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Beginner's Guide to Buying Lumber

Background On Trees

First things first, let's get some common background on forest trees and how the trees are cut or processed into lumber. Nearly all, about 99.99% of the lumber that you see in a lumber yard, or a Big Box store, comes from the forests. In the forest, they were cut down in one of several different ways, either by clear-cutting a tract of land or by selective cutting one and leaving the others to continue to grow. Once the tree is cut down and sent to a sawmill there is NO way you would be able to tell if it was taken by clear-cutting or selective harvest.

However, let's take a minute to think about those two methods, clear-cutting and selective harvest. The landowner has a huge financial stake in how the trees are cut, if you think that the landowner is going to waste their money with one method over the other. You might want to rethink that decision. While clear-cutting may look to be a horrible waste, depending on many different factors, it may in fact be the best for the land and the next generation of trees that will be grown on that land. On the other hand, selective cutting may look to be a better or more environmentally sound method. There are some cases where it is not the best for the land and the next generation of trees that will be grown on that land.

Now, in certain areas in the country, you may be able to find lumber from what are called the Urban Forest. The Urban Forest is another name for city trees; these are trees that have been harvested inside of the city limits, most commonly from dead, dying, or storm-damaged trees. However, as a general rule, these trees are smaller, which yields a smaller board (narrower and shorter). As it turns out, Minneapolis does have an urban forester and, in fact, does sell lumber from downed urban trees. The lumberyard is called **Wood From the Hood**: https://woodfromthehood.com. They have a large assortment of live-edge slabs and a somewhat steady supply of Elm, Ash, White Oak, and Silver Maple.

While you might think that those big neighborhood trees that get blown down or die would make some great lumber, in reality, they do not. There are a couple of big problems with that type of tree. First, more than likely, there will be metal hidden in them, anything from kids pounding in a nail, posting a yard sale sign, or even an old fence post might be hiding deep in the wood from years ago.

You might be surprised what a tree can engulf given enough time to grow around it. This is why Urban Logging can be expensive for the sawyer.

Also, the trees often do not have enough length in the trunk to make commercial logging viable. If you are unaware, lumber is milled nearly exclusively from the tree trunks and not the limbs, regardless of how large they may be. This is due to the internal stress the limbs have as they are supporting a very heavy load of the branch.

Some people own mobile band saw mills who may be willing to cut up the trunk for a percentage of the tree. Lastly, once the wood is cut, you will need to be able to properly store and dry the freshly cut lumber, generally for one year per inch of thickness. Those nice two-inch slabs used for tables might not be looking so quick and easy right now.

And, while we are on the subject of trees and cutting them down for lumber, according to the U.S. Forest Service:

> ***1610 to 1910:*** *U.S. forestland dropped from over 1 billion acres, driven by agricultural expansion and industrialization. Forest cover did stabilize in the 20th century, holding at roughly 765–766 million acres—about 33–35% of total land—due to reforestation in the Northeast and fire management practices.*

Additionally -

> ***20th Century Stabilization & Recovery:*** *Despite continued urban development, forest area has remained relatively stable since the early 1900s. This was driven by the abandonment of marginal farms (particularly in the Northeast), which allowed forests to return.*
>
> ***Modern Status (Present):*** *As of 2012-2023, the U.S. has approximately 765-811 million acres of forest land, representing roughly 33-36% of the country.*

Now the number and percentages of tree species on that land have changed, due to a number of factors such as over-harvesting, and fungal infections such as Oak Wilt, Black Knot, or Chestnut Blight. Or insect carried diseases such as Dutch Elm Disease and Emerald Ash Borer.

It looks like the amount of forested land is fairly stable, and it is being managed in a way that there will be forested land and lumber for us to use for the foreseeable future. Both hardwood

and softwood trees are grown in forests, and at first glance, they may look similar; however, they are quite different once you look more closely. Take these two examples.

Softwood (Pine) Forest –

Note: How close the trees are, or how dense the trees in this forest are. Softwoods can and do grow much closer to each other than do hardwoods. This is an example of clear cutting, note the wide-open space where the smaller trees are growing.

Hardwood Forest –

Note: How the trees are spaced out from each other. Hardwoods need much more space from each other for their branches and leaves to capture sunlight. Notice there are few younger trees in this picture. It may "look nicer" however, when these larger trees are cut – where are the smaller ones?

Hardwoods and Softwoods

The terms softwood and hardwood have been used in this document for a while. What is the difference between them, or what makes one a hardwood and the other a softwood?

Hardwood Trees - Are part of a botanical group called angiosperms, which translates to "enclosed seed" because their seeds are protected within a fruit or nut shell. Common species include **Oak, Walnut, and Maple**.

Key Characteristics:

- **Leaves -** Most are deciduous, meaning they have broad, finely veined leaves that change color and drop during autumn and winter.
- **Growth & Density -** These trees generally grow much slower than softwoods, sometimes taking up to **150 years** or more to mature. This slow growth creates a more complex and dense cellular structure, resulting in lumber that is exceptionally heavy and durable.

- **Habitat -** They are found in both temperate and tropical forests across the globe.

Softwood Trees - Come from **gymnosperms**, a term derived from the Greek for “naked seed." Unlike hardwoods, their seeds—such as those found in **pine cones**—have no protective housing, allowing them to spread rapidly via the wind. Common examples include Pines, Cedars, and Spruces.

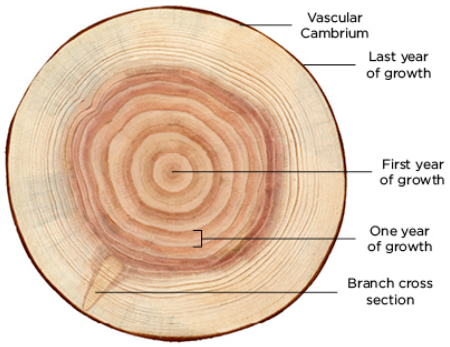
Key Characteristics:

- **Leaves -** These trees are typically evergreens with needle-like leaves that stay green year-round rather than shedding annually.
- **Growth & Density -** Softwoods grow significantly faster than hardwoods, often reaching maturity in just **40 years**. This rapid growth results in lumber that is generally less dense.
- **Reproduction -** Because their seeds are unenclosed, they can populate new areas much more easily and quickly than slower-growing species.

And, as you may expect, most hardwoods are in fact harder than most softwoods. It is important to remember that not all hardwoods are harder than softwoods, and not all softwoods are softer than hardwoods. There is a measurement, called the Janka scale, that is used to determine the hardness of different species. The Janka scale or test measures the amount of force required to embed a 0.444" steel ball into the wood sample to half of its diameter. There is a website, called the “Wood Database”, https://www.wood-database.com/, that contains a vast amount of information on 600 different species of wood. The Website contains information on wood types, location, color/appearance, decay resistance, tree height, average dry weight, and Janka hardness. Take a minute and go explore the Wood Database. It can be an extremely valuable resource in finding information on different wood species.

