# Harvesting Firewood *from* Your Woods

TOPICS:

# Tree & Forest Biology

Cutting trees for firewood requires careful management. The management decisions you make can either improve or harm the long-term health and productivity of your woodlands. Understanding how and where trees grow can aid your decisions about which trees to cut, and will lead to improvements in the overall health of your woodlands.

Trees have several basic requirements for long-term survival: nutrients, space, water and sunlight. The competition for these resources will determine how well a tree grows and how long it will survive.

Tree roots are responsible for the uptake of water and nutrients. The quality and quantity of these nutrients vary depending on the soil. Different trees are adapted to the different soil types, from sand to clay. Clay and loam soils hold water and nutrients better than sandy soils. That means trees growing on sandy soils need to be able to grow in low nutrient and low moisture conditions. Each soil type can only support a limited number of trees, based on their size. Trees become stressed when there is too much competition for water and nutrients. To keep your forest healthy, some trees should be removed to make room for others to grow.

*Jeffrey J. Strobel*

Trees also need sunlight and space for survival. Trees collect sunlight with their leaves and convert it to sugars, which are used to build more branches and roots. Trees need space around them (both above and below ground) to grow and become healthier.

Finally, trees grow and interact with each other. Trees compete for water, space and nutrients, but especially sunlight. Different tree species have adapted to growing in different light conditions, from full sunlight to full shade and degrees in-between. Some trees grow best in full sunlight (called shade intolerant), while others flourish in the shade (shade tolerant). For example, a wildfire or wind storm affecting at least 10 acres can provide full sunlight where aspen, white birch and red pine will thrive. By creating large openings (for example, conducting a clear-cut timber harvest) you will favor those trees. Shade-tolerant trees such as balsam fir and sugar maple often prevail over a long period on a shady forest floor. By maintaining a mature forest – allowing only small patches of sunlight to reach the forest floor – you favor shade-tolerant trees.

If you have a favorite firewood species, you can better manage your forest for that tree's growing needs by understanding soil, shade tolerance, and succession.

## SOIL PREFERENCE AND SHADE TOLERANCE FOR VARIOUS FIREWOOD TREES

| Tree Type | Soil Preference | Shade Tolerance |
|---|---|---|
| **Apple** | Sandy loam to a sandy clay loam soil; good soil drainage | Full sun |
| **White Oak** | Variety of types, but best on fertile, well-drained soils | Prefers full sun, but tolerates some shade |
| **Hickory** | Rich, moist soils | Full sun to partial shade |
| **Black Locust*** | Extremely adaptable; tolerates dry sterile soils | Full sun |
| **Ironwood/Hophornbeam** | Rich, not too dry soil | Tolerates shade |
| **Sugar/Hard Maple** | Moist to well-drained rich soils | Full sun to deep shade |
| **Elm (Slippery, Red, Rock)** | Rich, moist soils (Slippery and Red)<br>Dry soils, heavy clay (Rock) | Moderately shade tolerant |
| **Red Oak** | Variety, but best on fertile, well-drained soils | Full sun |
| **White Ash** | Well-drained upland soils | Full sun |
| **Black Walnut** | Fertile, well-drained loams and silt loams; southern ⅓ of the state | Full sun |
| **Tamarack/Larch** | Moist, organic soils and well-drained uplands | Full sun |
| **Red/Soft Maple** | Prefers moist to moderately well-drained soils. Moderately drought tolerant | Moderately shade tolerant |

| Tree Type | Soil Preference | Shade Tolerance |
|---|---|---|
| **White/Paper Birch** | Moist to moderately drained soils | Full sun |
| **Ash (Green, Black)** | Fertile, moist soils | Full sun |
| **Red Pine** | Sandy loam or dry, rocky ridges | Full sun |
| **White Pine** | Prefers fertile, well-drained soil, but will grow in sandy, dry soils as well | Moderately shade tolerant |
| **Aspen/Poplar** | Sandy or rich soils that are moist (Big-tooth) Grows well on sandy, gravelly soils but thrives on good soil (Quaking) | Full sun, very fast-growing |
| **Basswood** | Good soil with adequate moisture | Full sun to partial shade |

