# Tools for Trail Work

By Jim Schmid
(Adapted by Rick Landenberger 6/24/16)

A wide variety of tools are available to layout, construct, and maintain trails. Local and individual preferences often dictate the kinds of tools which are chosen for various tasks. Some of the most commonly used tools and tips on using the tool safely and effectively are presented. Every trail worker needs to learn how to choose the correct tool for the job, use it effectively and safely, care for it, and store it properly.

## *Tool Safety*

The following should be covered during crew leader training, and then again with student crewmembers, before the start of any trail work.

*Have the right personal protective devices*. Along with wearing long pants, long-sleeve shirts, and work boots, crewmembers should have available hardhats, gloves, and safety glasses.

*Choose the right tool for the job.* The wrong tool can make you work in an awkward stance which will wear you out.

*Carry the tool properly.* Always carry tools in your hands and down at your side on the down hill side of the trail. Use blade guards whenever possible. Never carry tools over your shoulder.

*Travel safely.* Stay at least 10 feet apart on the hike in and out from the work site—space yourself along the trail.

*Proper use begins with a good grip.* Wet or muddy gloves may cause a tool to slip from your hands, striking you or someone near you.

*Watch out for people around you.* When chopping or brushing, be aware of any people in the surrounding area. The combined length of your arm and tool could reach a person working near you. Also, be aware of trail users. Often a user may try to pass right into your back swing. If you see someone coming, stop work, notify your co-workers and wait for them to pass.

*Make sure you have a clear area in which to work.* Never raise a tool above your shoulders, and be aware of overhead or side hazards. A hazard is anything that could interfere with the complete swing of your tool, and knock it from your hands or down onto any part of your body. Keep your tool in front of you at all times. You should never need to swing your tool over your head.

*Be alert for hazardous footing.* Make sure you have a firm, balanced, and comfortable stance before starting your work. Clear limbs, sticks, loose rocks, or other debris from your footing area. Particularly with striking tools—make sure your feet are spaced well away from your target area.

*Make sure your tool is sharp.* A dull tool that bounces or glances off of what it was attempting to cut can be very dangerous. A sharp tool will cut faster and be less tiring.

## *Safety Tools*

**First Aid Kit**

A standard first aid kit should contain the basic components to handle minor incidents (blisters, splinters, small cuts, etc.) that may occur during a workday.

**Gloves**

Work gloves are necessary to grip tools as well as to protect the hands from blisters, thorny brush, poison oak or ivy, or any other minor scratches associated with trail work.

**Safety Glasses**

Safety glasses should be worn when working with picks in rock or hardened material, or anywhere flying debris is present. Also required when using power tools.

**Hard Hat**

Protective headgear (hard hats) are used where there is a danger of falling debris from above the work area (tree canopy or falling rocks), or where one crew may be working above another, such as near a switchback.

**Two-way Radio**

In remote backcountry areas, a two-way radio or cell phone may be required in case of emergency. Radios should be assigned to crew leaders as determined by the number of crews, remoteness of the work site, and accessibility to emergency facilities.

**Footwear**

Sturdy shoes or boots are preferred due to the rugged terrain associated with trail work. They are necessary to protect the feet from glancing tools, and provide good footing when working.

**Water**


All workers should carry adequate water supplies, and crew leaders should carry extra water. Workers should minimize or stop work if there is not an adequate supply of drinking water at the worksite.

**Protective Creams**

Creams can be used as a pre- or post- treatment for poison oak or ivy exposure. Other creams are insect repellents and sunblocks.

## *Brushing Tools*

**Weed Cutters (Grass Whip/Swizzle Stick/Swing Blade/Weed Whip)**

Weed cutters are used to clear trail corridors of succulent vegetation (grass, light brush, briars, and tree seedlings). It is meant to be swung back and forth with both hands. There are two varieties: the L-shaped weed whip cuts grass and weeds but is unstable for use on larger growth, the triangular-frame weed whip cuts briars and woody stems up to a half-inch in diameter. Screws holding the serrated double-edged blade in place can work loose, so check them often.

*Safety tip:* Avoid the golf swing. Swing tool no higher than your side.

**Machete**

Machetes are best used to clear the way when surveying new trail routes through dense vegetation. A slightly angled (off-vertical) stroke of the machete is more effective than a low horizontal swing. Being an effective, but crude cutter, the machete should not be used to hack branches from trailside trees.

*Safety tip:* Use extreme care when working with others. Always be aware of who is working next to you.

**Woodman's Pal Axe**

Used to cut and clear vegetation the 16 inch long Woodman's Pal Axe is easy to carry and to use.

*Safety tip:* When not in use be sure to keep in it's sheath to protect the blade.

**Swedish Safety Brush Axe (Sandvik)**

Also known as a Sandvik, the Swedish Safety Brush Axe is a machete-like tool with a short, replaceable blade. Because of the shorter blade and longer handle (27 inch overall length), the tool may be safer than a machete. Its shorter handle and lighter weight make it faster, easier to control, and safer than an axe or brush hook. The thin, flat, replaceable steel blade cuts easily through springy hardwood stems.

