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- **Splitting firewood by hand is an arduous task which can be made easier by following the advice in this article:**
- **Use a splitting axe or splitting maul to split firewood, not a felling axe.**
- **Use wedges and drive them with the splitting maul.**
- **Follow the grain of the wood.**
- **Use small existing drying cracks in the wood to insert wedges.**
- **For easy to split wood use an “impact rod”.**
- **Use a chopping block with an old car tire mounted on top.**
- **Maintain your equipment.**

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Splitting firewood by hand

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Introduction

Firewood needs to be split to increase the drying rate and make pieces uniform in size. Dry, evenly sized firewood will greatly improve combustion, resulting in better heating and less smoke. This means having firewood seasoned to a moisture content of 20% or less and split into sizes of 7-9 cm diameter.

Splitting firewood by hand has always been an arduous task, which traditionally has been tackled with brute force and ignorance. Splitting by hand will remain hard labour, but by following simple advice provided here it can be made a lot easier.

There are several items to consider:

- wood, species and structure
- personal protection gear
- tools and tool maintenance

Advice on the right time of year of harvesting, drying rates and how to stack and store firewood can be found in a number of earlier COFORD Connects Notes, available at www.woodenergy.ie.

Species and wood structure

There is a world of difference between wood species in how easily they can be split. Several hardwood species such as ash, beech and birch tend to have straight grain and are easy to split, while European oak is more difficult due to its anatomy. The American oak species, like white and red oak, are easy to split. One of the most difficult hardwood species to split is horse chestnut, because of its very gnarled wood structure.

Softwoods such as spruce, pine and Douglas fir split relatively easily as long as the distance between branch whorls is more than say 30 cm and do not extend to the end of the log (as in treetops and in early thinnings).

This brings us to the structure of the wood. Branches often impede splitting, because branch wood tends to be denser and grows at an angle to the grain or splitting direction. However, with this knowledge, problems can be reduced. Branches grow from the stem surface, eventually die back and their remnants are incorporated as knots in the stem as it grows. They do not extend to the stem core, so by splitting the log through the middle, branch knots can be avoided.

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Hardwoods, which tend to have much thicker branches and forks than softwoods can be split exactly through the centre of the branch (Figure 1, the green line indicates the splitting direction).



Figure 1: Split a fork through the middle of the log, the green line indicates the direction of the split.

Splitting through the branch or fork “armpit” is almost impossible (see Figure 2, the red line shows how not to attempt to split).



Figure 2: How not to split through a fork or branch (the red line indicates how not to split)

Softwoods should be split at the end farthest away from the branch whorl to enable the splitting force to pass through the log. When cross-cutting logs before splitting, try to get long knot-free pieces on the log as possible. If you have a log with a ring of branches at either end, this log will be difficult to split.

It is good practice to split the wood immediately after cross-cutting as this will make the wood dry faster by exposing more surface area to wind and sun. A round log has by definition the lowest surface area for a given volume. On top of that, it is encased by bark, a device that nature has designed to protect the cambium beneath the bark from drying out. Often, during splitting, some bark will fall off, which together with the increased surface area will quicken drying.

However fresh hardwood is not always easy to split, because the splitting axe can rebound. With freshly felled fast-grown softwood on the other hand, the axe can become stuck in the wood as the applied force is absorbed by water-filled cells and will not propagate properly through the log. So, waiting a few weeks after cutting can help in that case. Visible small cracks will appear on the cut surface of logs after some drying. By hitting these cracks, splitting is a lot easier. One can also insert a wedge into these cracks by lightly tapping the wedge in place before letting go with brute force.

Curiously enough it is often difficult to make the first split in larger hardwood logs. Once the log has been split in two, however, it is then far easier to make further splits. A tip here is to use a chainsaw to make a cut in the edge of the log at about 45° to the cut surface (Figure 3). This cut can then be used to insert a wedge into the log so that by driving the wedge into the wood, a larger force can be exerted than just by the splitting axe.

Cutting at an angle greater than 45° will result in long slivers of sawdust which may clog the sprocket of the chainsaw.

Personal protection gear

When working with sharp tools, one should always wear shoes or boots with a protective hard toecap. Not only will the cap prevent injury to the foot if the axe glances off the log, but also when pieces of wood are falling on it.

Proper heavy-duty working gloves are a must when splitting and handling firewood. Often sharp splinters are attached to the logs and can become embedded in the skin. These should be removed as soon as possible as they can cause inflammation.