***Black locust is considered an invasive species, and is not recommended for planting.**

## CHARACTERISTICS OF GOOD FIREWOOD

When it comes to choosing which trees you want to manage for firewood use, there are several qualities of the various trees to consider: heat value, smoke production, fragrance and splitting ease. Although heat value is often the main reason people choose one wood over another, the other qualities are worth considering. For example, elm has a high heat value, but if you are splitting wood by hand you might regret that decision due to the difficulty of splitting.

Heat value is measured in BTUs, or British thermal units. The primary factors in determining the BTU value are the density of the wood and its moisture content. Those with a "high" rating produce more heat than those with a "low" rating. Smoke production is primarily based on how well wood is dried/seasoned. Green wood will always produce

more smoke, regardless of the type of tree. Fragrance is a rather subjective quality. However, some trees are known for their firewood fragrance or lack of fragrance.

The factors tied to splitting ease include the density of the wood and the orientation of the wood grains (whether straight or interlocking).

## COMMON TREES IN WISCONSIN AND THEIR FIREWOOD VALUES

| Tree Type | Heat Value* | Smoke Production | Fragrance | Splitting Ease |
|---|---|---|---|---|
| **Apple** | Highest | Moderate | Excellent; sweet | Difficult |
| **White Oak** | Highest | Light | Good | Easy-moderate |
| **Hickory** | Highest | Light | Excellent | Easy-moderate |
| **Black Locust*** | Highest | Light | Slight | Moderate-difficult |
| **Ironwood/Hophornbeam** | Highest | Light | Good | Moderate-difficult |
| **Sugar/Hard Maple** | High | Moderate | Light | Moderate-difficult |
| **Elm (Slippery, Red, Rock)** | High | Moderate | Good | Moderate-difficult |
| **Red Oak** | High | Light | Good | Easy-moderate |
| **White Ash** | High | Light | Slight | Easy-moderate |
| **Black Walnut** | High | Moderate | Good | Easy |
| **Tamarack/Larch** | Low | Moderate | Slight | Easy-moderate |

| Tree Type | Heat Value* | Smoke Production | Fragrance | Splitting Ease |
|---|---|---|---|---|
| **Red/Soft Maple** | Low | Light | Good | Easy-moderate |
| **White/Paper Birch** | Low | Moderate | Slight | Moderate |
| **Ash (Green, Black)** | Low | Light | Slight | Easy |
| **Pine (White, Red)** | Lowest | Moderate | Good | Easy |
| **Aspen/Poplar** | Lowest | Moderate | Slight | Easy |
| **Basswood** | Lowest | Moderate | Good | Easy |

***Pound for pound, all tree species have the same BTU value, which is why wood density plays an important role in the BTU rating of each tree species.**

# Planning a Harvest

Assuming you have an interest in getting firewood from your woodland, it is important to have a plan for which trees you are going to cut. It is also a good idea to integrate your plan for firewood production with other goals you have for your forest. A comprehensive forest management plan will address all aspects of your forest, integrate your goals, and provide a timeline of when and where to do various management activities. Goals for your forest can include wildlife habitat, forest health, recreational opportunities, timber sales and firewood. A management plan that focuses on firewood would still consider all your goals and the overall forest, but only have management prescriptions for firewood harvesting.

You can create a forest management plan for your property with the resources in this publication and those provided by the Wisconsin Department of Natural Resources (WI DNR) and the University of Wisconsin–Extension (UWEX). However, if your intention is to conduct a timber sale where you will work with a logger, it is highly recommended you first utilize the services of a forester. A forester has knowledge of local market conditions and knows which trees to harvest to meet your goals.

