

Chainsaw Safety

Using a chainsaw can be very dangerous and it is your responsibility to read and follow the operator's manual. The following information is a collection of material to assist you with operating your chainsaw but it is not a complete list of everything that you need to follow to safely operate a chainsaw. All chainsaw operators must follow the [DNCR Chainsaw policy](#) while on DNCR property.

Some of the important steps to follow are:

- 1) Never work alone
- 2) Develop a work plan and follow it.
- 3) Use a properly maintained saw and keep the chain sharp.
- 4) Wear all of your personal protective equipment (PPE's); a hard hat with ear and eye protection & face screen, long pants, chainsaw safety chaps that extend from the waist to the top of the boot, and safety toe boots. All PPE's for every cut every time.
- 5) When preparing to cut a tree; remember the five fingers to success:
 - a. Hazards
 - b. Lean in 2 directions
 - c. Escape
 - d. Hinge size
 - e. Plan

Plan to have a safe cutting experience and do not cut beyond your ability. Hire a professional Arborist to cut the dangerous trees. Start safe, work safe, and you will go home safe.

Personal Protective Equipment (PPE)

Required (*every time you operate a chainsaw on DNCR Property*)

1. **Helmet** – With a six-point harness system, Ultraviolet (UV) degrades the plastic over time. A regularly used helmet should be replaced every 3 to 5 years. Hard hats should also be marked for when they went into service. If a helmet takes a big hit or is damaged in any way, it should be retired immediately. **Do not** paint or alter hard hats.
2. **Eye Protection** – must be used whenever hazards from flying particles exist (i.e. any time sawyers (chainsaw operators) are operating the saw). Face screens or rated safety glasses are the most common options.
3. **Hearing Protection** – This may be muffs or plugs. Hearing protection should always be in place prior to starting the chainsaw.
4. **Leg Protection** – must meet or exceed [ASTM F1897-14](#) standards. Most leg protection materials are made of kevlar, polyester, or nylon. They should wrap around the lower leg, and

cover the tops of your boots. All leg protective garments should be replaced if they have been cut with the saw. Chainsaw chaps are the most common form of leg protection.

5. **Boots** — A composite-toed or steel-toed boots. Chainsaw operators should consider calk soles for non-slip footwear

6. **1st Aid kit** - should have some sort of way to stop major bleeding. Preferably it should be on your person if possible or nearby and easily accessible.

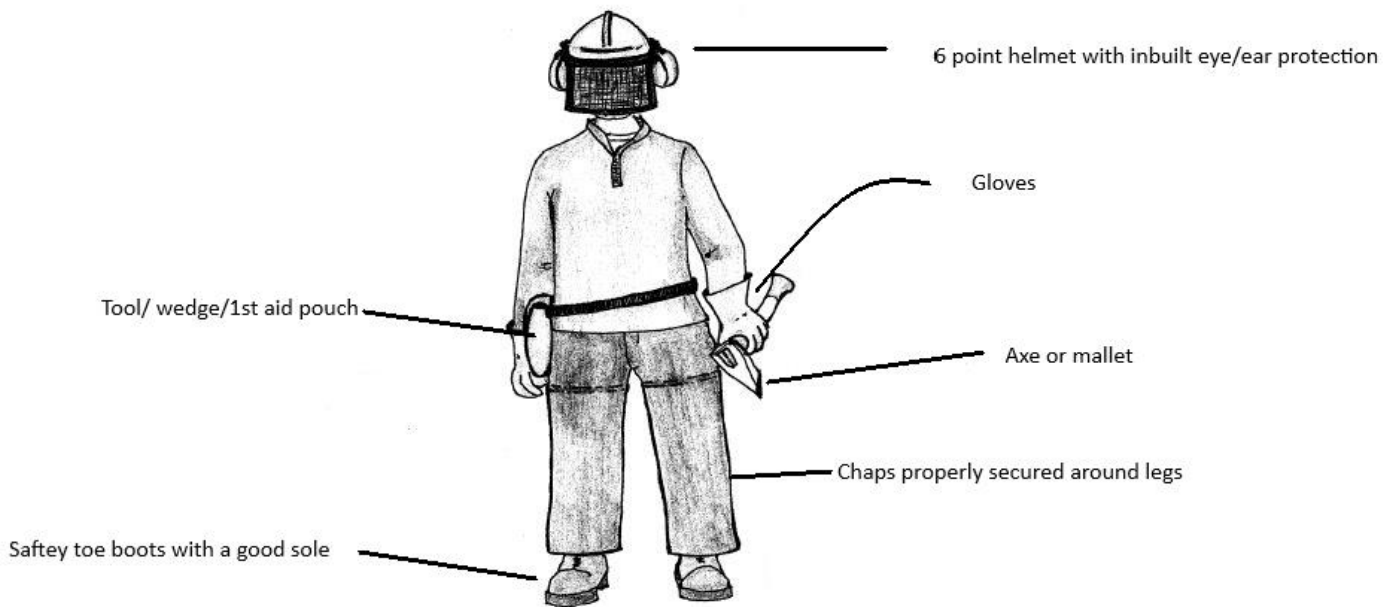
Suggested

7. **Gloves** — an extra barrier to protect your hand from cuts and scrapes while operating the saw.

8. **Tool Belt** — an easy way to carry wedges, first aid kit, and tools needed to maintain a saw.

9. **Axe or Mallet** — Needed to drive wedges. An axe is also useful to cut the chain out should it become pinched.