Growth Rings

Lastly, while discussing background information, let’s take a look at wood growth rings. Trees grow out from the center, which creates growth rings. Faster-growing trees will have wider growth rings, while slower-growing trees will have narrower growth rings. Tree growth rings are annual layers of new wood (xylem) produced by the cambium layer, appearing as alternating light (spring/summer) and dark (late summer/fall) bands in temperate climates. One light band and one dark band equal one year of growth.



Typical of a softwood species tree

In addition to faster-growing tree species, having wider growth rings. The growing conditions will also have an effect on the size of growth rings. Wider growth rings in trees will often result from years with more rainfall or better growing conditions.

You may hear people talking about old-growth lumber versus new-growth lumber as the graphic below illustrates.

Two examples of a 2 X 4, the sample on the left is an example of new growth lumber note the wider growth rings. The sample on the right is old growth lumber many more growth rings. Now the old growth board is stronger than the new growth board, however the new growth is more than strong enough for its purpose. Current building codes reflect current lumber availability. Note: this is an example of softwoods typically used for construction building.

The same is true for the hardwood lumber, however, not quite as extreme. Because hardwoods naturally grow more slowly, the difference between new growth and old growth lumber is less. When you see dramatic examples like the one above, they are nearly always showing the difference in construction lumber, not hardwood lumber that is used for making furniture.

At The Saw Mill

The milling process for softwoods can be quite different from that of hardwoods. Most softwoods are milled for use in the construction industry. While some Pine and other softwood boards, like Cedar or Redwood, are milled for consumer usage, they are most often flat sawn to maximize the yield for each log.

Hardwood milling is done with an eye for how the boards will look and work, not only for yield on each log. To achieve this, the boards can be sawn in one of several different ways. Those different ways include Flat or Plain Sawn, Quarter Sawn, Rift Sawn, and Live Sawn. Let's take a closer look at the advantages and disadvantages of each of the methods

Flat or Plain Sawn
Red Oak

Plain (or flat) sawing is the most efficient and common milling technique. In this process, the sawyer aligns the first cut parallel to the curvature of the log. Then, they keep cutting the wood, switching between going the same direction as the log and across it, until they reach the middle.

Characteristics and Advantages:

- **Efficient & Cost-Effective** - This method maximizes the number of boards that can be milled from a single log, reducing waste and making it the most affordable option.
- **Aesthetic Appeal** - Plain sawn boards display a distinctive "cathedral grain" pattern, giving wood surfaces a natural, dynamic look.
- **Readily Available** - Due to its widespread use, plain sawn lumber is one of the most accessible options on the market.

Quarter Sawn
White Oak

The rift and quarter sawn milling methods are often misunderstood in woodworking. The key difference lies in the angle of the tree's growth rings relative to the board's surface, as seen from the end of the cut.

Quarter Sawn:

- Growth rings are at an angle of 60 to 90 degrees to the surface.
- Creates straight grain patterns and often showcases medullary rays, which appear as flecks or ribbons, adding a unique visual element to certain species like oak.
- Higher resistance to moisture absorption, making it more stable than plain sawn lumber.

Rift Sawn
White Oak

Rift Sawn:

- Growth rings are at an angle of 30 to 60 degrees to the surface.
- Produces a clean, straight grain with minimal variation and no visible medullary rays.
- Highly sought for precision applications such as fine furniture, cabinetry, and architectural mill work.

Milling Process for Both Quarter and Rift Sawn:

1. A log is first cut into four quarters, often called cants.

2. Each quarter or cant is then sliced parallel to its flat face, with the sawyer turning the cant 90 degrees after each cut.
3. The first, wider cuts become quarter sawn boards, while the smaller cuts with a lower grain angle become rift sawn boards.

Advantages of Rift and Quarter Sawn Milling:

- **Dimensional Stability** - The perpendicular grain alignment minimizes expansion and contraction due to humidity changes.
- **Durability** - Less prone to warping and cupping, making it ideal for flooring and high-end woodworking projects.
- **Refined Aesthetics** - The uniform grain structure provides a sleek, modern look that suits minimalist and modern designs.

Live Sawn
White Oak

Live sawn, or original cut, is a milling technique that produces the widest boards possible from a log by making parallel cuts from top to bottom. This method captures the entire cross-section of the log, resulting in a unique blend of cathedral grain, vertical grain, medullary rays, and sapwood within a single board.

Key Visual & Structural Elements:

- **Cathedral Grain** - Found in the outer sections of the board, adding a dramatic and sweeping aesthetic.
- **Vertical Grain** - Visible in the inner sections, offering a more linear and structured appearance.

- **Medullary Rays** - Radiating from the log's center, these unique flecks or streaks are highly prized in species like oak.
- **Sapwood Contrast** - The lighter outer layer of the log creates natural visual interest against the heartwood.

Benefits of Live Sawn Milling:

- **Minimal Waste, Maximum Sustainability** - Because the entire log is used, this method supports sustainable forestry practices by increasing overall yield.
- **Superior Stability** - The variety of grain orientations within a single board improves dimensional stability, reducing the likelihood of warping.
- **Organic Aesthetic Appeal** - Live sawn boards feature a striking mix of grain patterns, making them ideal for bold, naturalistic designs.

Not all lumberyards will have lumber available in each of the different methods of cutting. Most lumberyards in the upper Midwest will carry a limited supply of quarter-sawn and rift-sawn lumber in a limited number of different species. Nearly all lumberyards in this area will carry a significant amount of flat or plain sawn hardwoods. You may ask, where to source quarter or rift sawn hardwoods? There are several online wood sources that carry a surprising amount of hardwood that have been cut in other manners, such as quarter and rift sawn. Check out these YouTube™ videos on online lumber sources for additional information.

- https://www.youtube.com/watch?v=zCXgP0Hu1Nk
- https://www.youtube.com/watch?v=PkyqPzy21WM

Methods for Drying Lumber

Once the tree has been processed into boards, the next stage in turning it into usable lumber for your project is to allow it or help the moisture to leave the wood. This is a process that can be done in one of two different ways, or a combination of the two. The two distinct methods are air drying or using a kiln, often referred to as kilning.

First, why does the lumber need to be dried before it is used? Compared to wet or "green wood", dry wood is more stable, durable, and workable.

- **Durability** – Moisture is the best friend of wood-decaying fungi and microorganisms. Wet wood is more susceptible to rot, insect infestations, and weakening over time. A lower moisture level makes it much harder for these threats to thrive.