Anyone who has ever split wood by hand knows that straight trees are easier to split than the crooked ones or those with multiple

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forks. However, cutting the nice straight trees shouldn't be your starting point for choosing which trees to cut for firewood. This is where a management plan will be helpful. Looking at the overall health and goals for the forest, a forester will help you determine the best trees to cut for the future of your woodland. This does not mean you will be left to harvest just the dead and dying trees. In fact, leaving some of those trees can improve your woodland's wildlife habitat. Standing dead trees (snags), fallen logs and brush piles provide nesting and feeding sites for a variety of wildlife.

General guidance says to leave three to four standing dead trees per acre. For every 20-acre woodlot, leave the following: four to five snags or den (wildlife habitat) trees over 18 inches diameter at breast height (DBH), 30 to 40 snag or den trees over 14 inches DBH, and 50-60 snags over six inches DBH. A management plan would help you decide which of those to set aside from any firewood harvesting.

There are few downsides to having a management plan. However, there are some consequences of not planning ahead before taking the chainsaw to a stand of trees. If the typical life of a tree is 100 years, think of the time it will take for a forest to recover from poor choices. With the assistance of a forester and a management plan, you can be confident of your decision to fell one tree rather than another.

## PROPER SAFETY EQUIPMENT AND CHAINSAW USE TECHNIQUES

Chainsaws are powerful tools, and thousands of people get injured each year using a chainsaw because they don't follow some simple safety procedures. Broad guidelines for felling and processing trees with a chainsaw include never working alone, using proper techniques and using the right safety equipment. The safety equipment includes:

- A chainsaw helmet or hard hat;
- Safety goggles or glasses;
- Ear muffs, ear plugs, or other hearing protective gear;
- Chainsaw chaps;
- Work gloves;
- Work boots with a steel toe; and
- Clothes that fit well with no dangling shirt tails or sleeves.

*University of Missouri Extension*

If you decide to work alone in the woods, be sure to let someone know where you are working. Proper techniques for using a chainsaw safely include:

- Always engage the chain break when you are not actively cutting.
- Always keep two hands on the saw when actively cutting.
- Always ensure you have stable footing when cutting.
- Never cut with a chainsaw above your shoulders.
- As much as possible, cut with the flat part of the bar and not the tip.
- Keep the blade sharp (sharp blades will throw chips and dull blades will throw dust).
- Keep your left thumb wrapped around the front handle (not on top of the handle).
- Place the saw on the ground and make sure the bar tip is clear of obstructions when starting.
- Trim the limbs from the fallen trunk while standing on the opposite side of the trunk.

Chainsaw safety and use training is recommended for anyone felling trees, whether it is a single tree in the yard or hundreds of trees in your woodlot. The Forest Industry Safety and Training Alliance (FISTA) offers this training and you can find more information about this organization by visiting their website (fistausa.org).

## ORDER OF REMOVAL

When deciding which trees to cut, identify the trees that are or can be the best quality, best growing and most productive, consistent with your woodland objectives. Poor choices can result in a woodland that is not as productive as you need it to be, nor will such choices meet all your other goals for the woodland.

A step-by-step guide for deciding which trees to cut was established by the WI DNR to help landowners get the most out of their harvest. This "order of removal" is a numbered, sequential list of which trees should be considered first for cutting, followed by the next important trees to harvest.

Each numbered step is completed before going on to the next step. This process is undertaken for a small, defined area of your forest, sometimes called a *stand*. Stands are made of trees of similar species and ages. Complete an evaluation of the stand before moving on to other parts of your forest.

The order of removal is:

1. Remove high-risk trees.
2. Make room for your best (or crop) trees to grow.
3. Remove trees with low vigor.
4. Remove trees with poor form/quality.
5. Favor species that fit your objectives.
6. Remove trees to create adequate spacing for your crop trees.