Figure 1: example of a sawyer wearing proper PPE



PPE Retirement

PPE ages and over time will need replacement. Helmets should be replaced when damaged or after 3 to 5 years of heavy use. Chaps need to be replaced upon damage which includes buckles if they start to go missing. All retired PPE should be modified so they can't be worn before they are thrown out.

Required Safety Features

All chainsaws have 5 required safety features in order to be used (see figure 2).

- 1) Antivibration Mount
- 2) Chain brake
- 3) Chain catch peg
- 4) Throttle interlock system
- 5) Rear hand guard

Figure 2: location of features on a chainsaw
(Credit: Google)



Daily Safety Check

Before using a saw, one should always do a daily safety Check by reviewing the following on your saw:

- 1) Chain brake
- 2) Throttle interlock
- 3) Chain catch
- 4) Screws and bolts tight
- 5) Muffle and spark arrester and air filter secure

Maintaining and starting a chainsaw

As all saws are different, please make sure to reference and read your owner's manual on how to properly start and care for your specific chainsaw. Most owners' manuals may also be found online for free.

How does a Chainsaw cut

A chain works by pushing and pulling. Pushing refers to the force exerted when the chain rotates away from the power head, pushing the chainsaw away from the object it's cutting, while pulling refers to the force when the chain rotates towards the power head, pulling the chainsaw towards the cutting surface. When cutting on the top of a log, the chain is "pushing" the saw away, and when cutting on the bottom, the chain is "pulling" the saw towards the operator (see figure 3 for diagram).

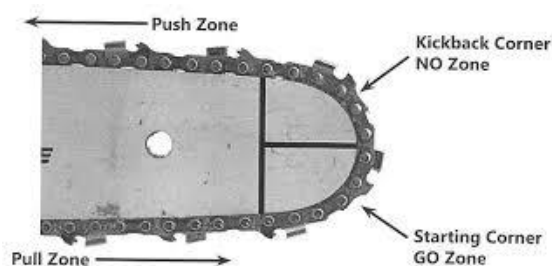


Figure 3: chainsaw bar diagram showing how a chain works
(Credit: Google)

The kickback corner is the area in which the chain slightly leaves the bar as it rounds the corner, while the starting corner is where the comes back into the bar. It is also the area where the sawyer will start most bore/plunge cuts.

Kickback

Kickback by definition is the sudden, upward motion of a chainsaw's guide bar. It is one of the most common causes of chain saw accidents. If proper cutting techniques are not followed, kickback may happen and can be very dangerous and may result in serious injury.

There are two situations that can cause kickback when using a chainsaw. These two situations can be caused by multiple ways. The first is when the moving chain at the tip/nose of the guide bar strikes an object. The second is when the wood closes in, pinching the saw chain in the middle of the cut. Both of these situations cause the chain saw's guide bar to launch (kick) up and back, which may cause the user to lose control of the saw possibly resulting in injury to themselves or others.

Posture

When cutting with a saw a sawyer should stand with a straight back, hold the saw close to there body, and keep their feet firmly planted. While holding a chainsaw make sure it is with both hands, wrapping ones thumbs and fingers around the handles.

Bars, Chains, and Fuels

Bar and chains

Chainsaw bars come in different sizes but the information for all bars normally can be located in the corner of the bar. A bar is broken into four parts; Bar length, Drive links, Gauge, and Pitch (see figure 4 below credit Oregon Tool Inc.).

- Bar length: is how far the bar sticks out past the saw.
- Drive links: are the links that sit in the bar and are counted by the total amount within the whole chain.
- Gauge: is the with of the groove within the bar. 0.50 and 0.58 are the most common.
- Pitch: is the distance between the rivets in inches divided by 2. The most common pitched or 3/8 LP (small home owner) .325(< 50cc) and 3/8 (> 50cc).

Figure 4: how to find a proper chain by Oregon Tools Inc.

OREGON

FIND THE RIGHT CHAIN.

YOUR TAILMOUNT MAY HAVE ALL THE INFO YOU NEED.

1 BAR LENGTH
SIMPLY MEASURE EXPOSED BAR

$17\text{-}1/2'' = 18''$
Round up to nearest even number.

2 DRIVE LINKS
COUNT ALL LINKS ON EXISTING CHAIN

One Drive Link 1 2 3 4... = 62

3 GAUGE
FIND A COIN THAT FITS THE GROOVE

$.063$ $.058$
 $.050$ Less than $.043$

4 PITCH
DIVIDE 3 RIVET'S DISTANCE BY 2

COMMON SIZES:
.325", 3/8" LP, 3/8", 1/4"

NOTE:
3/8" is typically for saws $\geq 50\text{cc}$
and 3/8" LP is for smaller saws.

Fuel

The vast majority of all gas-powered saws run on a 50:1 fuel to oil mix, but some saws do run on 40:1. Your owner's manual can easily verify your saws fuel to oil ratio. You can mix your fuel yourself using a high-octane gas or you can purchase your fuel premixed. This would not pertain to an electric chainsaw (Note: that at this time DNCR does not allow the use of electric chainsaws on DNCR properties).

Bar oil

Bar oil acts as a lubricant for the chain itself by reducing friction between the chain and the guide bar as it cuts which prevents overheating and minimizes wear and tear on the chain and bar. Bar oil usually comes in summer, winter, and all-season mixes. The summer and all-season mixes are usually thicker and tackier compared to winter mixes which is thinner to reduce thickening in winter conditions.