- **Dimensional stability** – Wood is hydroscopic – when it absorbs moisture, it expands and when it dries out, it shrinks. This process will lead to warping and cracking. If wet wood is not dried in a controlled way, it will shrink unevenly and cause damage.

- **Workability** – Wet wood can cause blades to gum up and clog up sanding equipment. Not only this, but it's also slippery and more difficult to handle. Dry wood is easier to machine, allows for cleaner cuts, and holds fixtures more readily.

- **Easier to finish** – Wood finishes do not adhere best to moist surfaces. Because dry wood has open pores, it is more receptive to the uptake of treatments, stains, and oils. The finishes will penetrate more deeply, giving a longer-lasting and higher-quality finish.

When the lumber mill processes the trees into boards, the moisture content of the wood will typically be in the 40% range, or even significantly higher, into the 80% and 90% range. To be classified as "dry" or seasoned, the moisture content needs to be below 20%, with a 10% moisture content being an ideal moisture content (depending on your location). To properly dry out the rough lumber, the first step is to properly stack or sticker the lumber so air is allowed to circulate around each board. The graphic below illustrates a stack of rough-sawn lumber stickered to begin the drying process.

Note: the logs at the base of the stack to keep the stack up and off the ground. Also, the space between each layer of boards, and the space between each board to allow for air to freely circulate around each board. Typically, each stack will have a top to keep rain off the very first layer of boards.

Air Drying or Kiln Drying

Air Drying is done once the rough-sawn boards are stickered, most commonly outside, where air will be able to circulate around each board. They will typically be left to dry for about one year per inch of thickness. Yes, that's not a typo; the general rule is one year drying per inch of thickness for air-drying lumber. Think about this… air drying a three- or four-inch slab for the nice bar or table top, and you will soon understand the meaning of the word patience.

Kiln drying is a faster, more controlled alternative to air drying. It takes place in a large enclosed chamber and involves blowing hot air on the sticked packs of wood – essentially, a purpose-built oven for wood.

Two popular types are:

- **Conventional Kilns** - The most common industrial kiln, suited to large-scale operations. Hot air is generated by a boiler, often powered by waste sawdust. In the control room, temperature, relative humidity (using vents), and air flow (using fans) are all regulated to give precise environmental control.
- **Dehumidification Kilns** - An electric-powered closed-loop system is most common for smaller operations. After drying the wood, moist, warm air comes in contact with refrigeration coils. This condenses the moisture into a liquid, which is drained as cool water. The cool, dry air is then reheated using a heat pump and reused.

Temperatures used in the kiln are dependent on the species, but usually start around 40°C (100° F) and are slowly raised to around 60°C (140° F).

The moisture content of the wood is monitored using probes and physical samples. The wood may be conditioned towards the end of its drying process – this involves using humidification to relieve any internal stresses and prevent the outer layers from drying too fast.

The kiln drying process can take mere days, but it is usually at least several weeks. Once the timber is dried to an appropriate moisture content – around 8% for indoor use and fine woodworking – it is then taken out of stickers. Then, the wood can be properly graded, sorted, and sent to a lumberyard or store for purchase.

Most commonly, the lumber industry will use a combination of both Air and Kiln drying for optimal cost, efficiency, and process flow. The graphic below shows the enormous size of lumber storage pre-and post-drying.

Note: Stickered hardwood being "conditioned" either before or after kilning.

Lumberyards or Big Box Store

Lumberyards can be scary, intimidating, threatening, but also a wonderful experience in finding and purchasing lumber for your project. You will find most lumberyards have large amounts of common hardwoods in a wide variety of widths and thicknesses. Many, but not all, will have several different grades of lumber available for purchase. They can offer excellent value for your purchasing dollars, and most are willing to assist you in finding what it is you are looking for.

Big Box stores offer only a very limited hardwood selection in limited widths and thicknesses, and at an inflated price to the woodworker. Often, the lumber will be warped, cupped, or contain other defects that will require additional work to use them in your projects. If you could guess by now, I'm not a big fan of big box stores for furniture-grade hardwood. If I need a couple of pressure-treated 2X4s for a little outdoor project, sure, I'll go there. However, for 150 board feet of rift sawn White Oak, no way – just not going to happen. They don't carry that wood species, and if they did, the wood would not be of a good enough grade for furniture building.

Speaking The Lumberyard Language

So, let's talk about going to a real, live lumberyard, complete with forklift trucks, panel saws, and some very large radial arm saws. They can be rather intimidating and yes, even a little threatening for the first-time lumber buyer. Here is a list of some things to do, some things to be aware of, and yeah, some things you really don't want to do.

First things first, walk in and go up to the front desk or order desk and introduce yourself and let them know what you are looking for, the type of wood, and the amount of wood you are looking for. Sometimes it will be helpful to let them know you are interested in making a dining room table. And yes, they know that you are a first-time visitor – even if you're not a first-time visitor. Just between you and me, they will know within a minute or two if you are a relative beginner or not. The conversation might go something like this.

> ***You**: Hi, I'm Paul Ehrlich, and I'm looking to buy some Red Oak for a Dining Room table I'm thinking about building. I'm a little new at this, so I might need a little help if that's alright.*
>
> ***Them**: No problem, do you know how much Oak you will need for your table?*
>
> ***You**: Yep, I figured about 100 Board feet of 4/4 stock for the table and apron, and about 13 board feet of 8/4 stock for the legs. That includes about 30% extra for waste.*
>
> ***Them**: Perfect, Oak is going to cost about $4.75 board foot for 4/4, FAS, s4s, and $6.45 board foot for 8/4 FAS, s4s. If you go out the door behind you into the yard, turn right*

and go into Shed #1, Door #2, and ask to speak with Hank; he can assist you with your order.