After each step, evaluate the stand for adequate stocking. Stocking is a general term that describes the number of trees per acre, or the density of trees per acre, in a particular forest stand. When foresters refer to stocking they will be talking about the desired number of trees for healthy, productive growth. Forestry scientists have calculated the ideal number of trees per acre for various tree types, and have identified conditions where a forest stand is overstocked, fully stocked or understocked. Biologically, if a stand is considered overstocked, it means that trees aren't growing as well as they should, due to competition for resources. In this case the stand should be thinned to improve the growth of the remaining trees. See *Estimating Stocking Conditions* (UW–Extension Publication G3362) to learn more about determining stand density.

In the process of marking timber, a forester considers several factors. The forester first takes a sample plot (an inventory of trees within part of the forest) to evaluate stand density and see if some trees need to be harvested to make room for the best trees to grow. If the stand density is too high, the forester selects trees according to the order of removal, working down from the top of the list to the bottom.

After marking the trees for removal defined by each step, the forester checks the resulting density before moving on to the next step. Frequently, in previously unthinned stands, only part of the order of removal list is completed. You should follow this process, marking trees before cutting and always remembering to "measure twice and cut once."

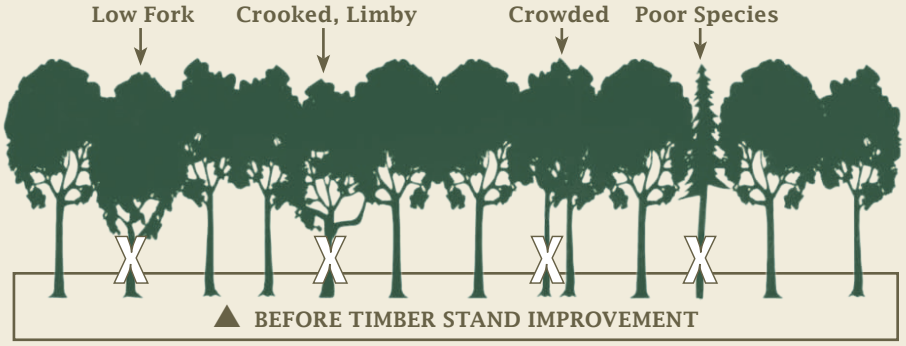
Details for the steps in the process (adapted from the WI DNR order of removal) include:


William Klase

A high-risk tree.

***1. Remove high-risk trees.*** First mark the high-risk trees as the ones to be cut. High-risk trees are defined as trees that will not live to the next scheduled cut, usually 8-15 years. After you have marked all the high-risk trees, re-evaluate the stand to see if the density is where you want it to be. If the stand is still too dense, continue on to step 2. Repeat this process for each step, checking the density before moving on to the next step.

***2. Make room for your crop trees to grow.*** Harvest the trees surrounding and crowding your best trees (those of the highest quality and that meet your other objectives) to make room for those trees to grow vigorously. Keep in mind not all crop trees need release because they already may have plenty of growing space and be in a dominant crown position.





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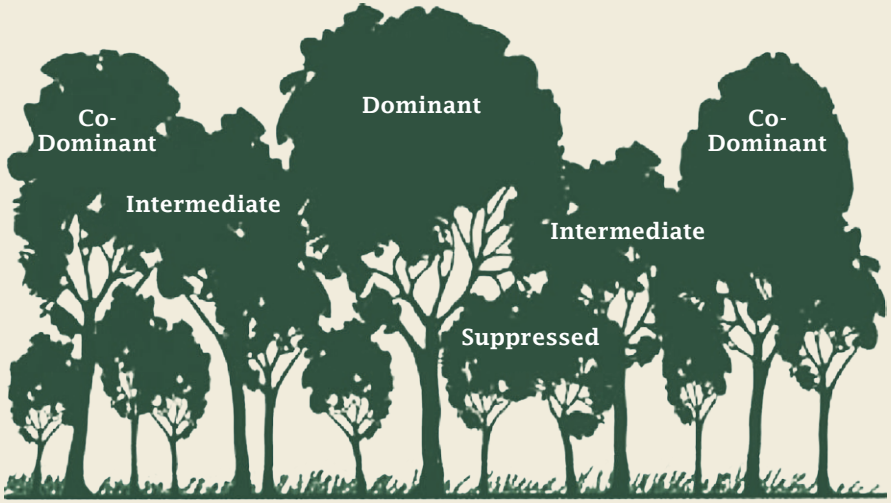


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*William Klase photos*

Examples of poor-quality trees.