Other Tools to have when using a Chainsaw

Felling lever

A felling lever is a tool used in tree felling (cutting down trees) that helps control the direction of the falling tree by providing additional leverage. It essentially acts as a mechanical aid to guide the tree's fall by applying pressure at a specific point after the initial cuts are made. Most levers also have an inbuilt hook that can assist in the rolling of logs or a tree.

Felling wedges

A felling wedge is used in tree felling to help control the direction a tree falls by physically lifting it in the desired direction, essentially preventing the tree from pinching the chainsaw during the back cut and ensuring it falls where intended. They are particularly useful for trees with back lean (leaning against the desired felling direction).

Axes, mallets, and handsaws

Though a mallet can work for pounding wedges into a tree, an axe is more commonly used as it can also be used for limbing or for getting ones saw unstuck.

A handsaw is a great safety addition as it can be used to remove branches that are bit too high to safely cut with a chainsaw, but would be in the way of felling or bucking (cutting a felled and delimbed tree) up a tree.

Rope

Traditionally a bull rope is a strong, durable rope used for rigging and tree work. It's often used to move tree limbs and branches, secure limbs, and pull-down trees.

Situational Awareness

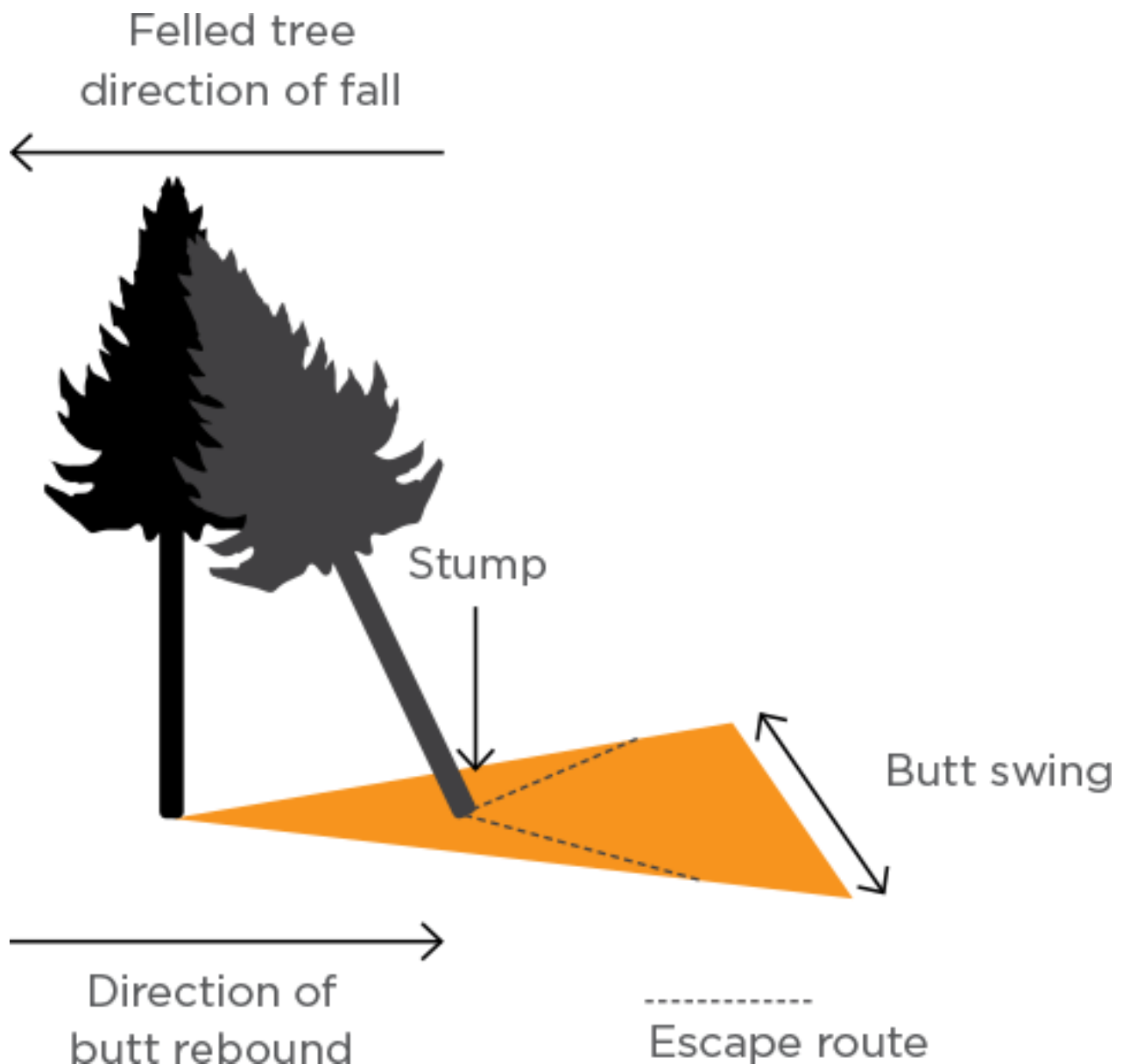
Hazards

Using a chainsaw can be dangerous if safety precautions are not followed. By identifying hazards, sawyers can reduce the risk to themselves and to others. Hazards are both above and below (above - overhead hazards, below - eye level to the ground hazards). Some common hazards are kickback, falling debris, stump jumps, tripping and slipping, flying debris, environment, heat, weather, people, cars, powerlines, buildings, and user experience.