***You**: Okay, thank you.*

Now, before you meet with Hank, let's decipher that conversation. There was a ton of information in what was said. By the way, great first step, you know what kind of wood you want to use, how much wood in total you would need, and how much of each of the different thicknesses. The tabletop and apron will be made from 4/4, pronounced as four-quarter, which is one-inch *nominal* thickness. If you were to measure the wood, it would most likely measure to be 13/16" or 7/8"; it will **NOT** be one inch thick. The 8/4, pronounced as eight-quarter, or two-inch *nominal* thickness, once again, is not actually two inches, more like 1 ¾" to 1 13/16" thick. You also were smart and provided yourself a little extra material about 30%. Not that you are going to waste it, or make mistakes, it is simply that you will need to cut out the pieces, rather than just gluing them together, and 30% is a good "estimate". The seller or "Them" provided you with the cost in board feet for each of the two thicknesses. Yes, it can be a little confusing why there are two different prices for the same wood species. The reasoning is that the 8/4 wood is going to require additional handling and is more difficult to get out of a tree, and a higher price than the 4/4 wood is charged when the tree is milled into boards. Now what about that "**FAS**" and "**s4s**" in the pricing quote? **FAS** is a grade or quality of board. **FAS** stands for "**F**irsts **A**nd **S**econds", it is the highest grade of hardwood boards as they will contain a minimum of surface defects on both faces (sides), and will be at least 6 inches wide and 8 feet long. The next grade down from **FAS** is "**Select,**" which is allowed to have more surface imperfections and be narrower and shorter in length. **FAS** and **Select** are the most common grades of lumber used for furniture building. Many other grades will be covered a little later in this document. The **s4s** refers to "**S**urfaced **F**our **S**ides"; these boards are surfaced on all four sides or all edges. Other surfacing standards will be discussed later as well. Lastly, he let you know that Hank will help you find the oak lumber in the warehouse or shed and that he will be the person you will be dealing with, not the person behind the desk in the office.
When you meet Hank, he will most likely ask what you are looking for. You can repeat your needs, and he will show you where the Oak is located. He might stay to assist you, or might leave you and go on with the rest of his job; it really depends on the business model of the lumberyard. A "good" lumber yard employee will see that you might be a little intimidated and ask if you would like some help. If they always accept their offer, it is the polite thing to do. This is where it can become uncomfortable for the novice lumber yard buyer. You will see either vertical or horizontal stacks of Oak; the boards will be in a variety of widths and can be quite long, like 12, 16, or even 20 feet long.

And here is where you will need to know about the wood you need for your dining room table. You should have an idea about what lengths you can use and how to maximize each board for

your project. Once again, a good lumberyard employee will help if you ask them. For example, if your table is going to be four feet wide, purchasing one 16-foot-long board is not going to leave you with 4 four-foot-long pieces. There will be some waste at both ends, and the width of your saw cut must be included in your calculations.

As you look through the stock, keep in mind you want to find boards that have the same color and similar grain figuring. Any boards you look at and then skip… remember to replace as you found them. If you see boards that have a slight defect in them, don't ask for a reduction in price, as it has already been taken into consideration. One last thing, most lumberyards will cross-cut a board to a shorter length as long as they are left with a "reasonable" even length. If you need six feet from a 20-foot board, most likely, no problem. If you want 11 feet from a 14-foot board, sorry, you need to take the whole board. Lastly, if you need the boards cut to length to get them home, some yards will provide one cut per board, others won't, and do not expect or even ask to have them do multiple cuts on a single board. This is a big no-go for them.

Lumber Yard Etiquette

Here is part of an excellent article from the March 2026 issue of **Wood** magazine that discusses Lumber Yard Etiquette:

> *If you don't have a retail woodworking store or hardwood lumber dealer in your area, you may need to purchase from a sawmill or supplier that usually caters to commercial or professional customers. If so, it's a good idea to call ahead and ask if they sell to the general public and if there are any minimum order requirements. Most dealers will expect you to know how many board feet you want, so don't show up with a cutting diagram and ask the salesperson to figure out how much wood you need. Some dealers don't allow you to pick out your own lumber, but most are usually willing to accommodate requests if you need boards of a certain width or length. If the dealer does allow you to pick out your boards, be neat about it and don't leave the rejected boards in a pile for the employees to restack. If a board has a bad knot or crack, move on to the next one instead of trying to haggle with the salesperson over it. These defects have already been taken into account in the grading of the lumber. Don't be afraid to ask questions, but be respectful of the salesperson's time as well, especially if the store is busy.*

In closing, one last comment about purchasing at a Lumberyard… Don't be "**that guy**".

Buy From the Mill

If you are having a difficult time finding a good lumberyard or want to see what an alternative to a lumber yard is, you may want to try a sawmill. Buying from a sawmill is often cheaper and better than hitting a big-box store. You get access to higher-quality, unique cuts—like

quarter-sawn grain—and custom milling you won't find at retail. Plus, it’s a great way to support local businesses while getting sustainable wood you can actually trace back to the source.

However, there are some considerations.

- **Moisture Content**: Lumber is often sold "green" (high moisture), requiring you to air-dry it (sticker and stack) for multiple months before use. Remember that one year per inch of thickness.
- **Processing Needed**: Wood is typically rough-sawn and requires finishing work like planing and jointing.
- **Inspection**: You must inspect the wood for defects like knots, as you may be buying directly from a pile.
- **Minimum Order**: Don't be surprised if you can't purchase only one or two boards at a time. It also might be a good idea to call ahead and see if you can pick up lumber the same day or if you need to order a few days in advance.

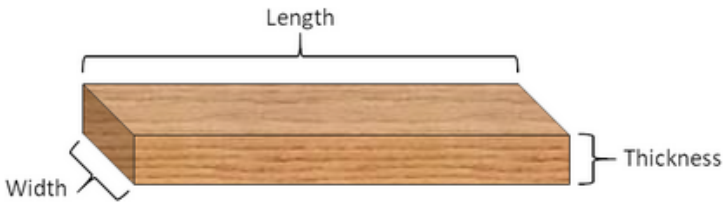
What Is a Board Foot

Lumber is sold in units of measurement called Board Foot (feet). Just like milk is sold by the gallon, flour is sold by the pound, and eggs are sold by the dozen or half dozen. You would never go to a gas station and ask for seven and one-half pounds of gas or walk into a movie theater and purchase 93 minutes of viewing time, would you?

A board foot is simply the unit of measure, or the volume of the piece of wood when purchasing lumber boards, not sheets of plywood or linear feet of moldings, just lumber boards. It is the unit of measure that the “lumberjack” or “tree feller” uses out in the forest when they cut down the tree, the sawyer at the lumber mill, and people at the lumberyard use board feet as well. Don’t expect the entire wood industry to change; it most likely won’t, any time soon. We are stuck with it, and once you get acquainted and used to it, it’s really not that difficult to understand.

How to Calculate Board Feet

So, let’s start off with: the thickness (T) measured in inches times the width (W) in inches times the length (L) in inches, the formula is:

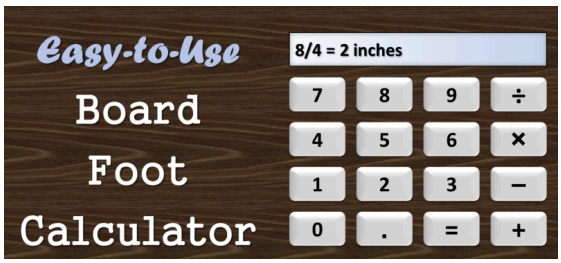


$$\frac{T" \times W" \times L"}{144} = BF$$

A piece of wood that is one inch thick, 12 inches wide, and 12 inches long would be one board foot. A piece of wood two inches thick, six inches wide, and 12 inches long would also be one board foot. If the piece of wood is longer than one foot, let's say it is 8 feet long, then the math gets a little easier. It would be:

$$\frac{T" \times W" \times L'}{12} = BF$$

Now, before anyone hyperventilates about math and fractions, there are many free web-based and cell phone apps to help you calculate board foot(age). Here are just a few of them.

