Crosscut Saw Course Supplement
Ver 11.11

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Estimating Weights
Estimating Heights
Cutting Large Suspended Logs
Wedges
Relieving Severe Top Bind
Torsion Bind
Split Trunks
Getting Your Saw Unstuck
Mechanical Advantage
Use of Levers
Moving Logs
Organizing a Cutting Scenario
Axes
Helpful Knots
Safety Issues
Miscellaneous Stuff

DISCLAIMER: The information that follows has probably been around for ages but a lot of it seems to have been forgotten. We’ve stumbled on it mainly by having to extricate ourselves from some mess we managed to create; by word of mouth from other sawyers; purely by accident, and even occasionally by inspiration. This supplement has not been approved by any reliable or authoritative person so take it all with a grain of salt and use it at your own risk. Be safe – Experiment – Have fun.

SAFETY FIRST IS A GOOD OLD SAW
ESTIMATING WEIGHTS

Number of steps to travel 100 feet: ________________________________

CALCULATING VOLUME: 1 cubic foot = 1728 cubic inches

A) Box = Width x Height x Length = cubic inches/feet

B) Cylinder (tree) = Area of Circle (cross-section) x length = cubic inches/feet

\[ \text{d} = \text{diameter} \quad \text{c} = \text{circumference} \]

Area of a Circle = \(0.8d^2\)

\[ = 0.08c^2 \quad (\text{can use if don’t have a cut face to measure}) \]

C) Sphere = \(0.5d^3\)  (sometimes helpful for estimating rock weights)

MATERIAL WEIGHTS IN POUNDS PER CUBIC FOOT

- Water = 63#/cu.ft.
- Wood = 60#/cu.ft. since most wood will float; allows extra safety factor – in reality, most wood is in the 40-50 range)
- Granite, solid = 168#/cu.ft.
- Granite, broken = 103#/cu.ft.
- Gravel with sand = 120#/cu.ft.
- Soil = 90 to 100#/cu.ft.
ESTIMATING HEIGHTS
(Also useful for selecting your tent/sleeping site!)

1) Compass (based on 45 degree angle trigonometry) – must be a compass that has a second clinometer needle – the regular North-South needle is not functional in the vertical position
   - Set dial so 315 degrees is at the N bearing line
   - Turn compass on its side
   - Back away from the tree and sight along the upper edge to the top of the tree
   - Check to be certain that clinometer arrow is at 0 degrees – could alternately put 0 degrees at the N bearing line, in which case the clinometer needle will need to read 45 degrees – the former is easier to read
   - Pace off the distance to the tree and add the distance from your eyes to the ground.

2) Short Stick or Pencil
   - Hold the short stick or pencil vertically out in front of you
   - Close one eye and back away from the tree until the bottom of the pencil matches up with the bottom of the tree and the top matches up with the top of the tree
   - Lay the stick on its side, still matched up with the base of the tree
   - Find a point at right angles to the tree, that lines up with the other end of the stick
   - Go to that point or have a partner go there
   - Pace off the distance from there, back to the tree

3) Long Stick (based on 45 degree angle trigonometry)
   - Find a stick longer than your arm
   - Extend arm out parallel to ground
     - Place one end of stick next to corner of eye
     - Grip stick where it passes through your hand
   - Flip stick up into vertical position
   - Since your head will be tilted back raise hand slightly
   - Move forward or backward until you sight the top of the tree across the top of the stick
   - Measure distance to base of tree and compensate for your height and any differences in elevation between your feet and base of the tree
SAW LENGTH RECOMMENDATIONS

a) 2-person: twice log diameter plus 6”
b) 1-person: minimum saw length (i.e. for large trees) would be log diameter plus 6”;
Some people use felling saws effectively but bucking saws usually cut faster.

c) a saw that is too short for
double bucking may work
fine for a single bucker:

The key is to ensure that the
saw carries wood shavings
all the way out of the log

CUTTING LARGE SUSPENDED LOGS
(NOTE: We’re talking about logs greater than three feet in diameter, and suspended more than
4 feet above ground – that means if you are on top of a 5 foot log, you are 9 feet above ground
– more than enough distance to break bones, including your neck! It is very satisfying to cut
out and drop a 12,000# section of a tree and then move it out of the trail corridor but there are
tremendous inherent dangers involved so you need to pay special attention to potential hazards
and do a thorough on-site safety analysis before you do anything else. We started out trying
things like using lag bolts for foot-steps and using climbing harnesses and tying off to other
trees to support ourselves while starting cuts. We’ve finally built a modified springboard setup
which we are very pleased with. HOWEVER, we aren’t recommending anything – whatever
you decide to try, just make certain you have identified all the safety risks and mitigated them
(for example, by using safety rigging and fall arrest harnesses, etc.) If you think something
isn’t safe, it probably isn’t and you shouldn’t risk doing it.
CUTTING SEQUENCE ON LARGE OVERHEAD LOGS