Escape Route

The escape route is the path one takes when getting away from the tree they just felled. The escape route should be 45° away from the direction of fall of a tree. All hazards should be removed from this route prior to starting the tree felling process. When walking away from the tree a sawyer should not fully turn their back to it. They should always keep their eyes on it as it falls. The reason they escape 45° from the tree is because it is both away from the direction of fall and it also reduces the chances of being hit if the tree were to snap back or “butt swing” (when a tree kick back/ jumps off of the stump).

Figure 5: visual diagram of a proper escape route



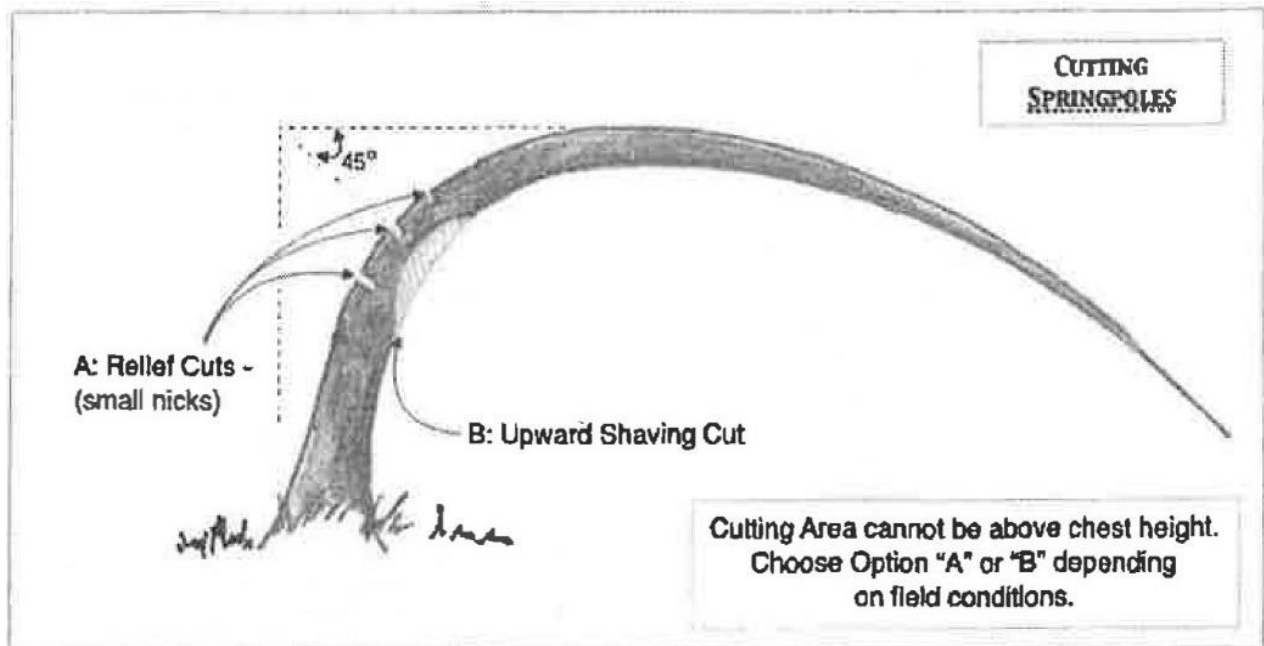
Spotter(s)

A spotter or spotters are an extra set(s) of eyes for the sawyer. They help to identify hazards the sawyer may have missed and can be used to block off an area and keep unwanted people out of the area.

Spring Poles

A spring pole is usually a small tree or sapling that is bent under tension due to being pinned by a larger fallen tree. This means that when cut, it can suddenly snap back with a significant amount of force due to the released tension, posing a potential danger to the sawyer if not handled properly. In short, it's a tree limb under extreme stress that can "spring" back violently if cut incorrectly. The diagram below shows the two proper ways to cut a spring pole.

Figure 6: the 2 proper ways to cut a spring pole (credit: DNCR)



Tree Rot

Rotting trees have extra risks and can be unpredictable due to the reduced strength of the tree. This can affect felling directions, cause sudden breakage, and potentially cause an injury due to the weakened wood which can crumble or split unexpectedly. Some trees the sawyer may not know are rotted until after they start cutting into them.

Widow makers

Widow makers are a broken or detached tree limb or treetop that can fall and cause injury or death. These can be identified while checking for hazards. If possible, try to remove this hazard prior to felling or work under one.

Terrain

Terrain by definition is a stretch of land, especially with regard to its physical features. Know the area you are working on, be it a hill or a field will help to better identify hazards and help to come up with a proper work plan.

Power Lines, Building, and Vehicles.

Three of the most common hazards. Always look up and out for them. If tree is near a powerline or building, please leave the removal to a trained expert. As a rule of thumb never work within two (2) tree lengths of a building or powerline. Vehicles, for the most part, can be moved. If there is a chance it may be hit: move it.

