

How to Build a Shelf

By Natalie Bogwalker with Asteria Pontoni





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From Natalie



Building my first shelf was an extremely powerful experience for me. I still remember having a bunch of jars cluttering my space and feeling so aggravated at my lack of organization. Then I felt such delight in my ability when I finally did something about it. The result: jars perfectly fitting on shelves suited to each size. Clutter gone. Amazing.

That was 15 years ago. At the time, I was building out of slab wood (the scraps left over from milling logs), making my cuts with a chainsaw and attaching everything together with a borrowed drill.

Since then, I've built a lot of things, including my own log cabin, an outdoor kitchen, multiple tiny houses and about a dozen outbuildings. In addition to structures, I've built shelving, cabinets and desks, and I've taken pride in the beauty and style of my trim. Throughout the course of all this building, I've mastered the use of most power tools used in construction. Since I like to keep my building activities out of the shop (I prefer to work outside) and free of the need for fancy shop tools (I like to keep things affordable, and some of those tools are not), there are a few specialized tools that I don't have total proficiency in. But that hasn't gotten in my way one bit.

In addition to working on my own projects, I've taught hundreds of students about building. From total beginners who had never wielded a drill, to seasoned carpenters wanting to explore natural and sustainable building modalities, I've worked with many students over the years. Again and again I've witnessed in my students that same delight that I felt with building my first shelf. So I'd like to share some shelf-building guidance with you here. I hope you'll also feel empowered and excited about your own carpentry capacity.

Getting Started

For this project you will need to borrow or buy some basic tools (see complete list below). I give the example of a basic shelf using commercial lumber that you could buy from any lumberyard or from one of those rightfully maligned big-box building stores (yes, I occasionally buy things from those hated places, too). You are totally welcome to salvage lumber for your shelf as well.

The plan presented here is for a shelf with arbitrarily chosen dimensions (it will be a nicely-sized shelf, but not necessarily exactly what you need, if you follow the plan exactly). You can also use this guide to make a shelf of whatever dimensions you may desire.

Before we get into it too much, I want to establish a few conventions here. When discussing the dimensions of lumber, generally:

- Inches are referred to as X" (double quotes)
- Feet are referred to as X' (an apostrophe)

When the dimensions of a board are given, they are given in:

1. Thickness (in inches)
2. Width (in inches)
3. Length (in feet or inches; if not indicated, it's probably in feet)

Also, it bears noting that commercial lumber is always thinner and narrower than labeled, though not shorter. There are actually reasons for this beyond lumber companies trying to con you out of material. As wood dries after being cut, it shrinks in thickness and width, but not in length. Commercial lumber is planed after it is dried, which is why the surface is relatively smooth in comparison to rough cut lumber. Planing wood also takes away from thickness and width.

Since most lumber is sold after it's been dried and planed, it's helpful to have some consistency and standards for measurements. Consequently, boards labeled as 1" are actually $\frac{3}{4}$ " thick, those labeled as 2" are actually 1- $\frac{1}{2}$ " thick, and so on. This means a "two by four" piece of lumber is actually 1- $\frac{1}{2}$ " by 3- $\frac{1}{2}$ ". If you go straight to a sawmill to buy your lumber (much easier to find if you live in a rural area that has a lot of forests), you'll get boards that are much more similar in thickness and width to what the advertised measurements claim. However, if you use rough-sawn lumber straight from a mill, you'll get rough boards that are not consistent. Whatever you're working with, I strongly suggest that you measure the actual boards and go from there, rather than making a plan or any cuts based on advertised dimensions.

Useful Tools for This Project

If you don't have your own tools, you might be able to find them through a local tool library. You can also borrow tools from a friend, neighbor or family member. Another



Selecting commercial lumber

option is to rent tools; some hardware stores provide this service. If you plan on making carpentry part of your life, I encourage you to acquire some or all of the following tools for yourself. To see a list of our favorite brands and styles of each of these tools, [click here](#).

Note: this guide does not include tutorials on power tool use. I believe [in-person learning](#) or video tutorials are better ways to communicate how to use tools that have so much potential for injury. Plus, some of you might be bored by the copious number of pages I would need to dedicate to the proper use of power tools. If you don't already know how to use these tools, I suggest looking up tutorials on YouTube, or taking a class on carpentry or tiny house building with [Wild Abundance](#) (way better and more fun than YouTube, by the way).