*Safety tip:* A sharp tool is a safe tool. Replace the blade when dull or when it becomes badly nicked.

**Brush Hook (Bush Hook/Ditch Blade/Ditch Blade Axe)**

For removal of brush too heavy for a weed cutter and too light for an axe, consider either the double- or single-edged brush hook. Swung like an axe, the brush hook's long 36 inch handle and heavy head give it a

powerful cut. Their curved blades also pose extra safety hazards. Always maintain a firm grip with both hands on the handle. Cut with a slicing rather than a hacking motion and pull back on the handle at the end of the swing to utilize the 12 inch curved blade. Carry brush hooks with the head forward like a shovel.

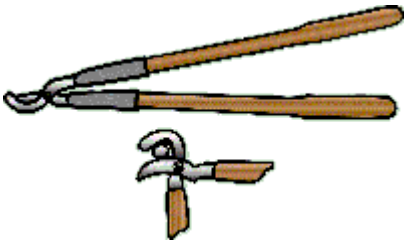
*Safety tip:* Never use an overhead swing. Keep the brush hook in front of you at all times.

**Bank Blade (Hook Blade/Swing Blade/Bush Axe/Kaiser Bank Blade)**

Bank blades are used to cut brush, briar, or undergrowth. The 40 inch heavy blade sharpened on both sides and sturdy hickory handle keep you well away from the vegetation you are cutting.

*Safety tip*: Never use an overhead swing. Keep the bank blade in front of you at all times.

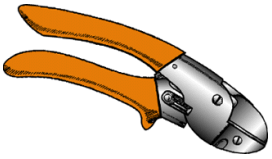
**Loppers (Lopping Shears/Pruning Shears)**



Loppers are designed for clearing heavy vegetation from trails. With their long handles, a sturdy pair of loppers has the mechanical advantage to cut cleanly through all sorts of brush and branches (most cut limbs of 1 to 1¾ inches in diameter). If you have a choice, select heavy-duty loppers with fiberglass or metal handles. Cutting heads are either the sliding-blade-and-hook type (known as bypass) or the anvil type. Some have simple pivot actions, while others have compound or gear-driven actions for increased cutting power. Do not try to twist the handles when biting into a resistant branch. This can bend the blade and ruin a pair of loppers quickly. If the loppers can't cut the branch, use a bow saw. Carry loppers with the jaws pointed down and away from you or strap them against the back of a pack.

*Safety tip:* Carry loppers with hand around both handles.

**Hand Pruner**



Handier and lighter to carry than a lopper when only minor pruning is needed. Used to cut small branches encroaching on the trail. Also useful for cutting protruding roots that are tripping hazards. Mostly used for trail maintenance.

*Safety tip:* Can be carried in hand while hiking to clip small branches as encountered.

## *Sawing and Chopping Tools*

**Bow Saw**

A bow saw with a blade 16- to 21-inches in length is handy for cutting brush out of the trail and trimming small branches. The longer 36-inch bow saws are unwieldy for brushing projects. They

are better suited for cutting medium size logs along the trail or cutting firewood back in camp. When properly maintained they will cut quickly and efficiently, however they can bind easily. Bow saws cannot be resharpened due to the hardness of the blade. When the blade becomes dull, rusty, or bent, it should be replaced. If a saw has no sheath, make one by splitting open a piece of old garden hose as long as the blade. Fit the hose around the saw blade and hold it in place with cord or duct tape. A sheathed bow saw can be carried by hand or strapped onto a backpack.

*Safety tip:* Never use a bow saw to cut overhead branches. Use a pole saw instead.

**Razor-Tooth Saw (Protooth Saw)**

These saws have an extra thick, extra wide razor-tooth blade for rigidity and are used to cut limbs encroaching on the trail, cutting small tress or shrubs at the base, and removing small to medium sized windfalls. They come in a wide variety of sizes and tooth patterns.

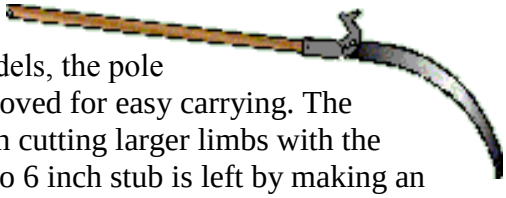
*Safety tip:* With their extra sharp teeth the saw should be kept in a sheath when not in use.

**Folding Pruning Saw**

A handy tool that is easy to carry, folding saws are a smaller alternative to the bow saw, with the ability to get into tighter places. They are useful for limbing, some brushing, and removing small downfall. There is a vast array of blade lengths and styles. Some have replaceable or interchangeable blades.

*Safety tip:* Make sure blade is locked in open position before using.

**Pole Saw with Pole Pruner**



A pole saw with pole pruner can be used to trim branches that would otherwise be out of arm's reach above a trail. On some models, the pole can be taken apart or telescoped into the handle and the blade removed for easy carrying. The built-in pruner can be operated from the ground with a rope. When cutting larger limbs with the pole saw, it is best to use a two-step process. In the first step, a 4 to 6 inch stub is left by making an under-cut and then a cut from top of the limb. This prevents stripping the bark from the trunk of the tree. In the second step, the stub is cut flush the with the trunk.