***3. Remove trees with low vigor.*** The next trees marked for cutting are those that are often smaller in diameter, have poorly developed crowns and do not hold a good position in the main canopy (i.e. suppressed trees).

***4. Remove trees with poor form/quality.*** At this stage, you are looking to favor the healthiest trees and remove those that are less so. This means removing trees with wounds, broken off branches and tops, or trees declining due to old age or disease and insect attacks.

***5. Favor species that fit your objectives.*** All else being equal, species is the next consideration. Although maintaining diversity is important, it is best to favor those trees that provide benefits that meet your goals for the property and are best suited for your soil and growing conditions.

***6. Remove trees to create adequate spacing for your crop trees.*** At this point, you have mostly high-quality trees left to choose from and need to decide which ones to harvest so that your favored trees have plenty of room to grow. A good guideline for creating room for an individual tree to thrive is to remove trees from three sides of your crop tree. That will create sufficient gaps for that tree to expand into, and protect the tree from being blown over by a strong wind.

At any time during this process, once the target density is achieved, stop harvesting and move on to the next part of your forest.

# Processing Trees into Firewood

The process for making good firewood can be summed up as:

- Cut and split logs to the right size;
- Place them in an area off the ground and exposed to the sun and wind; and
- Allow the logs to dry to less than 20% moisture content.

Anything less than this will most likely result in wood that still has too much moisture in it and/or may be rotting. The process of turning trees into firewood is just getting started once the trees have been felled and limbed. Cutting (or bucking) logs to the right length is the first step. You want firewood that fills your stove, furnace or fireplace, but is not too large. Buck logs into rounds (firewood-length round pieces that have yet to be split) that are two-to-three inches shorter than the length or width of your firebox, depending on how you orient the pieces when loading. Lean toward cutting the rounds shorter rather than longer, as these will dry faster than the longer pieces.

Wood will dry fastest if it is split rather than whole with bark intact. Split the wood to a maximum width of six inches and create a variety of different sizes so that you have more options when kindling or stoking the fire. Some fireboxes can handle larger-sized pieces and

Jeffrey J. Strobel

you may be able to use unsplit pieces, but it is a good idea to remove the bark to speed up drying.

## SPLITTING TECHNIQUES

Splitting rounds into firewood with a maul can be quick and efficient if you follow some simple guidelines. Always wear sight protection and use a splitting platform that raises the wood to be split to the proper height (the maul handle is parallel to the ground when you strike the piece). The platform could be a stump or a large piece of round wood that would be difficult to split. The splitting platform will ensure that you get the maximum effect of your swing (compared to being on the soft ground), and that your maul or axe doesn't hit rocks or your feet.

Try to make each swing of your maul as efficient and powerful as possible. A half-hearted swing can leave you with a stuck maul or axe and an incomplete split. Utilize your legs and your trunk or core muscles to get the maximum amount of force in each swing.


Jeffrey J. Strobel

Straighten your legs on the upswing and then bend them when bringing the maul down onto the piece. Bend at the waist as well when striking and try to snap your wrists right at the moment of impact.

Spend a moment studying each piece before deciding on how to attack it. If the piece already has cracks in it (sometimes called checks), then make those your target for splitting. Place knots at the bottom of the piece to facilitate easier splitting. If you can tell before your first swing that it is going to be a difficult piece, then start a crack by making a cut into the piece about an inch deep. Finally, some believe that pieces split easier when they are placed on the platform opposite the way they grew (i.e. upside down).