1) saw parallel with Ground until have
   Trouble removing chips

2) saw at 45˚ angle

3) saw at 45˚ angle on other side

4) saw parallel with ground again

Repeat 2 – 3 – 4 again if needed

IMPORTANT: use lots of wedges (12 for a 5’ diameter tree), plus at least a couple of sets of wide hanging (tie) wedges.

If having trouble clearing wood chips, use a curved pruning saw periodically to remove chips from the far end of the kerf (the set on pruning saw should be less than the set of the saw).

WEDGES

It is difficult to think of a situation where putting in too many wedges causes a problem but on the other hand, putting in too few wedges is THE most common reason saws get stuck. Get in the habit of using wedges on EVERY cut and remember that more is better. For most bucking operations, small pocket wedges are adequate. Each team should have 5-6 of these.

RELIEVING SEVERE TOP BIND

Sometimes there is so much top bind that you can’t even saw in far enough (even with a felling saw) to place a wedge. One alternative solution is to remove the saw as soon as any pinching is detected, move the saw over about 1/16” - 1/8” and start a second relief cut. As soon as it starts to pinch, return to the original cut and keep repeating the sequence until you can place a wedge. In a large tree, even with extreme bind, the compressed wood actually only moves a very short distance – usually less than 2 saw kerfs, so two parallel cuts, close together, will usually be adequate. In smaller diameter trees the movement can be much greater, so beware. This is the willow sprig versus the huge red fir phenomenon.
TORSIONAL BIND

Because of stresses on, or in, the tree, opposite sides of the kerf may rotate independently of each other. This can produce a severe bind which can be very difficult to relieve. The best way to prevent it is to sink an axe across the kerf or use hanging wedges.

SPLIT TRUNKS

An additional benefit of debarking before you saw is that you may be able to see splits in the trunk. As you saw through these, the sections will often move and bind the saw so proceed very slowly and carefully and use plenty of wedges. You may even want to single buck with just the tip of the saw as you approach the split.

GETTING SAWS UNSTUCK

If you are watching the kerf, feeling the resistance on the saw and using wedges properly, you shouldn’t get in the position of having to unstick your saw – that sounds really good, but in reality, if you saw enough trees Murphy will get the better of you at some point.

1) Since the teeth are the widest part of the saw (due to the set) it is counter-productive to try and yank the saw up through the kerf – doing so tends to tweak the saw and is bad for it. STOP, take a deep breath, and think about what you are going to do to get the saw out, intact.

2) Try using another log as a lever to raise the cut and release the bind.

3) OR put a piece of log underneath and use wedges to raise the cut – usually you can get more lifting force with this than with a lever.
4) NEVER use an axe within striking distance of the saw – there is some magical attractive force that will draw the axe to the saw and inflict major damage on it (and on your reputation as a qualified sawyer).

5) The last resort is to move to another location on the log and make a second cut with a new saw (try not to get this one stuck) or chop the log with an axe (at which point you will be cursing yourself for not having sharpened your axe properly before the project started).

Chop a nice ‘V’ far away from the saw

Place a rock or some cribbing under the stuck saw

If only I had . . . .
MECHANICAL ADVANTAGE (MA)

Remember that MA comes at the expense of having to pull more rope to move the load – a 2:1 system means you’ll have to pull 2 feet of rope to move the load 1 foot; in a 4:1 system, you have to pull 4 feet of rope to move the load one foot – you can go through a lot of rope in a hurry.

1. If a simple system is anchored on load, likely will have an “odd” MA

2. If a simple system is anchored somewhere other than load, likely will have an “even” MA

3. If the end of the rope you’re pulling on is pulling away from the load, it will be contributing to the MA calculation.

4. If the end of the rope you’re pulling on is pulling toward the load, it won’t be contributing to the MA calculation – it’s just providing a change of direction.