Cutting up and bucking of down trees

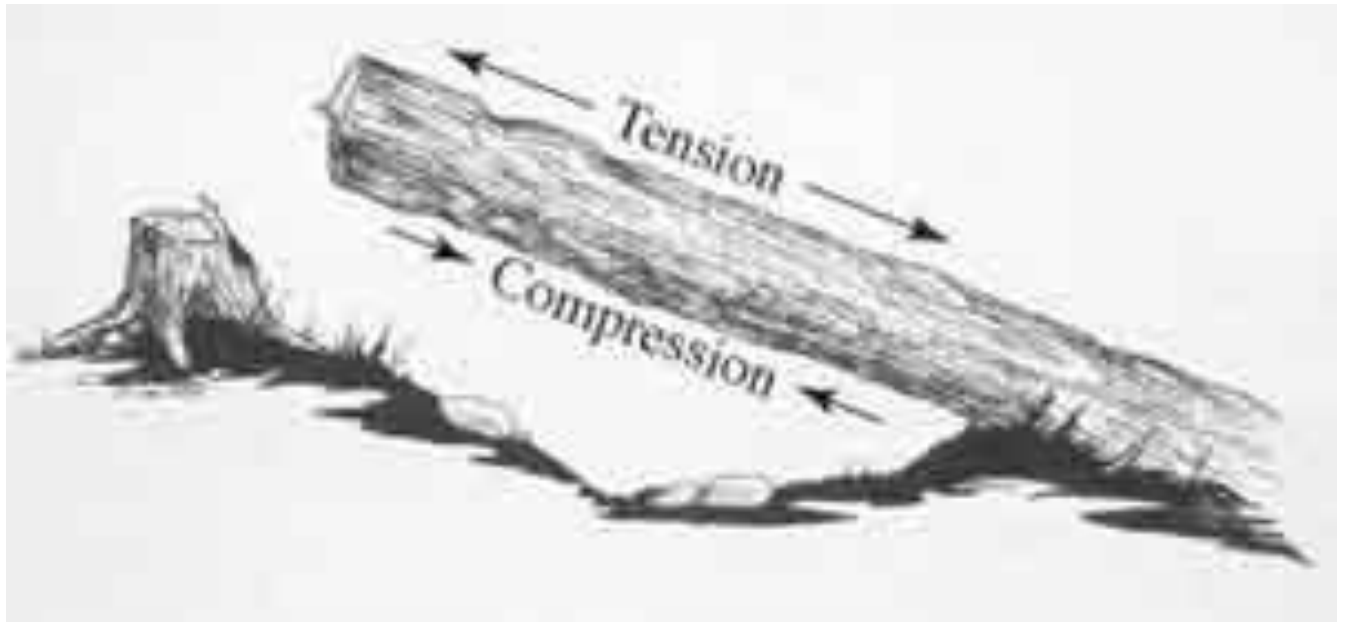
Identify your hazards

Even though the tree is already on the ground; always identify any potential hazards.

Tension and Compression

Tension refers to the area of the wood that is being stretched apart due to its position, while compression refers to the area of the wood that is being squeezed together, usually occurring on opposite sides of the log due to the force of gravity and the tree's weight distribution (see figure 7). If one does not identify these factors, they increase the chance of pinching their saw. Pinching is when the chainsaw blade gets trapped between two surfaces of wood, causing the chain to become tightly squeezed and potentially stopping the saw from moving freely.

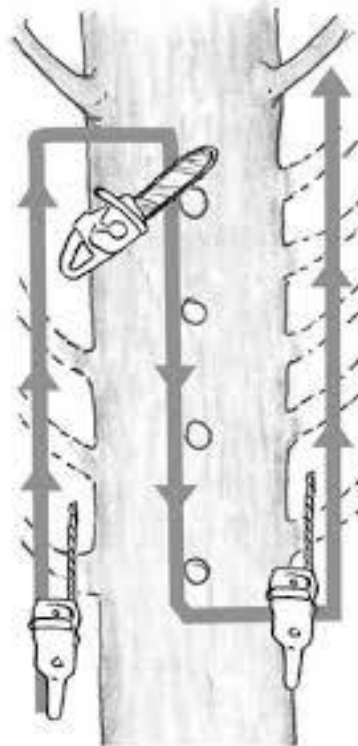
Figure 7: diagram of tension and compression (credit: Google)



Limbing

Limbing is the process of removing branches from a tree. While limbing, the sawyer should keep the saw close to them and try to rest most of the weight of the saw on the tree. Remove the branches as close to the trunk if possible. Some common hazards when limbing include kickback, hitting rocks, releasing spring poles (if not previously identified and released), and the cutting of chaps or boots.

Figure 8: how to properly limb a tree (credit: Google)



Bucking

Bucking is the process of cutting a felled and delimbed tree into desired lengths by making crosscuts with the chainsaw. In order to avoid pinching one's bar sawyers need to properly identify tension and compression while bucking. Be mindful of your feet as a log could easily land or roll on them while bucking up a tree.

Using Wedges

A felling wedge can be used to reduce pinching while bucking. If the sawyer is unsure of where the tension or compression on a tree is, they can drive a wedge into their partially-started cut to limit or stop a saw from pinching.

If in doubt don't cut it

If any tree makes the sawyer feel uncomfortable or they think it is above their skill level don't cut it. They should get in touch with a professional who has been properly trained to take care of it.

Felling a Tree

Establish your safe felling plan

A sawyer's safe felling plan has five points, and they can use their 5 fingers to help to remember them. Point 1 is hazards, 2 is lean, 3 is your escape plan, 4 is hinge info (how big of notch & how big of hinge) and 5 is your back cut plan. The plan will be made up of the points that are covered below

Figure 9: example on how to use your hand to make your plan



Identify your hazards

Identifying one's hazards is the first step in felling any tree, it may be that by doing this step you realize the hazards are too great or the tree is above your skill level, and being the only step needed.

Identify the lean

A tree's lean refers to when the main trunk of a tree deviates from a vertical position. Easy examples of lean are when a tree is growing at an angle instead of straight up. It can be identified by visually observing if the tree is noticeably tilted to one side when looking at its base and trunk, and noting if the top is not directly above the center of the stump. All trees have two leans; forward or back lean and a right or left lean.

