

Pruning and Trimming

Branch trimming from a standing tree presents special hazards and should be attempted only after experience is acquired using a chain saw at ground level.

Use a sturdy ladder long enough so you will not have to cut above waist level. Position it so excessive reaching will not be necessary. Move the ladder often to allow you to reach the work comfortably. Secure the ladder to the tree. Because a chain saw requires the use of both hands, it is best to wear a safety belt or otherwise tie yourself securely around the tree to prevent a fall, even at low heights.

Do not carry a running saw while climbing a ladder. Instead, use a rope to hoist the saw (Figure 19). You must have a secure position on the ladder to start a saw above ground level. Hoisting a running saw is hazardous, but is preferable to climbing a ladder with a running saw or starting a saw from an insecure position. Have a helper assist in hoisting the saw and steadying the ladder.

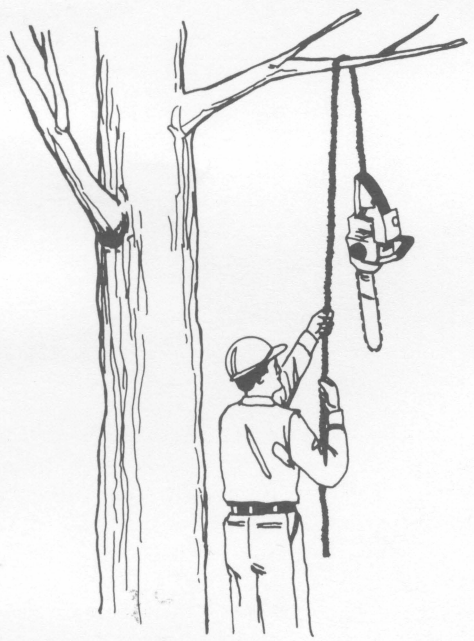

Figure 19. When removing a limb on a standing tree, hoist the saw with a rope. Don't carry the saw while climbing.

Always keep a firm grip on the saw with both hands when trimming. Control the saw at all times. Do not let it fall through a cut or it may strike your legs or other objects. Position the ladder where you will always work with the saw on your right side and work around a tree to the right.

Large branches should be undercut with care to avoid kickback, prevent splintering and direct their fall. Small branches should be underscored. Make this first undercut 6 to 10 inches from the trunk or supporting branch. To remove the limb, make a top cut above the undercut about 2 inches further out on the limb. After the limb falls, trim the stub close to the trunk as illustrated in Figure 20.

Pruning small limbs and trimming branch ends are more safely performed with topping shears or a small handsaw.

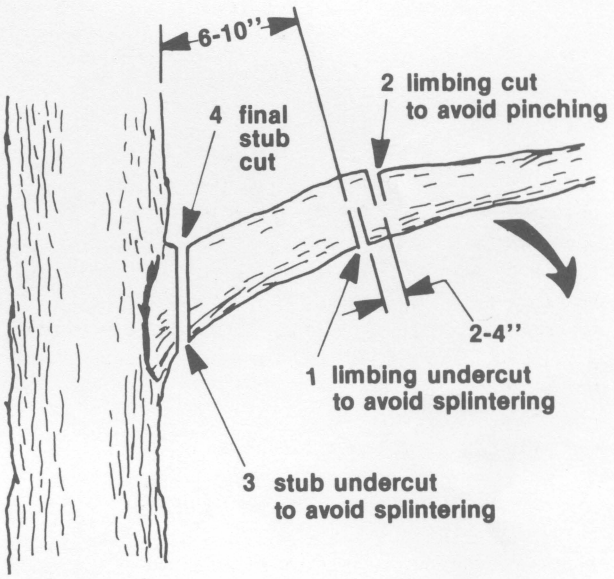

Figure 20. Pruning and trimming of branches should be done in the sequence shown to properly direct fall and avoid peeling trunk bark.

Transport and Storage

Transport a saw level with the gas cap up so the saw cannot tip and spill fuel. Avoid carrying the saw in a vehicle's passenger area. Protect yourself and the chain with a chain guard or a carrying case.

For storage, drain the fuel tank in a safe area and run the engine at idle until it stops. Remove the chain and store it in a container of oil. Disconnect the spark plug on gasoline models to reduce the possibility of accidental starting. Follow the owner's manual for cleaning and lubricating. Place the saw out of the reach of children.

Gasohol and Small Engines

According to a major small engine manufacturer, gasohol as a fuel source for small engines is not recommended because of possible damage to certain gaskets, seals, hoses and packings. Also, overall engine life was reported to be severely decreased.

Check with an authorized dealer or contact the manufacturer of your brand of small engine concerning the advisability of using gasohol as a gasoline substitute.

Chain Saws and Youth Under Sixteen

The Department of Labor has ruled that certain occupations are particularly hazardous for youth under age 16. The Hazardous Occupations Order forbids persons under 16 to operate, adjust or clean a chain saw or any power-driven saw. They also are forbidden to work from a ladder at a height of more than 20 feet and to be involved in any operations related to felling, bucking, skidding, loading or unloading of timber with a butt diameter of more than 6 inches. This order does not apply to youths working on land owned or operated by their parents or legal guardians. In such cases, activity should be limited to the youth's recognized skill level.

Educational programs conducted by the Texas Agricultural Extension Service serve people of all ages regardless of socioeconomic level, race, color, sex, religion or national origin.

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