SIMPLE MA SETUPS

1. Using rope and carabiners works well for climbing and rescue but is pretty worthless once you start applying heavy loads. The rope crosses a relatively very small diameter carabiner so there is a tremendous loss of efficiency because of friction – this is a sorry last resort for trying to move heavy objects.

2. Just using small Petzl pulleys instead of carabiners increases the efficiency of the system tremendously – this would be the best small system to carry routinely.

3. Pre-made block and tackles: you can buy a 7:1, 2,000# capacity block and tackle for around $20.00. Upgrading the bolts, adding carabiner attachment points and a quality rope can make the unit more serviceable. Just remember that as soon as you modify equipment, you have released the manufacturer from any and all liability and transferred it all to guess who - so proceed with caution and make certain you are willing to accept the accompanying risk. Most people can generate about 125# of pulling force so three people could generate close to 2,000# of force using this system.

4. Come-alongs are awkward to use and heavy to carry for what you get. Their best use is probably in lifting up objects vertically such as in a high line system. If you’re going to buy one, buy a good one – the cheap ones are a nightmare to use and will make you angry.
**USE OF LEVERS**

a) **NO!**

This is ineffective and is a recipe for a hernia – essentially you are wasting most of your force trying to push the bottom end of the lever through the soil toward you. You do get a little lateral force but very little lifting force.

b) **YES!**

This gives you a mechanical advantage of 5:1. Most people can apply 125# - 175# of force. As a result, you get a lot of lifting force but virtually no lateral force. Using this technique, you can effectively “float and row” heavy rocks across the ground.
MOVING LOGS

(You have two choices: reduce friction or increase your pulling force)

1. use small logs as rollers to move log along its long axis or slides to roll log perpendicular to its long axis (usually easier than the former) - can also help reduce friction by removing bark

2. roll up onto a fulcrum (log or rock) so can pivot in any direction; need to estimate center of weight; to gain height, place two rocks or two other logs at right angles, under fulcrum (if only use one, log will want to roll off)

3. construct a mechanical advantage system using rope, carabiners, and webbing; pretty difficult to overload this type of system

4. use a pre-rigged light weight block and tackle for mechanical advantage; need to know strength of rope

5. use a Maasdam rope puller (this is essentially a come-along that uses a rope rather than a steel cable, so the length of pull is limited only by the length of rope you are using)

6. use a grip-hoist with pulleys and anchors to create mechanical advantage; once get to this level, can use to move heavy rocks too

NOTE: Beware of uncontrolled moving rocks or logs – if they hit the base of a tree with enough force, they can blow out the top of the tree and send it back toward you

Examples:
1) Using rollers / ramps:

Easy to just roll logs although you can pull lengthwise if have enough rollers

Have you identified all the safety risks and taken steps to mitigate them?
2) Balancing and rolling:

3) Pivoting:

Two people can roll extremely heavy logs up onto a low pivot and then easily spin the log in any direction – the pivot only needs to be high enough to keep the ends of the log an inch or two off the ground when it is balanced on the pivot.

Thus you don’t have to keep rolling the log down the trail – you can turn and roll it off the side.
4) Rolling one log up and over another (make certain log won’t roll back on top of you!)

If you need more force, anchor rope on far side, loop under and over log to be moved (like a sling) and pull – this gives you a 2:1 mechanical advantage

5) Hooking onto logs

YES! Pull strap or rope across log, toward you

NO! Now you’re working against yourself and are just trying to drag the log
ORGANIZING A CUTTING SCENARIO

“I knew they were inexperienced sawyers when the first thing they did was take the sheath off the saw” Anonymous

1) **LOOK UP** for overhead hazards

2) **CLEAN UP** work area – often changes your initial impression of how to organize the work

3) **SIZE UP** and plan your cuts

First, walk completely around the entire length of the tree. You will often discover something that may change your initial plan. Decide how you are going to move the cut piece AND where you are going to place it. Not unusual to spend far more time preparing the site (chocking, ramps, rollers) than cutting the tree. While it is tempting (as in “easy”) to put logs parallel to the trail tread (and they do keep people on the trail), that is far outweighed by the potential damage the channeling of water will do to the trail, especially if they are on the downhill side of the tread. Sometimes the log will be useful to stabilize the lower side of the tread but this is the exception rather than the rule. Plus, any logs parallel to the trail will make movement of subsequent logs a nightmare.

Your ignorance - and some other things - will become apparent soon enough . . .

If you fail to size up Your work area

NEVER leave logs in, or across, a waterbar, or in a drainage.