When working with a chainsaw, safety pants, strong steel-capped footwear, hearing protection and gloves are to be worn of course. Hearing protectors are often attached to the helmet, but a helmet is not strictly needed when cutting firewood or making the occasional cut when splitting logs.

Tools

Splitting wood requires a simple tool kit:

- a large splitting axe
- a small chopping axe
- wedges
- a chopping block or a piece of thick plywood.

Modern tools are available, and these are described underneath. It goes without saying that tools need to be well maintained to get the best results from as little labour as possible.

Large splitting axes, mauls

A normal delimiting axe with a sharp blade is not suitable for splitting wood. These axes have been ground slightly hollow behind the edge and have a narrow blade, so that they can slice through the wood fibres (at an angle to the grain). Delimiting axes therefore tend to get stuck in the wood and become difficult to prize out.

Splitting on the other hand means separating fibres along the grain of the wood.

A good splitting axe does not have to be sharp;

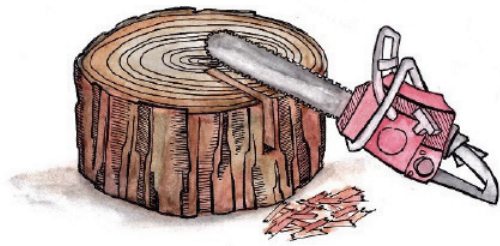


Figure 3: How to make an opening cut with a chainsaw to enable a splitting wedge to be hammered into the log to split it.

Some people make a cut in the centre of the log with the chainsaw (Figure 4). This is a very dangerous practice and should always be avoided. When making such a cut the chainsaw is very prone to kickback, where the saw will uncontrollably fly upwards pivoting around the hands and may cause injury to your face or upper torso.



Figure 4: A cut in the centre of the log. NEVER USE THIS DANGEROUS APPROACH.

rather the blade should be thick and wide. The other end of the axe head should be flat and wide, to drive wedges without destroying the axe. There are many different types of splitting axes (Figure 5).



Figure 5: Types of axe, the top three are used for splitting, the next two are for delimiting and the bottom one is a simple chopping axe. Note the profiles to the left of each axe.

If one drives a wedge with a normal delimiting axe, then it is very likely that the housing of the shaft will become deformed, resulting in a loose shaft. The head will eventually fly off or the shaft will break.

Traditionally, axes have shafts made from shock absorbent timbers such as ash or hickory. Increasingly splitting axes have glass fibre handles, which are more resilient than wood and almost impossible to break.

One of the main risks when using a splitting axe is hitting the log with the shaft of the axe rather than

the head. This will damage the shaft or in the worst case break it. Repeated damage will also result in breaking. For this reason, splitting axes sometimes have a metal protection plate behind the head. Alternatively, they are equipped with a glass fibre shaft (Figure 6).



Figure 6: Splitting axe with glass fibre shaft.

Glass fibre shafts do vary in quality. Some are too flexible, which will have the axe rebounding of the log if it does not hit it full on. If one does not have a good grip on the handle, the axe may fly off in an unwanted direction and generally can be difficult to control.

Small chopping axe

A small chopping axe is only used if the logs do not split all the way through and the pieces are still connected by some fibres. These can be easily cut through with a well-sharpened chopping axe. The chopping axe is also used to make kindling from straight, knot-free split logs, especially from ash, pine or spruce which tend to split rather easily, especially when dry.

Wedges

Wedges come in many sizes and shapes and have functions from aiding in felling trees to splitting wood. However, wedges for tree felling are not suitable for splitting wood and vice versa. Splitting wedges should be made from steel, while felling wedges are usually of aluminium or plastic. These materials do not harm the chain of the chainsaw if it inadvertently comes in contact with the wedge, whereas an iron wedge can do a lot of damage.

Splitting wedges can have many shapes, from the common flat one, to those that are twisted or look like a grenade (Figure 7).



Figure 7: Some examples of splitting wedges

The head of the wedge should be slightly rounded when taken into use. The head becomes flattened in use and will in time produce a burr at the edge.

Chopping block

A chopping block has three functions: to give a solid foundation to absorb the force of the stroke of the splitting maul, to protect the edge of the splitting axe against contact with soil and stones and last but not least to raise the logs to be split to a better working height.

The two first functions can be provided by placing the logs on a thick sheet of plywood or a similar board product. This will prevent logs from sinking into the soil, and if the logs are split on a hard surface, take any missed blows from the splitting axe without damaging the head.