*Safety tip:* Never stand right below the branch you are cutting. Stand well clear of the falling branch.

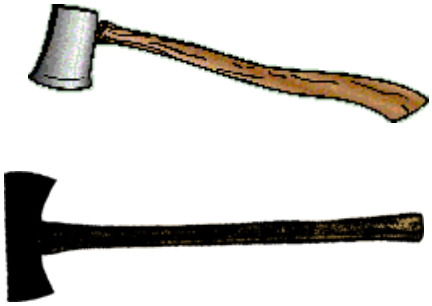
**Crosscut Saw**

Favored a century ago by loggers felling trees, the crosscut saw is still used to cut logs for timber projects and to clear large deadfall from trails and campsites, especially in Federally designated Wilderness Areas (and by those who prefer not to use chainsaws). Crosscut saws are available in two basic designs—one-person and two-person. The one-person models are

generally 3 to 4 feet in length and perhaps most useful for clearing blowdowns. Two-person crosscuts are 5 to 8 feet in length, with a handle at each end. Pictured is a bucking crosscut which has a straight back and is heavier and stiffer than felling saws. Felling crosscuts are light, flexible, and have concave backs that conform easily to the arc of the cut and the sawyer's arm. Crosscut saws require special skills and care and must always be sheathed before they are carried. A sheath can be made from an old piece of fire hose split open to fit over the saw blade.

*Safety tip:* Know where the log will roll after you cut it and plan your stance accordingly.

**Axe (Ax)**

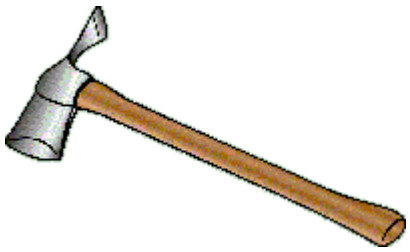


Axes can be used to chop deadfall from trails, shape stakes for turnpikes and waterbars, and cut notches for structures made of timber. Most trail crews use the single bit axe (one sharp side) versus the double bit axe (two sharp sides) feeling that one sharp blade is safer than two. Although the axe is a traditional wood working tool, saws are usually recommended for trail work because they are safer and generally more efficient. The axe is best reserved for cutting jobs too thick for available saws. When not in use, or when carrying the axe, the blade should be covered with a sheath.

*Safety tip:* Never use a single bit axe as a sledgehammer or as a splitting wedge.

## *Grubbing and Raking Tools*

**Pulaski**



Developed to grub and chop duff during forest fires, the Pulaski combines an axe bit with an adz-shaped grub hoe on a 36 inch wood or fiberglass handle. It is preferred by many trail crews for loosening dirt, cutting through roots, or grubbing brush because it is widely available and easier to carry than single-purpose tools. Unlike grub hoes or mattocks the Pulaski is a sharp-edged took, and should not be used in rocky soil. With the bit and adz keenly honed, a Pulaski is an excellent woodworking tool for shaping the notches and joints of turnpikes, bridges, and other timber projects. A sharpened Pulaski should be marked to discourage anyone from mistakenly dulling a Pulaski meant for timber work by using it for digging.

*Safety tip:* Work with Pulaski in front of you. Never swing above shoulder level.

**Hoes (Grub Hoe/Adze Hoe/Hazel Hoe)**

Grub hoes of various weights are available and are good for building and repairing trail tread and for digging trenches to hold turnpike logs and waterbars. They usually come with a 34 inch handle and a six-inch-wide blade set at an "adze angle" and are maintained and used like a mattock. Grub hoes are not usually sharpened.

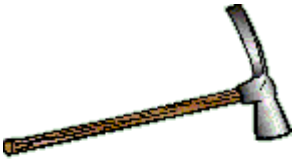
*Safety tip:* The handle can be removed for ease in packing.

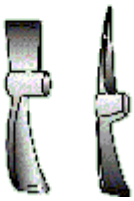
**Pick (Pick-ax/Pick-axe)**

Picks are rarely necessary in trail work, its function being adequately served by the pick mattock. The standard pick has a combination of narrow chisel blade on one end and pointed tip on the other. It can be used to break or pry small rocks, loosen heavy soil and gravel, or to dig a trench or hole. As with any tool used for breaking hard soil or rock, safety glasses should be worn to protect your eyes from flying debris.

*Safety tip:* Picks should not be used as a lever to pry loose large rock.

**Mattock**





A mattock is a heavy sturdy grubbing tool with an adz blade that can be used as a hoe for digging in hard ground. The other blade of a mattock may be a pick (pick mattock) for breaking or prying small rocks or a cutting edge (cutter mattock) for chopping roots. Mattocks may be purchased with head weights ranging from three to six pounds. For heavy work, use at least a five-pound head. Handles are generally 36 inches long, a good length for almost all trail work. The head should tighten on the handle as the mattock is swung, but sometimes it loosens and slides down the handle. To keep the head in place, put a small sheet-metal screw into the handle just below the head.