- **Tape measure**
- **Sharp carpentry pencil**
- **Speedy square or framing square**
- **Drill*** and/or **impact driver*** with appropriate **drill bits** and **driver bits** (drills are used to drill holes in wood, and impact drivers are used to drive screws into wood...both can do both with the appropriate bits, but those are the jobs they were made for)
- **Saws** (your saw choice will influence some aspects of your design; you don't need them all)

For cutting across your boards (you can choose one)

- **Hand saw**
- **Circular saw*** (especially important if you are using a plywood backing for your shelf)
- **Chop saw*** or sliding miter saw (this is way easier to use for making cuts for shelves and verticals)

For cutting ledger strips (this is the hardest cut...you can choose to use one of the following saws, or you can scrounge or purchase very narrow boards for this purpose in a range of sizes, thus avoiding the need to make these cuts)

- **Table saw*** (best choice, but large, expensive and dangerous)
- **Circular saw*** (will work with some finesse, but definitely not easy)

For cutting a plywood backing (if you choose to use a plywood backing)

- **Circular saw***

** Denotes a power tool*



Using a chop saw



A nice, comfortable tool belt with many pockets; yours doesn't have to be this fancy



A "Stanley Fat Max" tape measure



Using an impact driver to drive a screw



Using a circular saw



Using a table saw

Steps to Building a Shelf

Step 1: Envision your shelf in space

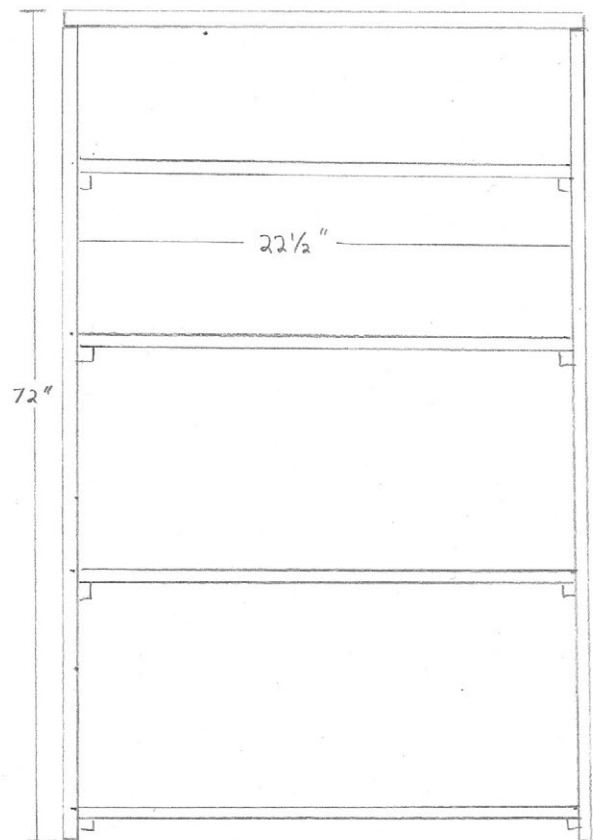
First, decide where you want to put your shelf and what kinds of items you want to live on it. Next, measure the dimensions of your space (height, width and depth). Keep in mind how much room you will want leftover on either side of your shelf and possibly above it, depending on the height of your ceiling. You might want the top of your shelf to act as a shelf. If so, you'll need to leave room for the things that you want to live up there to fit below your ceiling.

Some standard measurements of things commonly kept on shelves:

- Pint-sized canning jar: 5"
- Quart-sized canning jar: 7"
- Half gallon-sized canning jar: 9"
- Books: 7", 9", 12" or larger

Step 2: Draw your design and make a plan

Sketch out how you want your shelf to look, including how much space you want in between every shelf. As you do this, keep in mind your desired final dimensions and the dimensions of the objects that you want to fit on your shelves. Remember to leave space for the thickness of the boards you'll use for the shelves. You'll probably want this thickness to be $\frac{3}{4}$ " if you're using commercial lumber, or 1" if you've got rough-sawn lumber. However, if your shelves span a long distance, or if what they'll be holding up is quite heavy, you might want to use 1- $\frac{1}{2}$ " lumber (keeping in mind that commercial "2-inch" thick lumber is actually 1- $\frac{1}{2}$ inches thick...I know, I know, it can be



confusing). I've laid out my example shelf with commercial "1-inch" lumber (which is actually $\frac{3}{4}$ " thick). The dimensions of this example are arbitrary, so please adjust your design to suit your needs.