After you have the piece to split oriented correctly, it is time to start swinging. Your initial strikes are best targeted at the near side of the piece rather than the center. Subsequent strikes will be targeted closer to the center as you walk the crack you develop across the piece.

Rather than halving or quartering larger rounds, start by "peeling" them. To do this, carve off chunks from around the edges of the round, leaving the center intact. After you have peeled the entire outside of the round, the center is much easier to split.

Some folks use old tires to keep from having to stoop to pick up split firewood or chase pieces that have flown away following splitting. The tires are secured to the top of the splitting platform, and pieces to be split are placed inside of the tire (or tires, depending on the size). Then, swing the maul as you normally would. Split pieces will stay within the tire and you can balance odd-shaped pieces against the inside of the tire for carefree splitting.

Gas- or electric-powered log splitters are handy tools for stubborn pieces or when the work load is excessive. These powerful tools can easily cause you harm, so take the proper precautions for safety. Use sight and hearing protection, wear steel-toed boots and ensure that your clothing is tucked in so that nothing can get caught by the mechanisms. Keep your hands free from the log while splitting and develop a good system of communication with anyone you are working with near the splitter.

## STACKING TECHNIQUES AND GUIDELINES

Again, the key elements for stacking wood are to get the wood off the ground and expose it to sun and wind so that it quickly and thoroughly dries. Therefore, finding the right spot to stack wood can be critical for drying. Under an evergreen tree may seem like a good location to keep the rain off, but the shade can slow the drying process dramatically. Likewise, firewood that is stacked inside a woodshed will take nearly twice as long to dry, compared to an open area exposed to the sun and wind. Flat areas are


WI DNR

A stack of firewood that is safely more than 30 feet from the home.


Hearth.com

A chimney-style stack of firewood.


WI DNR

Free-standing ranks of firewood.

preferable to uneven terrain, especially if you are stacking on a pallet. Wherever you decide to stack, ensure that the wood is at least 30 feet from your home so that the firewood doesn't become a source of fuel for a wildfire that could end up damaging your home.

The platform on which the wood is stacked is also an important part of the drying process. If the runners (e.g. posts or cut branches) you use as a base are too narrow or already rotting, then your bottom layer of wood may absorb water from the ground. Work to get the bottom layer of your stack four to six inches off the ground. Along with having the right size and stoutness, the base should be level and well-seated in the ground so that your pile doesn't topple over.

People have many different opinions on what the stack should look like. The rank and chimney styles are most common, and in this publication we focus on the rank. The term rank comes from "ranked and well stowed" used for measuring a cord and here refers to a single row of stacked firewood. A free-standing rank is the best way to dry your wood. End supports can either be posts you have driven into the ground or cribs at either end of the rank.

When using posts to support the ends of ranks, anchoring it back into the stack of wood is the key to ensuring the post stays upright. Tie one end of a six-foot length of twine or rope to a piece of firewood and tie the other end to the post. As you are adding pieces to the second row of wood, place this tied piece into the row with the rope fully extended. Repeat this process when you get to the fourth row. The pieces tied to the post and buried in the stack will keep the post from bowing outwards.

To create a crib, place two or three pieces parallel to each other at the start of the rank and no more than the length of the longest piece. Then stack two or three pieces on top of those, oriented 90 degrees from the first two. Continue this process until you have reached the desired height for the rank. Then pile your firewood as you normally would between these cribs. Stack the wood so that it is loose with some air spaces between pieces to facilitate quicker drying.

The last thing to do is decide if you want to cover your stack. Some people say that there is no need to cover, and they believe covers will inhibit drying of the top layer of wood. Others say that the effect of rain on the stack is significant, so a cover is warranted. If you are going to cover your stack, ensure that the cover does not hang over the side which can trap moisture and slow drying. It is a good idea to remove covers during the warm summer months to facilitate faster drying.