*Safety tip:* The handle can be removed for ease in packing.

**McLeod**

The McLeod with its large hoe like blade on one side and tined blade on the other is a forest fire tool common in America's western mountain ranges. It was originally intended for raking fire lines with the teeth and for cutting branches and sod with the sharpened hoe edge. The McLeod is useful for removing slough and berm from a trail and tamping or compacting tread. It can also be used to shape a trail's backslope. Because of its shape, the McLeod is an awkward tool to transport and store. Carry it with the tines pointing toward the ground, ideally with a sheath over the cutting edge.

*Safety tip:* Stand the McLeod on its head instead of flat on the ground when you need to put it aside while working.

**Fire Rake (Council Tool)**

The fire rake with its three tempered steel blades and 5 foot handle has traditionally been preferred to the McLeod in the eastern states. The triangular tines can be honed with a file. The fire rake is lighter than the McLeod and is better for cutting leaves, mulch, small bushes, and debris from trail corridors than it is for shaping tread or backslopes.

*Safety tip:* Never carry a fire rake over your shoulder, keep it at your side.

**Combination Tool (Combi Tool)**

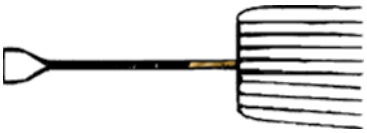
This is basically a military entrenching tool on a long handle, developed for firefighting. It serves as a light-duty shovel and scraper. There is a large locking bolt that secures the multi-angled shovel in its closed position.

*Safety tip:* Make sure locking bolt is tight before using.

**Fork (Cottonseed/Ensilage/Compost/Refuse)**

Used for shoveling twigs, pine straw, and trash, or mounds of stump chips.

*Safety tip:* Carry and use with care.



## *Digging and Tamping Tools*

**Digging-Tamping Bar**

A digging-tamping bar is about the same length as a rock bar but much lighter. It has a small blade at one end for loosening compacted or rocky soil and a flattened end for tamping. They work great for digging postholes and tamping the soil around a post once it is set. Some moving of rock can also be done using this bar, although it is not quite as rugged as a rock bar.

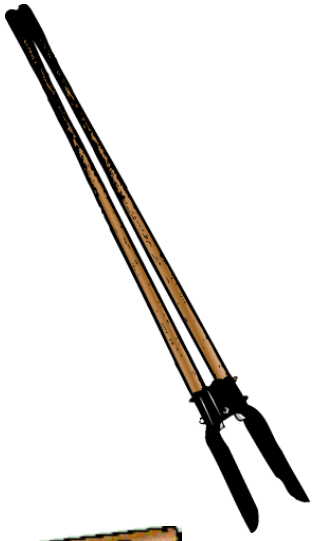
*Safety tip:* Not for use in moving large rock or logs.

**Shovels**

Shovels are available in various blade shapes and handle lengths. Fire shovels and round-point shovels are most common for trail work and are used to move loosened dirt, dig holes and trenches, and remove weeds. They can also be used for cleaning waterbars, culvert outlets, and diversion ditches. There are two kinds good for trail work. The long-handle shovel, best for digging holes, is generally 48 inches in length. The D-handle shovel, best for moving soil or digging in confined spaces, is generally 27 inches in length. Shovels can also be used to smooth trail tread. By bracing the shovel handle against the inside of your knee as you scrape the tread, you may be able to accomplish the work by using the strength of your legs rather than the muscles of your arms and back. The most common injuries when using a shovel are back injuries. Bending from the knees instead of the waist will help prevent injury.

*Safety tip:* Shovels shouldn't be used as a lever to pry rocks.

**Post Hole Digger**



Used for removing soil from holes for footings or posts the post hole digger has clam like scoops attached to long handles. Soil should be lifted from the hole with leg muscles—not back muscles. Use a digging bar to loosen compacted soil not the post hole digger. The post hole digger works best at removing loose soil. The scoops bend and break easily if used as a breaking tool.

*Safety tip:* Fingers can get pinched when the handles are closes—leather gloves are recommended.

## *Pounding and Hammering Tools*

**Sledgehammer**

A sledgehammer with a 6- to 8-pound head and a 3 foot-long handle is most useful for trail work. It can be used to crush rock into gravel (stone sledge) for trail repair, and for driving stakes or rebar (driving sledge) to secure waterbars and turnpikes. Because of differences in tempering, the stone and driving sledges are not interchangeable. Before swinging, you should make sure others are clear and you have a firm stance with feet spread to shoulder width and firmly planted. Even more than other striking tools, the sledge holds the potential for serious injury because of its greater, more awkward weight. Use only short controlled swings, never using all your might.

*Safety tip:* Because sledgehammers can cause stone chips to fly, anyone swinging the tool must wear a hardhat, eye protection, long pants, and boots.