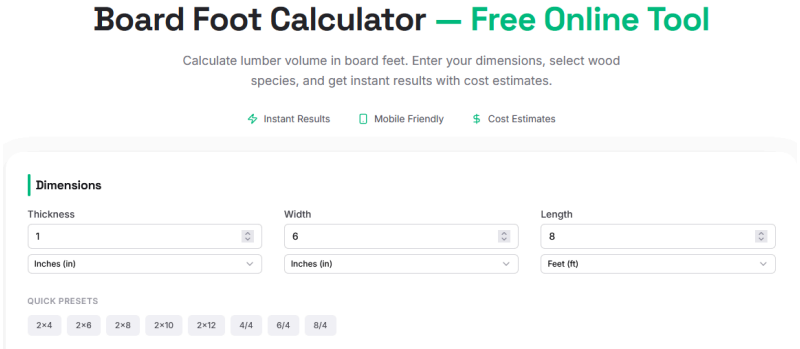


https://handtoolessentials.com/blog/woodworking/lumber-guides/board-foot-calculator/

This site also includes a cost per board foot feature.

https://handtoolessentials.com/blog/woodworking/lumber-guides/board-foot-calculator/

This site also features presets for stock thickness.



Not too tough so far; however, here is where things can get a little bit confusing if you're not careful.

Understanding Lumber Thickness

When speaking about lumber thickness, lumber is milled and sold in thicknesses, using a system called quarters. Standard lumberyards most often carry what is called 4/4, pronounced as (4 Quarter). If you were to measure it, it would be "*in the neighborhood*" of 13/16 or 7/8 of an inch thick. What gives? Well, the mill that sawed the tree into boards set their saw thickness "*in the neighborhood*" of one inch, then the boards were dried - they shrunk a little bit. Once dried they were planned smooth, and they got thinner, so you would be able to see the grain figure and behold - what was once 1 inch thick is now "*in the neighborhood*" of 13/16 or 7/8.

If you need to have a full 1-inch stock, you would purchase lumber that is 5/4 or 5 quarters, which will be "*in the neighborhood*" of 1 ¼ thick. Let's say you were looking for some 2-inch stock for some nice table legs. What thickness would you want? Most often, you would look for 8/4 (eight quarter) and be happy with legs that were made from stock that was "*in the neighborhood*" of 1-3/4 inches to 1-13/16 inches.

As a practical matter, 16 quarter or 4 inch (rough sawn) thick is about the thickest lumber you will find in this area of the country. However, on both the East and West coasts, you may find much thicker stock due to the wooden boat-building industry. Some of the thickest lumber "timbers" for the keel on sailing-powered warships are in the range of 10 to 19 inches thick. Those timbers were cut from extremely large trees and would be Oak (White or Live Oak, not Red), Elm, Larch, or tropical hardwoods like Purpleheart and Mahogany.

How Are Lumber Products Priced

Nearly all hardwood and softwood lumber (Boards) are sold using the Board Foot calculations. The exceptions are hardwood and softwoods that are under one inch (nominal) thickness, which will be sold by the square foot, such as an example, hardwood flooring.

Millwork like window casing, chair rails, or other molding is most often sold by the linear foot.

Construction lumber, like 2 X 4, 2 X 12, 1 X 2 (Furring Strips), is sold by the piece. For example, an eight-foot 2 X 4 is $4.12 at the lumberyard today. And yes, a 2 X 4 is not really 2 X 4 inches any longer, it is more like 1 ½ X 3 ½.

Lastly, plywood or other sheet goods like sheathing, underlayment, hardboard, particleboard, these are all sold by sheet, most commonly a 4' X 8'. Which, you may be surprised, is actually very close to 4' X 8' (48 inches by 96 inches) sheet or you may find smaller sheets, like 2' X 4' at some big box stores. In the last few years, there have been some imported plywood products

that are sold in somewhat non-standard sizes. Examples include some imported Baltic Birch Plywood sold in 3’ X 5” sheets, or high-grade Okoume Marine Grade plywood can be found in sizes up to 5’ X 10’ and larger for long boat hulls, and yes, it is quite expensive. A 4’ X 8’ ¾ inch thick Okoume Marine Grade plywood sheet will set you back about $350.00 per sheet.

Hardwood Lumber Grading

All commercially produced hardwood will go through a very high standard grading process in the US. The hardwood grading system is set by the **National Hardwood Lumber Association**. The boards are graded on the percentage of usable wood after accounting for any defects like knots, checks, or wane.

What are the different Hardwood Grades

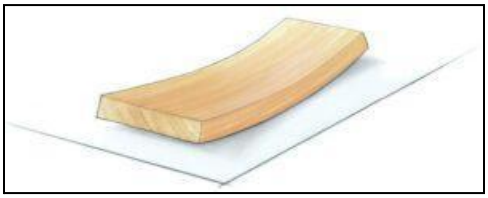
This highest grade of lumber is known as **FAS**, or **F**irsts **A**nd **S**econds. To be considered a FAS board, it must contain only a minimum amount of defects on both faces and must be at least six inches wide and eight feet in length.

Select is the next grade down from **FAS**; select boards may be narrower and shorter, and one of the faces may have more defects than what is allowed in a FAS Board.

The FAS and select are the two most suitable grades for furniture building. There are other grades. **Common no. 1** (common #1) is often used in cabinetry for interior parts such as braces and stiffeners. Common #1 is also used for rails and stiles (frame and panel door parts) where wide boards are not needed. Another lower grade is **Common #2,** used in places that are not seen. Not all lumber dealers will carry all grades or all lumber species.

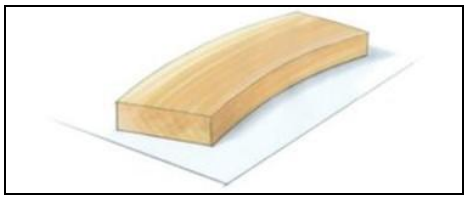
Common Lumber Defects

In talking about lumber grading, we have talked about defects. You may be asking yourself, what are these defects? Great question, here are some graphics showing common lumber defects and a brief description of what the defect is.