Once you get something to start rolling, you usually want to keep it in motion until it ends up where you want it – so put limbs across depressions where it might come to a stop, etc. NOTE: be very careful about turning logs loose on a slope – if they gain a lot of momentum and strike the base of a tree, the top of the tree can blow out and come back on top of you. Also you obviously have to be concerned about steam rolling over hikers, sleeping crew members, etc.
If you really want to maximize your efficiency as a sawyer, you must become proficient in using a double bit axe (able to swing accurately with either hand). The axe can be used for limbing, chopping out face cuts, severing logs, to steady the back of the saw while underbucking and even as a hanging wedge. One blade should be sharpened with a wide angle (like a Pulaski) for chopping where the edge might contact hard objects and the other blade sharpened with a more acute angle for fast cutting when only wood will be contacted. This latter edge will work much better for sinking in the tree trunk to hold the saw for underbucking. Some people paint a red mark on the acute blade to identify it readily. The axe cuts most efficiently when it hits the wood fibers at a 45 degree angle. Always try to cut limbs from the underside (toward the top of the tree) – chopping down into the crotch may even damage the acute angle edge.

An added safety precaution is to drill a 5/32” hole in the center of the axe head and insert a tension pin.

Sheath: A good axe needs a good sheath that is easy to put on and off and hard to lose.

Handles: The grain of the handle should be parallel to the axe blade (not perpendicular to it) so it can absorb the shock properly. Good axe handles are difficult to find so if you do find one, take good care of it! Scrape off the varnish (which serves no purpose other than to make it look nice and prevent it from absorbing a 1:1 mixture of boiled linseed oil and turpentine, which serves to both lubricate and preserve the wood fibers). Wipe it repeatedly with this mixture or even better, fill a capped 2” pipe with the mixture and soak the handle for a week. During the summer, wipe the handle down with the mixture occasionally and especially before storing it for the winter. Don’t soak your axe in water to tighten the handle as this will break wood fibers and weaken your handle. Place a screw hook in the handle end and hang it axe head down to keep the handle straight. Never leave it leaning against a wall for prolonged periods of time.

Sweet!
HELPFUL KNOTS

There are literally thousands of knots, but you will probably find that four or five will meet most of your needs.

**Clove Hitch:** great for quick attachment to pull limbs; can only pull in direction that keeps knot tight.

![Clove Hitch Diagram](image)

**Bowline:** all around handy knot – if you are going to place a lot of tension on it, use a double bowline.

![Bowline Diagram](image)

**Loggers Hitch** (aka Cow Hitch): good for anchoring a rope around a tree although a strap is less inclined to damage the bark.

![Loggers Hitch Diagram](image)
SAFETY ISSUES

1) Before you start pulling on things (with or without ropes), make certain you have cleared the path you’ll be moving along. You don’t want to send someone to the hospital impaled on a stick like shish-kabob (don’t laugh – this is a common injury), or with a head injury.

2) While someone has to be boss and have final authority, EVERYONE serves equally as the “Safety Officer” and can bring the operation to a halt until their concern is addressed and resolved.

3) When rolling logs, caution everyone to look out for stobs that can catch in the wrist band of gloves as the log turns – if that happens, the unfortunate person will not be able to get their hand out of the glove quickly enough and will end up with a broken wrist or shattered elbow (don’t laugh – this has happened).

4) Check the handles on hand tools EVERY day – actually whenever you pick up a tool someone else has used, you ought to do this check. Putting a tension pin in the head of an axe or Pulaski decreases the risk of the head flying off – this also makes them easier to sharpen with the MTDC Makita sander and sharpening jig. There are concerns about using any power tool to sharpen an axe since it is so easy to overheat the metal and change the temper, so beware.

MISCELLANEOUS STUFF

1) A 1” X 20’ strap is very handy for lifting and carrying stuff. You can make a hand hold by: 1) tying a bowline and using the loop; 2) put a stick through the loop so you can use both hands; 3) use a clove hitch on the stick.

2) A handy set of hanging wedges can be made from a pair of 4” brick sets - lately we’ve even made sets from 5” brick sets. If you want to be really fancy, you can drill holes in them (like Swiss Cheese) to make them lighter (aka the Dr. Carter modification).

3) An arborist throw bag (a small weighted bag with a long, small diameter line) is incredibly useful for getting a bigger rope up into a tree (think hazard tree that you want to pull down rather than risk cutting).