**Single Jack Hammer**

A single jack (3- to 4-pound head with short handle) hammer can be used with a star drill to punch holes in rock. The single jack can also be used to drive bridge spikes, and other uses that are too demanding for a regular claw-hammer, but do not require the heavy duty blows of a sledge.

*Safety tip:* Best to wear a hardhat and eye protection at all times.

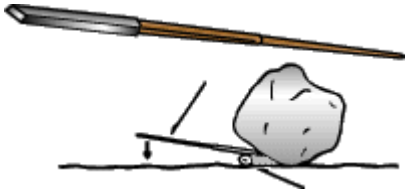
**Star Drill**

Star drills are usually about a foot long and weigh a pound. They are used with single jack hammers to punch holes in rock or open a seam/crack.

*Safety tip:* Best to wear a hardhat and eye protection at all times. Also best to wear gloves.

# *Lifting and Hauling Tools*

**Rockbar (Pry Bar)**



For trail work a rockbar 4-foot in length and weighing 16 to 18 pounds with a beveled end is best. This is an essential tool for prying and levering large, heavy objects such as boulders, logs, and beams. The secret of using a rockbar is leverage. Slip the beveled end under a heavy object, and then apply basic physics to raise the object and ease it toward its destination. As with all hand tools, rockbars require wise use. Work as a team, making sure everyone understands each step of a rock move before it begins. A rockbar can also be used as a drop hammer to break rock or open a crack.

*Safety tip:* Keep toes and fingers clear of places where they could be pinched.

**Timber Carrier (Log Carrier)**

Timber carriers are used for transporting heavy timbers and logs to and from a work site. They look like a giant ice tong with 5 foot long wooden handles. The long handles allow room for two persons on each side of the carrier. One carrier may be used to drag the log. Two or more may be used to carry a heavy log a long distance and to avoid dragging logs through a fragile area. Timber carriers can be used to move bridge stringers and are helpful in shelter construction.

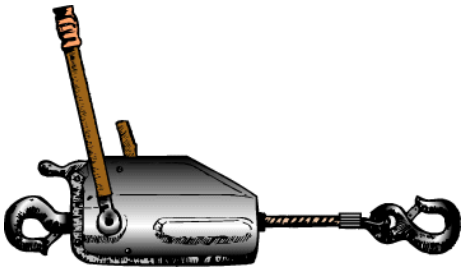
*Safety tip:* A firm tap on the back of the hooks will set the hooks into the log before carrying.

**Peavey and Cant Hook (Cant Dog/Log Dog)**

The peavey (named after its inventor Joseph Peavey) and cant hook (a cant is a square-edged timber or a squared log) are used for rolling and positioning logs and timbers. This includes rolling the log or timber to move it to another site or to rotate it in place. The main difference between these two tools is the shape of the tool's end. Peavys have a straight spike at the end whereas cant hooks have a blunt tip. The spike allows more control over the handling of the logs, but may cause more damage to the surface of the log. Both are used for essentially the same purpose. Peaveys are quicker to reposition when rolling a log or timber some distance and for maintaining momentum. Cant hooks provide for more precise rotating. When arranged as opposing pairs, either tool can serve as a timber carrier if a true carrier is not available.

*Safety tip:* Exercise caution not to roll timber or logs onto your or someone else's toes.

**Griphoist (Cable Winch)**



Griphoist is the brand name for a compact, lightweight-rigging tool (cable winch) that can be used to move rock or timber needed for trail structures. The machine consists of a metal body with a cable running through it. By cranking the lever, a set of levers clenches the cable and pulls it a few inches, moving heavy objects with ease. Its biggest advantage is that is a continuous cable puller. In other words, a cable of any length can be used. This allows for long pulls without having to re-anchor (i.e. across a stream or ravine). Nylon slings (less weight and less damage than chains) should be used to anchor the winch to a tree and to harness rock or logs. The winch cable should be kept freely suspended, rather than dragging it through dirt or rock, to avoid fraying and deterioration of the cable. Only crews trained in the art of rigging should use the Griphoist.

*Safety tip:* Always stand clear of stressed lines and out of the load's path of movement.

**Come Along (Comealong/Come-a-long/Come-along/Power Pull/Power Puller/Winch Puller/Ratchet Winch)**

The come along is a simple ratchet-and-pawl cable winch used for pulling, lifting, or stretching. The better models can move substantial loads (stump pulling or moving larger rocks and logs) without breaking but are limited by the length of cable that can be wound around the spool (usually about 25 feet). Because of this limitation, hauling material a considerable distance requires frequent re-anchoring of the winch.

*Safety tip:* Stay out from under the load.

**Rigging (Block and Tackle)**

Rigging refers to a system of cables, pulleys, and winches used to suspend and move heavy loads to a work site or into place. Rigging systems are most appropriate when there is a considerable amount of work to do at one site—such as when constructing a bridge, retaining wall, steps, or a shelter.

*Safety tip:* The set-up and use of a rigging system requires a sophisticated level of knowledge and special training or experience. It should not be attempted without this knowledge as severe accidents, caused by the heavy loads or a breaking cable, could occur.