Step 3: Make a cut list

You'll want a list of the dimensions of all the boards that you will need to cut. "Cut lists" are always read as width by height by length. All lengths will be exact, even though (as mentioned earlier) there is a conspiracy to confuse you on the other measurements (1" is actually $\frac{3}{4}$ ", 8" is actually 7- $\frac{1}{4}$ ", as 1-inch thick commercial lumber is always $\frac{1}{4}$ inch thinner and $\frac{1}{2}$ to $\frac{3}{4}$ narrower). I know, it's crazy, but all of your boards will be the same width in this design, so the exact width doesn't really matter that much. I follow convention and list the "as advertised" or pre-planed dimensions for simplicity, but hopefully you won't get confused because you're in on the secret. If you are using rough-sawn lumber directly from a sawmill, then the real dimensions of your lumber will actually be more like what's listed here.

Here's our cut list for the shelf for this project:

- 2 @ 1" x 8" x 71- $\frac{1}{4}$ " (for verticals)
- 4 @ 1" x 8" x 22- $\frac{1}{2}$ " (for interior shelves)
- 1 @ 1" x 8" x 24" (for top shelf)
- 8 @ 1" x 1" x 7- $\frac{1}{4}$ " (for ledger strips)

If you're going to make a shelf with different dimensions than mine, use this same approach to create your cut list.

Step 4: Make a materials list

This is basically a shopping list. I'm sure you have made one of these before.

Unless you are buying from bulk bins, groceries generally don't come in the exact quantities that you need for your recipe. The situation is similar with wood. You can't buy a 22- $\frac{1}{2}$ " board. Standard board lengths sold commercially are 8, 10 and 12 feet.

If you want a shelf that is 72" tall and 24" wide by 7- $\frac{1}{4}$ " deep, with 5 shelves, (our project shelf), you'll need: 1 board that is 1" x 8" x 12' for your two verticals plus another that is also 1" x 8" x 12' for your five shelves. You can likely get your ledger strips out of scrap wood, if you have any laying around. But if you don't have any scraps, you'll need to replace one of those 1x8x12's with 2 @ 1x8x8 (so that you end up with extra wood for your ledger strips from the boards that you buy).

It's important that you cut your ledger strips so that their length is parallel with the grain of the wood. It would be very convenient if you could just cut $\frac{3}{4}$ " off of the ends of your boards to make your ledger strips, but these would be extremely flimsy and likely impossible to attach to your verticals. That's because the grain of wood is what holds it together; it's literally the strands of fiber that give trees their strength. When you cut across the grain, the fibers in your finished piece are short and running in the opposite direction of where you need strength. Small pieces of end-grain wood are likely to crack apart at the grain lines, especially if you screw or nail into them.

Materials list for the project shelf:

- 2 @ 1x8x12 commercial lumber (which will actually be $\frac{3}{4}$ " thick and 7 $\frac{1}{4}$ " wide)
- 1 sheet $\frac{1}{4}$ " thick plywood for the back (these come in 4' x 8' sheets, so you'll likely have plenty left over), or a 1x4x8 for a diagonal brace
- At least 30 wood screws @ 1 $\frac{1}{4}$ " (make sure you get wood screws of the correct length: 1 $\frac{1}{2}$ " if using rough-sawn and 1 $\frac{1}{4}$ " if using commercial wood...you don't want your screws to pop out on the other side of the board)



Step 5: Lay out design

First, mark where the bottom of each shelf is going to be with a pencil (I like to make a V with the point of the V being at the exact measurement as this is the most accurate way of marking). Then use a speed square or framing square and a sharp pencil to mark solid lines (using the Vs you drew as a guide) where you will make your cuts. This will ensure that all angles are square and everything is level.