Bow—*Curve along the face of a board from end to end, like a rocker at the base of a rocking chair.*

Crook—*The end-to-end curve (warp) along a board’s edge. Not to be confused with this form of warp is the term crook timber, also known as compass timber, which is sawn from the roots and branch crotches of trees. The natural curvature of crook timber makes strong and beautiful stems, breasthooks, and quarter knees for boat building.*

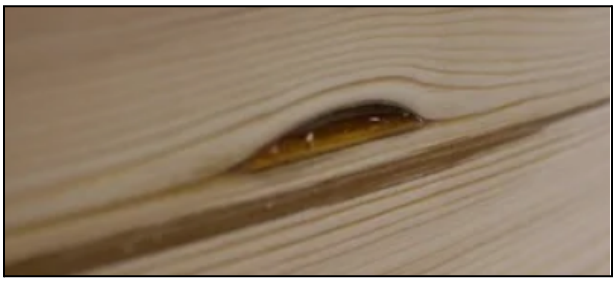


Cup or Cupping—*Curve along the width of a board from side to side. Cupping is the result of uneven drying. Using even slightly cupped wood on a table saw heightens the danger of the operation because it can lead to a pinched blade and kick-back. If cupped wood must be used, use a bandsaw, as it is less likely to cause harm. When cutting cupped wood on a bandsaw, be sure to place the board cupped-side-down on the worktable (as a frown) for better stability while you work.*

Twist—*An uneven warping that makes the board appear to be spiraling. This defect is a dangerous one to mill, a difficult one to correct, and should be avoided whenever possible.*

Checks or Checking—*Cracks in the wood, usually found at board ends and sometimes found in the middle of the board. Checking can be a result of uneven drying, living tree shakes, or mishandling (dropping). Look carefully at boards that have checks. While checks may appear to be only a few inches long (and many are), they might indicate a major weakness along the board's length.*

Pitch Pocket—*A pitch pocket is an opening between the growth rings that now holds, or did hold, resin. Most common on softwoods.*



Live Knot— *Live knots (also known as tight Knots) are so named because they were alive when the tree was harvested. They are more firmly attached to the board than dead knots. Since they usually are not rotten, they can sometimes be left alone rather than drilled out and plugged.*

Dead Knot, Loose Knot, Black Knot— *Dead, loose, or black knots are from a branch that was dead at the time of harvest. These are dark, rotten, and usually loose or easy to loosen and should be removed. They'll leave a dark hole that should be reamed free of residue and then plugged.*

Softwood Lumber Grading

Softwoods are graded for quality based on structural strength, appearance, and intended use, primarily through visual inspection of knots, grain, and defects like splits or wane. Grading classifies lumber—typically **Select** (highest quality) or **Common (#1-#4**)—using standards that define acceptable strength and aesthetic characteristics.

Key Factors in Softwood Grading include the following criteria.

- **Knots:** The size, soundness (tight or loose), and number of knots are major factors, with fewer/smaller knots indicating higher grades.

- **Defects:** Presence of wane (bark/missing wood), splits, checks (cracks), and shake are evaluated.
- **Grain:** The slope or angle of the grain can dictate strength.

Common Softwood Grading Categories include the following.

- **Select & Better:** Highest quality, nearly free of defects, used for finishing, trim, and cabinets.
- **#1 & #2 Common:** Known as Construction or Standard grades. These contain sound, tight knots and are used for general framing, decking, and siding.
- **#3 & #4 Common:** Referred to as Utility or Economy grades, featuring more or larger knots and defects, suitable for structural framing or bracing.

What Kind of Wood Should I Buy

That's a very tough question to answer because there are many factors to take into account when deciding on what type or species of wood to use on a project. Let's look at different types of wood through the lens of what type of project you are making first.

If it is an outdoor project, you will want to have a wood that is naturally resistant to rot, decay, and insect damage, such as:

- **Cedar:** Highly rot-resistant, aromatic, and lightweight; ideal for decks and fences.
- **Redwood:** Very durable and moisture-resistant; commonly used for garden structures.
- **Teak:** The gold standard for water resistance, often used for high-end outdoor furniture and boat building.
- **White Oak:** Unlike Red Oak, White Oak is water-resistant and suitable for outdoor use.

If your project will be an inside furniture or cabinet project, you will most likely want to use a hardwood for strength and durability, such as:

- **Oak (Red and White):** Renowned for strength and a pronounced grain.

- **Cherry:** Known for a warm reddish-brown color that darkens with age.

- **Maple:** Extremely hard and scratch-resistant; great for countertops and high-traffic flooring.

- **Walnut:** Prized for its deep, rich chocolate color; used for high-end furniture.

Or perhaps your project could be best described as a beginner or a practice piece, or even a prototype build, then you might want to look at these species.

- **Pine:** Inexpensive and soft, making it easy to cut and drill.

- **Poplar:** A “soft” hardwood that is very easy to work with and inexpensive, though often painted because its natural green streaks are considered less attractive.

- **Basswood:** The standard for carving due to its exceptionally soft, fine, and even grain.

Or, instead of looking at the type of project you are building, you want to focus on selecting the wood based on whether it is a hardwood, softwood, or engineered wood product. Each has several distinct advantages and disadvantages.

Hardwoods are generally denser, stronger, and more resistant to wear and scratches than softwoods. Take a look at the pros and cons of each of the three types of wood products.

- **Pros:** High durability, complex and attractive grain patterns, long lifespan.

- **Cons:** More expensive, heavier, and can be difficult to work with without specialized tools or sharp blades.

- **Common Examples:** Oak, Maple, Cherry, Walnut, Mahogany, and Hickory.

Softwoods account for roughly 80% of the world's timber and are standard for construction and framing. Softwoods are often used for practicing, prototype building, and building shop furniture.

- **Pros:** Affordable, widely available, and easier to cut, drill, and shape.
- **Cons:** Dents and scratches easily; generally, less strong than most hardwoods for daily-use furniture.
- **Common Examples:** Pine, Cedar, Spruce, Fir, and Redwood.

Lastly, there are many different kinds of engineered wood products that are manufactured by bonding wood fibers, particles, or even veneers with resin into many very usable products. Two such products are:

- **Plywood:** Made of layered veneers; highly stable and resistant to warping.
- **MDF (Medium-Density Fiberboard):** Ideal for painted furniture and cabinetry due to its extremely smooth surface, but heavy and not moisture-resistant.

Lastly, you could look at other factors in your wood selection, such as:

- **Workability:** Some woods, like **Hickory**, are very hard and can dull tool edges quickly. Others, like **Cherry**, are prone to burning during machining.
- **Finish: Pine** and **Birch** can be difficult to stain evenly, often resulting in blotchiness; they are better suited for painting or clear coats.
- **Grain Structure:** Closed-grain woods (e.g., **Beech, Maple, Cherry**) are preferred for food-safe items like cutting boards because they have smaller pores that block bacteria.
- **Sustainability:** Look for certifications like FSC (Forest Stewardship Council) to ensure wood is sourced from responsibly managed forests. Species like **Mahogany** and **Rosewood** have historically faced over-exploitation.