Identify your target

Identifying one's target (sawyer's identified landing spot for the tree) is key when figuring out how one will fell a tree. By identifying their target the sawyer will factor in the lean and the hazards to help determine where the tree would like to go and where you the sawyer would like to make it go.

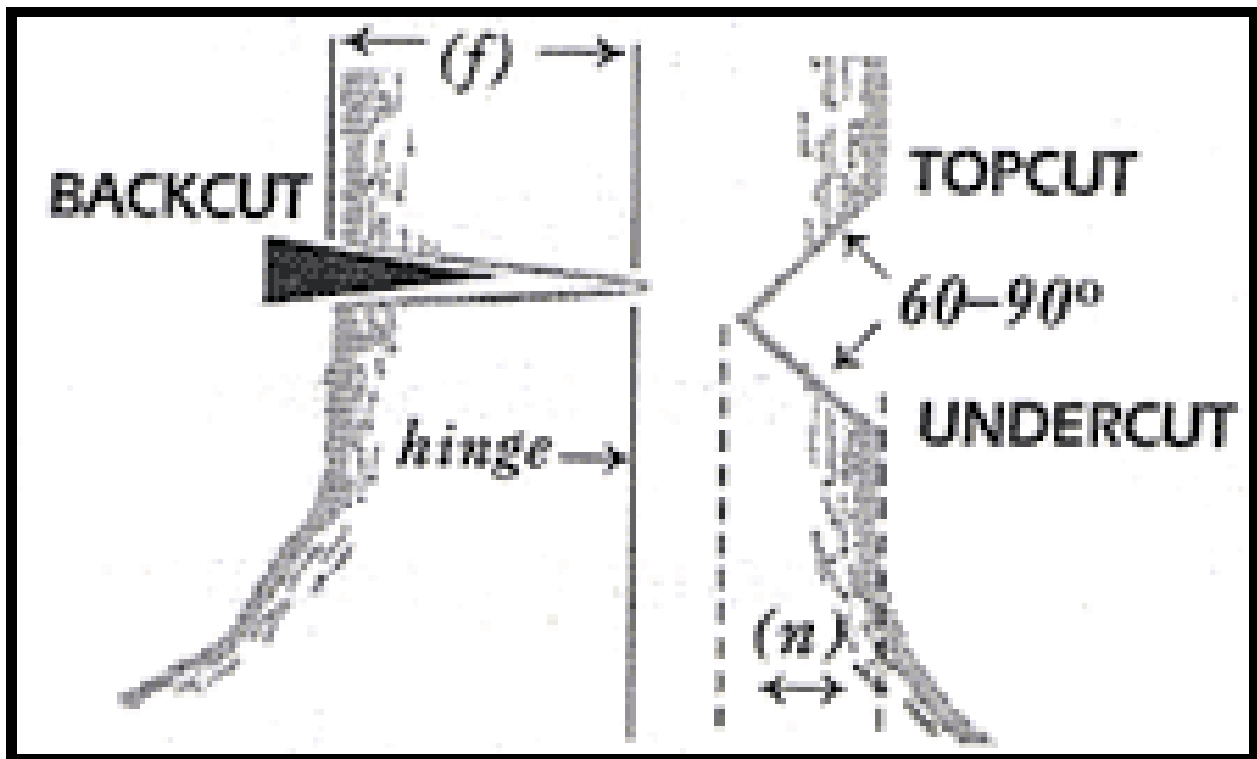
Escape route

As stated on page 6 plan and clear the escape based on where the sawyer has decided to fell the tree.

Notch

The notch(face cut) is an angled cut made into the side of the tree trunk, with the purpose of guiding the tree in the desired direction of fall by creating a hinge of wood that controls its movement as it comes down. It's the initial cut that establishes the direction the tree will fall towards. The notch should be cut at 90° and ideally will pop out after 2 cuts. The length of the notch should also be 80% of the Diameter at Breast Height (DBH) of the tree. For example, if a sawyer is felling a 12" DBH tree, their notch should be around 9.6". By doing a 90° angle notch instead of an old school 45° angle notch, they increase control, as they prevent the notch from fully closing. The larger notch also reduces the chance of the tree jumping off of the stump. A stump jump occurs when the hinge fails, and the tree detaches from the stump. The tree is in free fall and completely out of control. The tree can jump backwards and potentially strike the sawyer.

Figure 10: diagram of a proper notch (credit: DNCR)



Hinge

The hinge is the uncut section of wood left between the notch and the back cut (final cut made when felling a tree). the hinge should be 10% of the DBH of the tree. As such, a 20" DBH tree should have a 2-inch-wide hinge. Ideally after one fells a tree the fiber pull (the fiber in the hinge as it breaks/rips apart) should be less than 3 inches long. The hinge should be straight and even across its whole length.