The better working height that a chopping block provides comes at a cost: the split pieces tend to fall off the block onto the ground. If they are not split to a small enough size in one go, they will have to be lifted onto the block again. This can be avoided by placing a used car tyre on the top of the block (Figure 8). Fill the tyre with logs to be split. One then moves around the block, splitting one log after another without having to retrieve them from the ground.



Figure 8: A used car tyre keeping logs together during splitting.

If this method is working well for you, a further refinement is to place iron legs under the tyre, so it is raised a few centimetres off the block. This will allow debris and pieces of bark and dirt to fall away from under the tyre and will prevent it falling off the chopping block.

A piece of plywood can also accommodate a car tyre in much the same way. Equipment to constrain logs during splitting can be bought, but a used car tyre costs almost nothing, and is every bit as effective as the more expensive alternatives.

Tool maintenance

Before starting the splitting wood for drying and storage inspect the tools for the job.

If the splitting axe, the maul and the chopping axe have been correctly stored in a dry workshop or garage rusting will not be a problem. However, axe shafts can dry out and shrink, so heads can become loose. Before putting them to work put the chopping end in a bucket of water for some hours, so the wood in the shaft expands as moisture is taken up. This will make for a tighter fit with the head of the axe. Also, wood is more flexible with some moisture in it, and this will help to protect the shaft from splintering. If the splitting work is over several days, splitting axes should preferably be left outdoors in a safe place away from the reach of children. Also, check that the small wedges that keep the shaft in the head are tight. If not, just tap them in with a hammer.

If the tools are equipped with plain wooden handles (meaning that they have not been varnished or painted), then it is a very good idea to treat them with boiled linseed oil. Start with that when the tools are new and saturate the shaft with linseed oil. Let it dry for a few days and then treat again. Repeat this several times. Every time you have used the tool, just wipe them down with linseed oil, especially before you store the tools for a longer period. The linseed oil will keep the shafts supple and smooth.

Remove any burrs from the edge of the splitting axe and make sure that the edge of the chopping axe is sharp. Both are best done with a fine-toothed file or a sharpening stone. One could also use a wet grinding wheel or a flap-disc on an angle grinder. These are better than using a grinding disc. A grinding disk can overheat the edge, which can alter the temper of the metal and it can become brittle, best seen when the colour of the edge turns blue.

Over time, due to battering from the splitting maul, the heads of the splitting wedges will flatten, and burrs will be formed on the edges (Figure 8). Burrs are dangerous because if they extend too far, pieces may fly off when hit and can injure the user. So, every now and then use a grinding wheel or an angle grinder with a grinding disc to remove the burrs. Always wear gloves and goggles when using grinding wheels or an angle grinder.



Figure 9: Worn splitting wedges, note the burrs which require removal.

Tools like the impact rod and the foot-operated

splitter can use a drop of oil every now and then to operate smoothly.

When the splitting season is over, give the metal parts of your tools a nice wipe down with some oil to prevent rust. Treat the wooden shafts with boiled linseed oil.

New tools and equipment

Over the years many inventions have seen the light of day, which can make the work of manually splitting wood easier and/or different. New tools and equipment are not always useful for all kinds of wood. If the wood is very gnarled or has knots or forks, then the old-fashioned splitting axe and wedges are the better option.

There are several new tools to split wood:

- impact rods (for want of a better phrase)
- foot-operated splitter
- spiral splitter attachment to a drill.

Impact rods

With impact rods, one does not have to swing a splitting axe through the air and hope to hit the log at the right place. An impact rod comprises two parts: a tube with the splitting head on one end and a second weighted part that can slide over or inside the tube (Figure 10).



Figure 10: Logmatic impact log splitter

The procedure is simple: place the log on a sturdy piece of plywood, then place the splitting head on the log and lift the weighted top part slightly and tap the wedge into the wood so that it “bites”. Then lift the top part with both hands and ram it down. Release your grip on the top part just before it strikes the bottom part to avoid the impact shock on your hands and wrists. The force generated by the weighted top part will now force the wedge into and hopefully through the log. Several brands of impact rods are on the market today.

There are several variations on the impact rod splitter method as shown in Figure 11.



Figure 11: Other types of impact splitters

Foot-operated splitter

In a foot operated splitter, one places a log in the holder and then stamps down the lever that projects from the splitter. The log will be forced past the wedge. The idea is that one can exert more force with one’s legs and use the lever arm to increase the impact force (Figure 12).