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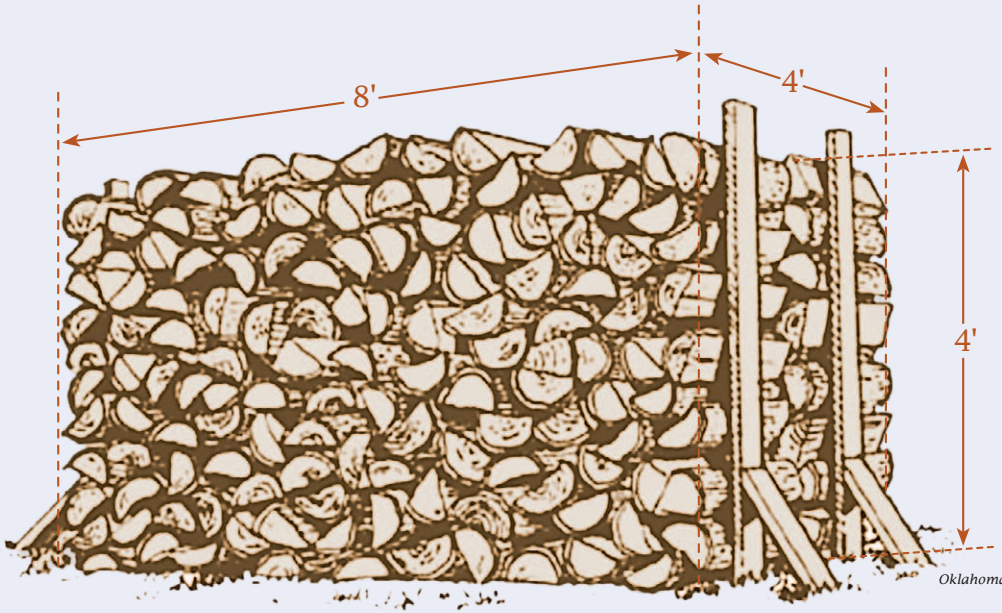
A crib helps support this firewood stack.

Drying times for firewood depend on the moisture content when the wood was split and stacked and how well you stacked your wood. The goal is to get the moisture content below 20%, which can be easily accomplished using the sun's heat and the wind. You can buy a moisture meter to measure the moisture content of your firewood. Don't measure the outside of a piece. Instead, split a piece and measure the center to




A cord of wood equals a stack of wood measuring 8 feet by 4 x 4. Whereas a face cord equals 8 x 4 x 16 inches.

get a more accurate moisture content reading. Striking two pieces together will also give you an indication of how dry the wood is. If the sound produced from the striking is sharp, the wood is dry. If it is dull, the wood still has too much moisture. It is best to let your wood season for 18 months before burning, but many woodland owners get by with only 12 months of drying when conditions are ideal.

Finally, to prevent the spread of harmful insects and diseases that affect trees, burn the firewood near where it was harvested. Some insects and diseases are so effective at killing our trees that the WI DNR has restricted the movement of firewood in and out of certain counties in the state. To learn more about where firewood quarantines are located, and to find other information about forest health and firewood, visit the WI DNR website (http://dnr.wi.gov/topic/invasives/firewood.html).

# Harvesting Firewood *from* Your Woods

This publication covers a variety of topics related to the harvest and use of firewood. We begin with some basic concepts of how trees grow and the characteristics of various trees used for firewood. The second section takes you into your woods, and looks at which trees to cut and at safety considerations. The third section works with you as you bring the trees home, and includes techniques for splitting, drying and stacking wood.

Visit **woodlandinfo.org** or talk with your local DNR Forester for more information. The website has links to documents mentioned in this publication.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The work has only begun.

*Photo above, Jeffrey J. Strobel. Front cover photos: Firewood stack, WI DNR; man with chainsaw and safety gear, Karla Ortman, UW-Madison*


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