Figure 11: example hinge (credit: Husqvarna)



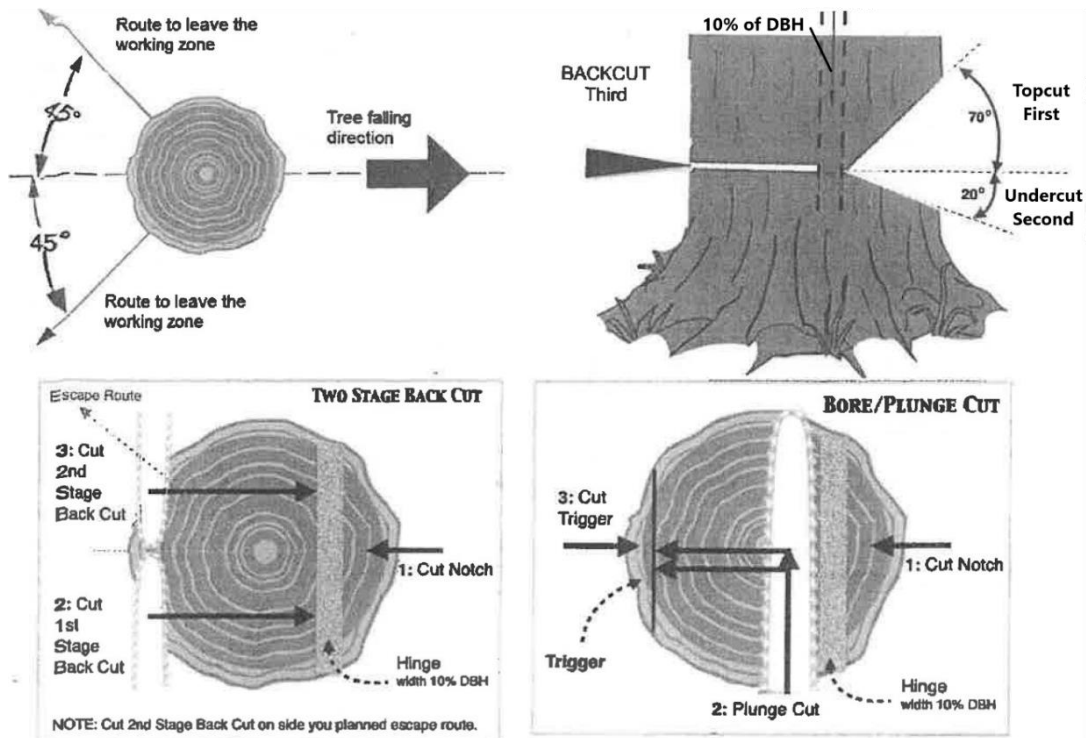
Bypass

Bypass is a situation where a chainsaw cut intended to create a felling hinge accidentally cuts too deeply into the wood, "bypassing" the crucial hinge fibers. This is typically caused by misalignment of the cuts in the notch, cutting too deeply into the hinge area, or not leaving enough wood to maintain its structural integrity.

Back cut plan

A back cut plan is the method in which the sawyer will cut the tree. IE, are they bore cutting (see page 14) or 2 stage back cutting (see page 13)? Does the sawyer need to remove any branches? This is also when a sawyer will determine if they will need wedges, a felling lever, rope or other specialized felling tools.

Figure 12: example images on how to do a Two Stage back cut and a bore cut (credit: DNCR)



2 Stage Back Cut

A 2-stage back cut is a technique where the final "back cut" is made in two separate cuts to better control the direction of the falling tree.

The sawyer will start out by cutting out their notch. Once a notch is set no one shall walk in front of it. Then, based on their determined hinge size, they will start on to opposite side of the notch and cut 55% of the tree, using the pulling side of the saw until they cut to the point where their hinge will be. That point is also referred to as "setting your hinge". The sawyer then will set (hammer in) a wedge, even if the tree has little to no back lean or has heavy front lean. Setting a wedge is always a healthy practice that reduces the chances of pinching ones saw or having the tree sit back on the hinge.

Upon successfully setting the wedge the sawyer will inform anyone in the area, that they are beginning their final cut, and they will make one final check that it is safe to start their final cut. The Sawyer will then cut the final 45% of the tree starting at the opposite of their notch and across from their previous cut. During this cut they are using the pulling side of the saw and cutting forward toward their hinge. The tree may start to come down before they get their hinge completely set. If it does, they will follow their escape route as soon as the tree starts to fall.

Always wait at least a few seconds to make sure any and all debris has landed before approaching the newly felled tree. If the hinge is set and the tree has not fallen yet, hammer in the wedge or use one of the other felling tools identified in their plan to help the tree fall.

Bore/Plunge Cut

A bore (plunge) cut is a chainsaw technique for felling trees that involves making a cut into the tree with the tip of the chainsaw's bar. Bore cuts are a safe and versatile way to fell trees of medium to large diameter. They can be used on trees that are leaning backwards or in other undesirable directions.

A bore cut begins by a sawyer cutting out their notch. Once the notch is complete, they will then align the bottom of the guide bar tip on the saw, positioned slightly behind the desired hinge width on the tree. They will pivot the saw into the cutting position. Holding the saw perpendicular to the tree they will then plunge the saw into the tree. Depending on the saw's bar length and the tree's DBH their saw will protrude out of the other side of the tree (one can bore a tree double their bar length). At this point they will set the hinge they will then cut back toward their trigger.