Step 6: Install ledger strips

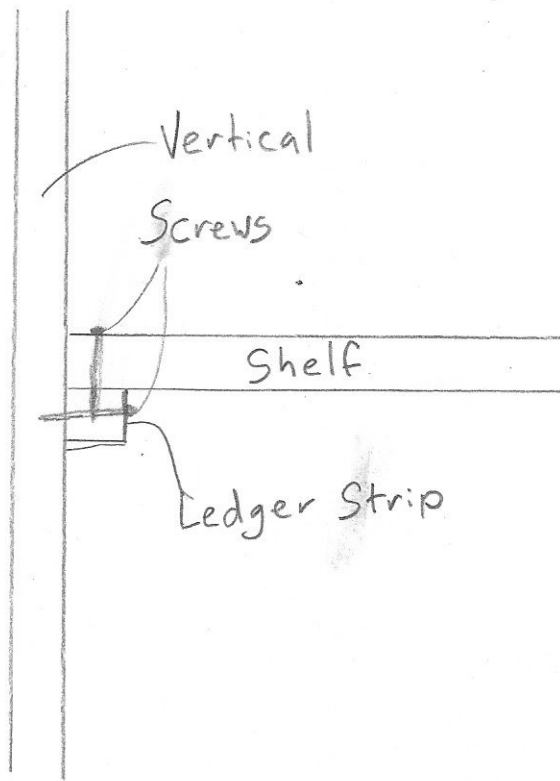
Pre-drill holes into the ledger strips so that when you put the screws in, the ledger strips won't crack. Next, with your vertical pieces laying flat on a work surface, place the ledger strips on the verticals so that the top of each strip lands on the line that you



have made for the bottom of the shelf. In fact, this is exactly where the bottom of the shelf will be, because it will rest on the ledger strip. Finally, screw through your pre-drilled holes in the ledger strips and then into the verticals of your shelf, making sure to hold the ledger strips steady right on that line you've drawn for your shelves. Fasten each ledger strip to the verticals with 2 or 3 screws.

Step 7: Install shelves

Stand the sides of your shelf up, as they will be when your shelf is finished. Either get a helper to assist you in holding the sides up as you screw on your first shelf, or brace at least one side against a wall or with a clamp attached to something stable. After you get your first shelf screwed on, the two sides will stand up more easily on their own. Install the lowest shelf first, screwing it to your ledger strips with 2 or 3 screws, depending on how wide your shelves are. Make sure not to hit the screws that attach the ledger strips to your verticals with the new screws that attach the shelf to the ledger strips.



It's generally a good idea to pre-drill the board that you are screwing through (in this case your shelf) when you are screwing within an inch of the end of the board. In most cases you do not need to pre-drill the board you are screwing into (though there are some exceptions to this as well as almost every rule in the world). Work your way up, attaching each shelf one at a time. If you have shelves that are particularly close, you may need to work in a different order, but this order works best for most shelves.

Step 8: Brace your shelf

Set your shelf face-down on a flat surface. Use a framing square to square up one shelf with one vertical side. If you did all of your measuring and installation correctly, this should make it so that all of your shelves

are perpendicular to your verticals, so that all of the shelves are parallel to each other, and so that the two verticals are parallel to each other.

If you don't have a framing square, you can also use a tape measure to square up your shelf. To do this, measure distance from the top of one of your verticals to the bottom of your other vertical, and from the top of that vertical to the bottom of the first one (basically, measuring a big X across the back of your shelf). Shimmy your shelf until the measurements are within 1/16-inch of each other.

In order to keep your shelf square, you'll need to install plywood on the back of the shelf, or use a 1" x 4" board to create a diagonal brace. First, you'll need to take measurements, scribe onto the plywood or brace (measure and then draw the line where you will make the cut), and cut it. Cutting plywood with a circular saw can be dangerous and awkward, so make sure to watch some YouTube videos on the subject or get help if that's the tool you'll be using. Some chop saws can rotate to make angled cuts, and this is much easier and safer. When you install the plywood or diagonal brace, make sure that you screw at least two screws into any board that the plywood or diagonal brace makes contact with.

Step 9: Admire and use your shelf

At this point your shelf should look like a shelf, and you'll likely be feeling pretty pleased with yourself. Now is the time to put your shelf to use. If you plan to stain or paint it, be sure to do that before you start putting things on it.



Once you master the basic shelf, you just might want to get fancier!

We hope this guide has been helpful and empowering. If you'd like more hands-on instruction, please join us for one of our [carpentry classes](#).

Good luck with all your future projects!