The Wood Database

One tool that can be invaluable in making a wood type decision is the **Wood Database,** which is an online warehouse of information on 600 different wood types. The database contains information on the following characteristics for nearly 600 different wood species.

- ✔ Color/Appearance
- ✔ Grain/Texture
- ✔ Rot Resistance
- ✔ Workability
- ✔ Odor
- ✔ Allergies/Toxicity
- ✔ Pricing/Availability
- ✔ Sustainability
- ✔ Comments
- ✔ Images of samples

Listed below are several different popular hard and softwood species, and a short description for each taken from the online resource, the **Wood Database**. This is provided as a quick reference to common wood species. Please consult other sources for additional information on each wood species.

Common Softwoods

- **Pine**: Is a widely available, affordable softwood commonly used for rustic furniture, interior trim, and framing due to its soft, easy-to-work nature. It has a light brown to white color, usually featuring noticeable knots. Advantages include cost-effectiveness and versatility, while disadvantages include susceptibility to dents, warping, and rot.

- **Cedar**: Heartwood reddish to pinkish brown, often with random streaks and bands of darker red/brown areas. Easy to work with both hand and machine tools, though it dents and scratches very easily due to its softness, and can sand unevenly. Should be moderately inexpensive for construction-grade lumber, though higher grades of clear, straight-grained, quartersawn lumber can be more expensive.

- **Fir**: Particularly Douglas Fir, is a highly durable, strong yet lightweight softwood commonly used for construction, framing, flooring, and furniture. Known for its straight grain, light reddish-brown color, and excellent strength-to-weight ratio, it is a versatile choice for both structural and cosmetic projects, though it requires treatment for outdoor use.

- **Redwood**: Heartwood color can range from a light pinkish brown to a deep reddish brown. Sapwood is a pale white/yellow. Rated as moderately durable to very durable regarding decay resistance. Typically, easy to work with hand tools or machinery, but planer tearout can occur on figured pieces with curly, wavy, or irregular grain. Glues and finishes well.

- **Spruce**: Typically, easy to work with hand tools or machinery, but planer tearout can occur on figured pieces with curly, wavy, or irregular grain. Glues and finishes well. Easy to work, as long as there are no knots present. Spruce finishes well, though it can give poor (blotchy and inconsistent) results when being stained due to its closed-pore structure. Norway Spruce in particular has been reported to cause skin irritation and asthma-like respiratory effects.

- **Larch**: Heartwood ranges from yellow to reddish brown. Narrow sapwood is yellowish white and is clearly demarcated from the heartwood. Grain is generally straight. Texture is medium to coarse with a greasy or oily feel. Most hand and machine operations produce good results. However, Western Larch is high in silica content and will blunt cutting edges. Also, because of the disparity between the soft earlywood and the hard latewood, sanding can create dips and uneven surfaces.

- **Hemlock**: Heartwood is light reddish brown. Sapwood may be slightly lighter in color, but it usually isn't distinguished from the heartwood. Grain is generally straight, but may be interlocked or spiraled. Has a coarse, uneven texture. Working properties are intermediate. The wood tends to splinter easily when being worked and tends to plane poorly. Also, because of the disparity between the soft earlywood and the hard latewood, sanding can create dips and uneven surfaces. Glues, stains, and finishes well

Common Hardwood

- **Red Oak**: With a light brown to reddish tint, red oak lumber is one of the most widely used species for woodworking. The grain of the wood tends to be straight. The rot-resistance and durability of the wood is not as great as those of its counterpart, white oak. Red oak lumber produces quality products with hand and machine tools. The wood responds well to glues and stains. In general, red oak

lumber finishes very well.

- **White Oak:** Lumber is both economical and rot-resistant. It is perfect for furniture creation and is typically white to very light brown. White oak wood is mostly straight-grained and is typically harder than red oak. Another aspect that makes white oak lumber so attractive is that is does not darken much with age.

- **Walnut:** One of the most enjoyed American hardwoods for its fine yet open grain, unique patterns, and bold dark color. Walnut is easy to cut, shape, and sand, and the wood takes on an amazing look with a clear finish. It is a favorite for furniture, paneling, musical instruments, and sculptures. Black walnut is from North America and is grown for woodworking; it is a moderately hard wood with a rating of 1010 on the Janka scale.

- **Hard Maple:** Hard maple selected for white color. Known for its durability and strength, hence its common use for flooring, butcher blocks, and large furniture. It has excellent turning properties, a fine, and even texture, and a natural luster. Paints and finishes very well. However, it can be rather difficult to stain using oil-based stains.

- **Cherry:** Cherry has no rivals that are as easy to work with, fine textured, strong, and regal in color. It's highly rated in all working properties, including wood bending and turning. Cherry's color ages to a richer, rusty red brown with any clear finish.

- **Mahogany:** Heartwood color can vary a fair amount, from a pale pinkish brown to a darker reddish brown. Color tends to darken with age. Grain can be straight, interlocked, irregular, or wavy. Texture is medium and uniform, with moderate natural luster. Typically, it is very easy to work with both hand and machine tools. Slight dulling of cutters can occur. Sands very easily. Turns, glues, stains, and finishes well.

- **Poplar:** Heartwood is light cream to yellowish brown, with occasional streaks of gray or green. Sapwood is pale yellow to white, not always clearly demarcated from the heartwood. It can also be seen in mineral-stained colors ranging from dark purple to red, green, or yellow. Poplar typically has a straight, uniform grain with a medium texture. Low natural luster. Very easy to work with in almost all regards, one of Poplar’s only downsides is its softness. Due to its low density, Poplar can sometimes

leave fuzzy surfaces and edges, especially during shaping or sanding.

- **Hickory:** One of the strongest and hardest woods native to the U.S., hickory is a great option for any woodworking needs you may have. Commonly used in home décor, flooring, furniture & tool handles, hickory has a wide variety of uses. Hickory lumber is often used when shock resistance is an important factor in the lumber you use. Due to its strength, hickory can be a tough wood to work with. It is suggested to use sharp tools, take time, and make little cuts slowly.

- **Alder:** (Red) Alder tends to be a light tan to reddish brown; color darkens and reddens with age. There is no visible distinction between heartwood and sapwood. Large aggregate rays appear as occasional small streaks on the face grain that can be mistaken for defects in the wood. Grain is generally straight, with a moderately fine, uniform texture. Red alder is very easy to work with both hand and machine tools; it sands especially easily.