**Wheelbarrow**

A wheelbarrow can be used to haul materials and tools to a work site as well as moving rock and dirt. Most wheelbarrows have a metal box and frame, wood or aluminum handles, and solid rubber or pneumatic tires. Pneumatic-tired wheelbarrows are recommended because you can adjust the tire inflation to roll easily on uneven terrain. Lift a loaded wheelbarrow with your legs, not with your back. Several light loads will be easier and safer to manage than one large one. Another

option is to use a two-wheeled cart. They have better balance and can often carry heavier loads—however, they require wider space to maneuver.

*Safety tip:* Do not overload. Stay behind handles, not between them.

**Canvas Bags**

C. R. Daniels, Inc. sells a heavy-duty canvas bag ($16-20 per bag) that is great for carrying dirt, small rocks, tools or anything you want to carry. Originally designed to carry coal these canvas bags can carry up to 95 pounds. They have four handles making it easy for two people to carry the load. You can have your logo silk screened or embroidered for a small additional fee.

*Safety tip:* Do not overload. Best to share the load with another person.

## *Bark Peeling Tools*

**Spud (Bark Spud/Peeling Spud)**

Bark spuds can greatly facilitate the removal of bark from green logs that will be used in your trail project. Removing the bark from the log will slow the decay process and give the wood a longer life. The bark spuds have a 1- to 4-foot long wood handle and a dished blade with three cutting edges. All three sides should be sharpened on the top side only. The blade slides between the bark and the wood. The best time of the year for removing bark is in the spring.

*Safety tip:* Push away from the body and keep hands and feet, as well as other workers, away from the front of the blade.

**Draw Knife (Drawknives)**

A draw knife is used to strip bark from small-diameter logs or poles for waterbars, turnpikes, and other timber work. Grasp it by both handles and pull the blade along the log toward yourself. A draw knife has its handles at a right angle to the blade whereas a bark knife has handles in line with the blade. Bark knifes are meant only for smoothing rough bark—not removing it.

*Safety tip:* Draw knives are razor sharp so caution is necessary.

**Adze (Carpenter Adze)**

An adze is basically an axe with a curved blade, pointing inwards at right angles to the handle. Its used to finish (hew) beams and logs to form a flat surface—such as the walking surface of a native log bridge. An adze should be kept very sharp and used only for hewing. It should be handled very carefully and contact with the ground avoided. It should always be protected with a sheath.

*Safety tip:* Exercise caution so an not to cut your feet or shins. When standing on the log being hewed, the toe of your front foot should be elevated so that a glancing blow strikes the bottom of the sole of your boot. Only the back of the heel of the front foot should be resting on the log.

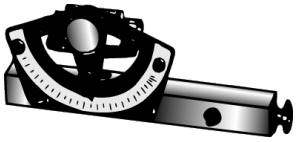
## *Survey, Layout, and Measuring Tools*

### Clinometer

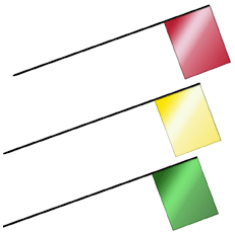
Clinometers are used by trail designers during trail layout to read the percent of grade between two points. It has a floating scale internally from which a grade is measured. A clinometer cannot be set to a fixed grade. Hold the clinometer to your eye and with both eyes open, sight parallel with the ground (upslope or downslope) to a target (stick or someone your own height), aiming at a point on the target that is equal to the height of your eye above the ground. Read directly from the percent scale. Percent slope, the relationship between the amount of elevational rise or drop over a horizonal distance. Expressed as a equation: Percent of Grade = Rise/Run x 100 percent. A section of trail 100 feet long with 10 feet of elevation difference would be a 10 percent grade.

*Tip:* Both eyes must be kept open when sighting through the clinometer.

### Abney Level



Hand-held instrument used since the late 1800s for backcountry surveying. Can be used to measure or set grade of a trail. A protractor mounted on the side of the level with the appropriate scale can be set to a fixed gradient, at which point the user sights through the abney to a fixed reference (usually a second person) until a bubble appears in the crosshair. When the crosshair bisects the bubble, this indicates the preset grade on the abney. The abney has been replaced in recent decades by the clinometer.



*Tip:* Check the screw that fixes gradient often to make sure it is still tight and you have the preset grade you want.

### Flagging (Ribbon/Wire Flag)

Flagging (roll of ribbon or wire flag) comes in a variety of colors and shapes. Flagging is used as a way of highlighting an area for trail alignment, construction, or maintenance. Ribbon or flag color should be chosen so that it is easily identifiable, and does not blend in with the surrounding terrain. All flagging materials should be removed once the areas work is completed.

*Tip:* Keep in mind that flagging will deteriorate in the elements.

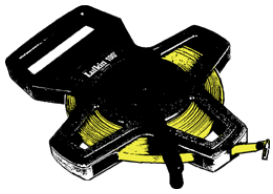
### Measuring Wheel

The measuring wheel is used to measure distance on the trail. It records the revolutions of a wheel and hence the distance traveled by a wheel on a trail or land surface. Measuring wheels can be used to measure distance for guidebook

descriptions and also noted in survey or assessment forms to pinpoint the location of work to be done along the trail.