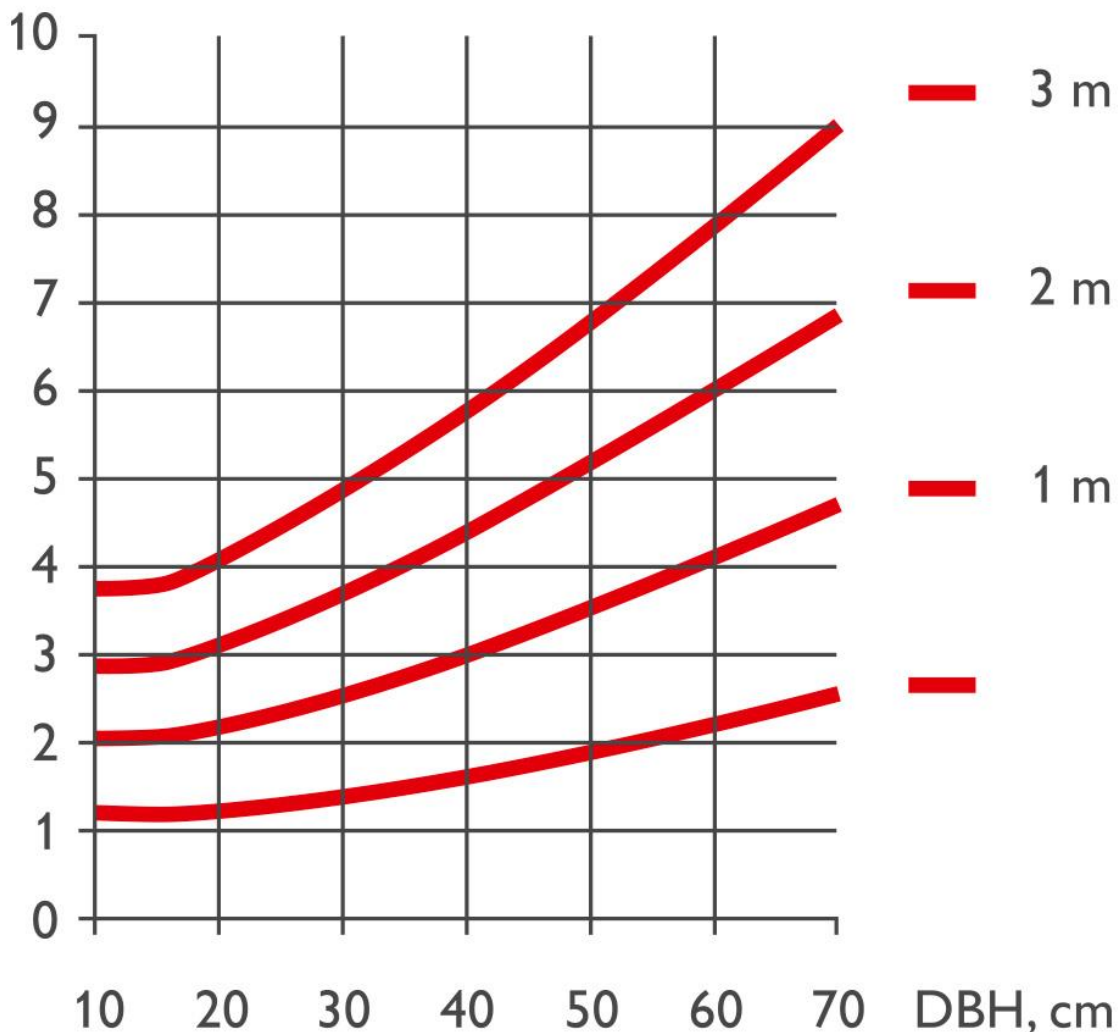
The trigger is the final small section of wood left uncut on the hinge side of the tree, which acts as a control mechanism, allowing the tree to fall only when the trigger is cut, ensuring the desired direction of fall and preventing uncontrolled movement. It can be located on the back or either side of the tree depending on the designated escape route. Once the trigger is set the sawyer will set their wedge(s) and then inform anyone in the area along with taking one final look around that they will be cutting the trigger, once snipped they will follow their designated escape route.

If the tree has not fallen over upon sniping the trigger they will further hammer in their wedges or use one of the other felling tools identified in their plan to assist in felling the tree. Once the tree has fallen, make sure to always wait a few seconds for the debris to land before approaching the tree again.

Wedges

Felling Wedges are a tool used to help fell trees by lifting them in the direction of the notch cut. Felling wedges can also help prevent the tree from leaning back on the saw or pinching the chainsaw bar. On average a 1-inch wedge can move a 6-inch DBH, 60-foot-tall tree 120° towards the direction of fell. If that tree were to double in DBH to a 12-inch DBH, that same wedge would only move the tree about 60° halving the amount of degree the wedge can move said tree, If that tree were to double again to a 24-inch DBH tree, the movement would be halved again to only about 30° (see figure 13 created by Husqvarna).

Figure 13: Wedge lift in regards to DBH(credit Husqvarna)



Last Cut

When felling a tree, it is important for the sawyer to always do one last look and inform people that the tree is coming down. This last look and notification, if followed, will significantly improve safety for everyone in the area.

What if a tree can't be felled?

There are many reasons a tree cannot be felled and identifying them is just as important. Skill level is a big one. Know when a tree is above the sawyer's level. Weather and wind are another huge factor. If wind get up over 15 miles an hour the sawyer may need to determine if the tree needs to come down at that time. Additionally, weather plays a huge factor as there are risks it may bring. Determine if the weather is appropriate for tree work is crucial. They should ask themselves if they need to be out there in extreme weather situations, and if cutting the tree can wait.

Reviewing your stump.

Reviewing (scoring) your stump is the practice of reviewing your cut after the tree has been felled. You should be looking to see if your notch is $\sim 90^\circ$, that your hinge thickness and hinge lengths are correct, that your notch cuts meet with little to no bypass, that the fiber pull is under 3" and lastly that your back cut is level and even.

Figure 14: an ideal stump (Credit: Game of Logging)