- **Teak:** Heartwood tends to be a golden or medium brown, with color darkening with age. Teak has been considered by many to be the gold standard for decay resistance, and its heartwood is rated as very durable. Easy to work in nearly all regards, with the only caveat being that teak contains a high level of silica (up to 1.4%), which has a pronounced blunting effect on cutting edges. Despite its widespread cultivation on plantations worldwide, teak is very expensive and very difficult to source. It is perhaps one of the most expensive lumbers on the market, at least for large-sized, non-figured wood.

Common Plywood Types

- **Structural Plywood:** Structural plywood is an engineered wood panel designed specifically for load-bearing applications that require high strength, stability, and reliability. Unlike decorative or interior plywood, it is manufactured and rigorously tested to meet strict industry and engineering standards. The primary differentiator of structural plywood is the use of extremely high-strength adhesives. These phenolic resin-based adhesives are waterproof and permanent, allowing the panel to withstand damp conditions, temperature fluctuations, and repeated wet-dry cycles without delaminating.

- **Hardwood Plywood**: Hardwood plywood is an engineered wood panel constructed by gluing thin layers of hardwood veneer (such as birch, maple, or oak) onto a core, which can be made of hardwood, softwood, or fiberboard. It features a decorative, durable hardwood surface, making it stronger and more warping-resistant than solid

wood, ideal for cabinetry, high-end furniture, and finished interior projects.

- **Softwood Plywood:** Softwood plywood is an engineered wood panel manufactured from the veneers of coniferous (evergreen) trees such as pine, spruce, fir, and cedar. It is characterized by its lightweight nature, cost-effectiveness, and primary use in structural and industrial applications.

- **Lumber Core Plywood**: Lumber core plywood is a specialized engineered wood product consisting of a central core made of solid wood strips (staves) sandwiched between layers of crossband and face veneers. Unlike standard plywood that uses multiple thin veneers throughout, the lumber core's central layer typically makes up about two-thirds of the panel's total thickness. It is primarily valued for its superior bending strength, exceptional screw-holding ability, and high dimensional stability.

- **MDF Core:** MDF core plywood is an engineered wood panel that combines a core made of medium-density fiberboard (MDF) with thin sheets of natural wood veneer on the face and back. It is valued for its exceptional flatness, consistent thickness, and dimensional stability, making it a premier substrate for high-quality furniture and cabinetry.

- **Exterior Plywood:** Exterior plywood is a water-resistant, durable engineered wood panel designed for long-term exposure to weather and moisture. It is constructed using waterproof, structural adhesives and is commonly used for structural sheathing, siding, subfloors, and outdoor signage.

- **Marine Plywood:** Marine plywood is a high-quality, water-resistant hardwood plywood designed for wet environments, built with waterproof (WBP) adhesive and no-void core veneers to prevent rot and decay. It is primarily used for boat hulls, docks, docksides, and high-moisture areas like kitchens or bathrooms.

What Is Pressure-Treated Lumber

Pressure-treated wood is lumber infused with chemical preservatives inside a high-pressure chamber to resist rot, fungal decay, and termites. It is designed for long-term durability in outdoor applications like decks, fences, and ground-contact projects. It protects against moisture but is not waterproof and requires sealing. It should NEVER be used in an interior setting. Pressure-treated lumber has a nasty habit of twisting, warping, and cupping as it dries out. Please, do not use pressure-treated lumber except for outdoor construction projects.

Tips and Tricks When Buying Lumber

Check every single board

Bring a pair of gloves and dress for the weather, because you'll typically search through the racks yourself. There is no **perfect** board, but some boards are better than others. Take your time selecting them. Sight down each board to see how twisted or bowed it might be. Feel its weight in your hands. Check to see if the board contains too much sapwood for your liking. Will the knots interfere with your plans, or can you work around them? Feel free to put it back and select a better board. But don't search endlessly for the perfect board; we love wood because it is imperfect. It is not laminate!

Choose straight boards

To choose straight boards, lift each piece and "sight down" its edges and faces from one end to check for warping, bowing, or twisting. Check all four sides for straightness, rotate the board to check for twists, and avoid pieces with significant curves, splits, or cupping (U-shape). Choose boards with minimal knots and straight, vertical grain patterns for maximum stability.

Be prepared

To be prepared at a lumber yard, arrive with a detailed, dimensioned cut list and a flexible mindset, as you will likely need to select your own boards from stacks. Essential tools to bring include a tape measure for verifying dimensions and a small notebook.

Buy Long

Buying long boards at a lumber yard is often preferred to reduce waste, minimize joints (creating a cleaner look/stronger structure), and sometimes to get higher-quality wood. Longer boards allow for more flexibility in cutting to precise lengths, ensuring consistent color matching, though they may have higher shipping/handling costs.

Check out the No.1 common

Do not automatically discount No. 1 Common as inferior or low-quality wood. Yes, it may have more defects than a FAS or a Select board. If you are looking for material to use for drawer slides, cleats, or other non-visible parts, Common #1 can be a good value for your woodworking budget.

Buy a little extra

When purchasing wood for a project, buy some extra. We all make mistakes not only in woodworking, but also in estimating how much material we might need to complete the project. It will also be beneficial when you find hidden defects in the stock you selected.

Look at H & M (Hit and Miss)

Also known as skip planing, refers to rough lumber that has been lightly surfaced on its faces to remove high spots and reveal the wood grain while leaving some rough-sawn patches. This process is not intended to produce a final, furniture-ready flat surface, but rather to make the lumber easier to inspect for defects. If you have access to a thickness planer, you may want to look at using Hit or Miss graded lumber. While not all lumberyards will carry this grade, however, if they do carry Hit and miss (H/M) lumber. It is a less expensive alternative, and often times a thicker board measuring in at 15/16 rather than the 13/16 or 7/8 inch thick.

2 X 12 Construction grade

If you like the way pine boards look or need to use pine in a furniture project, take a look at 2 X 12 construction grade pine. 2 X 12 is most often cut from much larger and more stable than other 2 X construction lumber. The center area of the 2 X 12 will be the pith; however, you will be able to cut that out and use the outer edges for some nice, thick quarter-sawn and stable pine boards. Great for table tops, high-end work benches, or other horizontal surfaces.

Be fussy about color

When you are selecting boards at the lumberyard, be sure to keep an eye on the color of each board. While it is possible to slightly influence color when applying a finish to your project it is far easier to start with boards that are reasonably the same color and grain pattern.

Storing boards to minimize warping

Keep the lumber up off the ground, and allow air to circulate around each piece of wood. Do not tightly cover the boards. Provide “stickers” to allow for air movement around each piece of wood. An alternative to horizontal storage can be vertical storage, if you have the vertical height for it.

Rough sawn can be a diamond in the rough

If you have access to a thickness planer, purchasing rough-sawn lumber can be a budget helper. However, rough cut lumber can be a little more difficult to read the grain and color of the boards; buyer beware.