*Tip:* Be sure counter is set to zero before staring out.

**Tape Measures**



The open reel case is made of lightweight polystyrene and is hi-viz blaze orange or yellow for excellent visibility. The tape measures come in different lengths; no need carrying more than you need. Great for measuring for bridges and other structures.

*Tip:* Clean the tape as you rewind it to prevent clogging from debris.

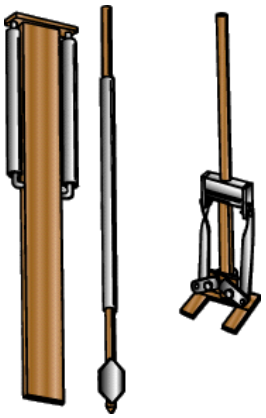
**GPS Receiver**

GPS, or Global Positioning Satellite, is a constellation of satellites around the earth that can be used to identify and store a position anywhere on the earth. A GPS receiver can be used for gathering waypoints along a proposed trail corridor or existing trail that indicate where to built a trail or points for maintenance. These points can be stored for future reference, and superimposed on an existing map to quickly identify the trail alignment or maintenance areas.

*Tip:* Carrying extra batteries are always a good idea.

## *Miscellaneous Tools*

**Flexible Post Tools (Post Driver, Pilot Driver, Post Puller)**



A special driver must be used when driving fiberglass trail posts into the ground. A special pilot driver helps when you have to drive a post into hard or rocky soil. The post puller is specifically designed for easy extraction of flexible posts. It eliminates the need of digging out the post.

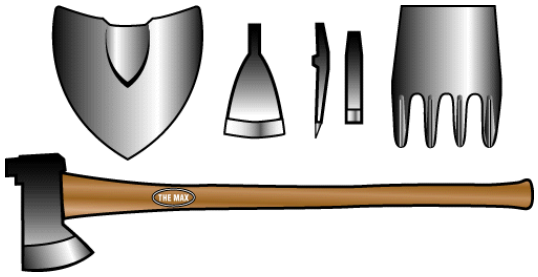
*Safety tip:* As with all pounding tools keep your hands and feet well out of the way.

**Hydraulic Jack**

Jacks are used to raise heavy weights such as a corner of a shelter that has settles, or a bridge beam so that shims can be places or the abutment built up. Can also be used to level heavy stone steps or any other structure—as long as room can be created to insert the jack under the object.

*Safety tip:* When working under heavy objects, there is always the danger of having it fall and crush whatever is under it. Extreme caution should be used when my part of the body is beneath the structure until it is securely in place.

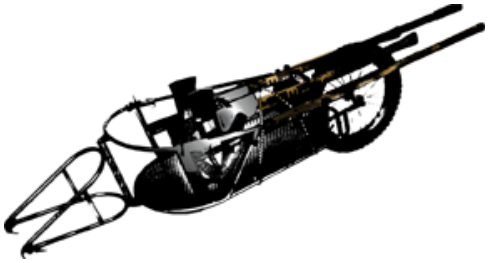
**MAX Multi- Purpose Axe**



Incorporates seven basic hand tools into one compact, versatile unit: A Hudson Bay style axe head permanently attached to a 36” fiberglass handle, with six quick-attach tools: shovel, mattock, pick, broad pick, fire rake, and hoe. Each component slips into a specially designed socket on the axe head and is secured by either a hitch pin or thumbscrew tightener. All components are drop-forged from high quality tool steel and fit into a compact canvas case that can be carried on a belt or strapped to a pack. Weights only 12-1/2 lbs

*Safety tip:* Make sure each tool is securely attached before use.

**B.O.B. YAK Trailer**



The YAK trailer also known as the Beast of Burden (BOB) seems to be the most prevalent single-wheeled trailer being used by trail crews. This versatile cargo carrier attaches to the hub of the rear wheel of a mountain bicycle by means of a special quick-release skewer. It can be used to carry hand tools, chainsaws, and day gear very well. BOB Trailers (www.bobtrailers.com) offers a holder that zip ties to the inside of the trailer for carrying hand tools more securely.

*Safety tip:* Do not overload. Make sure whatever you are carrying is well strapped down.

## *Tool Repair and Sharpening*

Tool handles crack and break all the time. Any tool that has a damaged handle should be condemned from use until a replacement is installed. The same is true for tools whose head is loose or cutting edge is broke. *Serious* injury can result from tools that need a new handle or have a broken head. Be sure your tools are in good shape before use.

**Files**

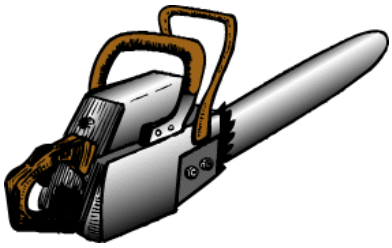
A 10- to 12-inch flat mill or flat single-cut bastard file is the simplest tool for shaping a bevel or giving a blade a fast edge. Because of the tooth design, files cut in only the forward direction. Dragging on the backstroke quickly dulls the file. If the file becomes clogged with filings, clean it with a wire brush or file card.