Figure 12: Example of a foot-operated splitter

Spiral splitter

Spiral splitters are a kind of threaded cone that is screwed into the wood by a handheld drill (Figure 13). The principle is well known from larger units that are powered by stationary electric motors or the PTO of a tractor.



Figure 13: Spiral splitter plus a range of shank types to attach it to a power drill.

The cost of these small cones is of course much lower than large machines. Care should always be taken when using a spiral splitter. If it gets stuck in the wood the log can quickly start to rotate around the drill and cause injury. Even if it does not rotate, it will exert a powerful wrench to the hand holding the drill.

Sappi

A sappi is a tool with a sharp hook at the end. By embedding the sharp end in the log, it makes it easy to lift or drag (Figure 14).



Figure 14: A sappi in use

The sappi also extends reach, so one does not have to stoop as much to move logs off the ground. These tools have a long history of use in Scandinavia and other countries during chainsaw harvesting of small softwoods and were used to stack logs.

Besides handling logs, a sappi can also be used to advantage when splitting kindling. Instead of holding the piece of wood by hand, one uses a sappi to stabilize the log without risking hitting one's hand with the chopping axe.

Splitting kindling

When firewood is used for heating, kindling is needed to start the fire off quickly and with a minimum of smoke.

Kindling is ideally suited to lighting a fire from the top down. Place 2-3 logs parallel to each other on the bottom of the fireplace. Then build a small pyramid of kindling on top of that. Insert a firelighter inside the pyramid and light the fire. The small fire will at first heat the chimney and create the necessary draft and then the heat at the bottom of the pile will slowly ignite the bigger logs. This method is a very environmentally friendly method to light the fire with a low amount of pollution.

To make kindling, select pieces of straight-grained,

knot-free wood. Hold the piece with a gloved hand (or even better with a sappi) and chop the wood to kindling with a chopping axe or hatchet, while the log rests on the chopping block.

There are several tools that can be used to produce kindling, which are much safer than the above method but much more expensive of course. In the kindling splitter (Figure 15), one inserts the wood to be split from the top and then hammers it down with a mallet. The second wall mounted kindling splitter is even more ingenious. Different lengths of kindling material can be easily and safely split with this equipment (Figure 16).



Figure 15: Kindling splitter: insert the wood from the top and hammer the log down against the anvil with a mallet



Figure 16: Wall-mounted kindling splitter

Summary

By using the right tools, it is possible to take much of the brute blunt force out of splitting firewood:

- use a proper splitting axe.
- use good quality iron or steel wedges (not plastic nor aluminium).
- bunch a lot of logs to be split tightly inside an old car tyre to keep them upright during splitting.
- never use an ordinary felling axe to drive a wedge, you will destroy the axe.

Take advantage of the structure of the wood to reduce effort:

- split from the end of the log from where you can have the longest “run” (the branch whorl is at the end of the log).
- split through the middle of the log.
- use existing drying cracks when splitting with the axe or to insert a wedge.
- always split a piece of forked wood from the bottom side.

Modern tools:

- If you have wood that is easy to split, you can use a splitting rod and a splitting axe for the difficult pieces.
- Extreme caution should be used when using a spiral splitter attached to hand-drill.
- Use a sappi to extend your reach and help with stacking and chopping wood.

Health and safety:

- Do not use a chainsaw to make a preliminary cut in the middle of a log, this can cause kickback and injury, better use it to cut openings at the edge of the log.
- use proper safety shoes and gloves when splitting wood, and safety pants and hearing protection when working with a chainsaw.

Images of the equipment shown have been sourced

from the internet. The equipment can be found on the internet trading platforms. The mention of tradenames does not constitute a recommendation.

Further reading

Further information on preparing and seasoning firewood and on combustion is contained in Volume II of the recently published *Wood as a Fuel*:

Kofman, PD, Hendrick E, 2021. Wood as a Fuel, Volume II Firewood. Wood Fuel Partnership, Dublin

More information can also be found in the following COFORD Connects Notes:

- Firewood.
- Producing firewood from conifer first thinnings
- Storage and seasoning of conifer and broadleaf firewood
- Long term storage and seasoning of conifer energy wood
- Producing firewood from broadleaf first thinnings
- Getting the most out of your Firewood

COFORD Connect Notes can be found on www.woodenergy.ie in the chapter on publications.