*Safety tip:* Make sure you file has a knuckle guard and a handle. Also good idea to wear gloves.

## *Power Tools*

Though the bulk of trail work involves the use of hand tools, there are occasions where power tools are more efficient. The small chain saw, motorized brush cutter, and other power tools are sometimes used for trail construction and maintenance. Manufacturers and agencies have good information and training on the safe use and care of these tools. All power tools should used only with the specific approval, and under the direct supervision, of trained personnel.

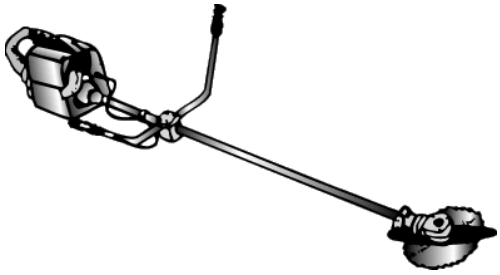
**Chainsaw**



Chainsaws with 16 inch blades are generally adequate for most trail work. Models should be obtained with chain brakes, vibration damped handles, and high quality mufflers. Chainsaws can be used to cut medium to large size blowdowns, clearing heavy sapling growth during trail construction, cutting trees into logs for wood construction projects such as bridges or shelters. Required personal protective gear includes leather gloves, ear muffs, eye protection, hardhat, and Kevlar (or similar) saw chaps.

*Safety tip:* Chainsaws should be used only by experienced workers who have undergone training and are certified for chainsaw use.

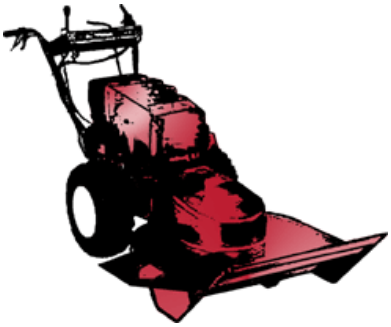
**Power Weed Cutter (Brushsaw)**



Generally, a power weed cutter with an engine of 35cc to 80cc and bicycle-type handlebars is recommended. Trail work requires a more powerful unit than one (weed whacker) that is used for lawn trimming. Trail work requires a saw type or a universal grass-brush blade—not a string cutter. The brushsaw is supported by a shoulder harness, but can still become very tiring. Be sure to work in a team and switch positions regularly. When not cutting, the other person can remove brush from the trail.

*Safety tip:* The open blade is on the end of a wand, and can snag and swing violently to the side, making it more prone to injure other workers rather than the operator. Other workers should stay clear.

**DR Field and Brush Mower**



This sturdy mower is an excellent choice for cutting heavy grass, weeds, briars, and even saplings from 1 to 2 ½ inch diameter. A DR Field and Brush Mower is simply a walk-behind brush-hog that is useful during trail construction and trail maintenance. It comes in 9, 11, 13, or 17 horsepower models. The 17 HP is the best for trail work with its heavy, 30 inch wide blade capable of powering through saplings up to 2 ½ inches thick. It is more useful than a sickle-bar mower because the material is chewed up and does not need to be removed from the trail as much as with a sickle-bar mower.

*Safety tip:* The mower can throw objects and injure others. Other workers should be kept at a safe distance away from the mower.

**Stump Grinder**

A gasoline-powered portable stump grinder is handy when you have lots of stumps to remove. They are powered by a chain saw motor and have carbide teeth that can be resharpened or replaced. They can grind through a stump in much less time than it would be needed to dig it out.

*Safety tip:* Proper safety gear is important especially goggles.

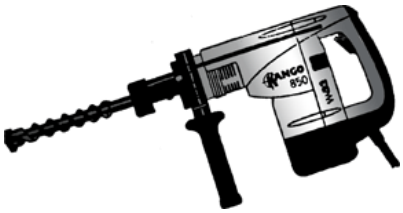
**Motorized Carriers (Power Wagon)**

Ideal for hauling stone, gravel, and dirt motorized carriers are useful for extra-heavy or frequent hauling needs. These come in various configurations and typically feature a small engine with a dump body.

*Safety tip:* Be sure to follow the suggested load limits.

**Rock Drills/Breakers**

Single use or combination rock drill/breakers or rotary hammer drills are available to drill holes in rock or concrete. They have many applications for blasting or splitting rock. They can be used break concrete or rock as well as cut asphalt. They can also be used to drive pipe, signposts, or ground anchors as well as chipping and shaping rock. Electric rotary hammer drills are lower in cost, size, and weight than gas powered models and the availability of lightweight gas generators has made it possible to use electric tools at project sites distant from roads. Some models available include: gas (Pionjar 120, Pico14) or electric (Kango).




*Safety tip:* Let the tool do the work, pushing hard can cause the bit to bind.