Understanding Green Wood

Achieving refined results from raw material

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"Green wood always cracks." "How do you keep it from shrinking and cracking?" These are typical comments I hear when I talk about using green wood. The fact is, green wood is a very good material for woodturning, and it's what I use for all of my work. It's possible to make finished, refined pieces from green wood, finished work that isn't cracked or grossly distorted.

Green woodwork has a long history, and it's only recently that we've adopted the attitude that wood always needs to be dry. Traditional chairmaking uses green wood to good effect, relying on the nature of green wood to shrink and lock the joints together, which lends a strength to the chair that couldn't be achieved with dry wood. If you've ever seen one of Curtis Buchanan's Windsor chairs or Brian Bogg's incredibly elegant contemporary Appalachian-style ladderback or rocking chairs, that's woodworking on a very refined level, and dependent on green wood. Alan Lacer's recent articles on the Old Sturbridge Village collection featured some very technically and aesthetically refined vessels that would have been made from green wood.

First, a clear understanding of the properties of wood is needed. Although some of us treat it as a mystery, wood is actually a very predictable material. We know virtually everything about most wood available to us, how it glues, screws, machines, sands, paints, weathers, resists or succumbs to insects and rot. More importantly to us, as woodturners, we know how much it will move in each direction as it dries. This is well documented, and quite easily observable by turning a couple of quick, simple bowls—let them dry for a few days, and you've just received an education on some significant properties of that wood. You're not after absolute numbers or percentages, but a feeling for how a particular wood will act as it dries.

Secondly, you need a clear *intent*, a good sense of what you're trying to accomplish. Green wood is not suitable for everything. You're not going to get a perfectly round salad bowl, for example, or a box with a lid that fits in any position. This may or may not matter as we'll see later in the article, but you do need a good idea of what you want to do.

Why use green wood? It's nearly impossible to get dry wood in large enough pieces for many uses. Green wood is easier to work in most cases and, from my perspective, a lot more fun. It's readily available and inexpensive. Construction sites, road-building projects, firewood cutters, country sawmills, etc., are all good sources. Find a firewood cutter and tell him what you want. You pay the going rate for firewood, and he doesn't have to split it—you both make out. Or get together with some friends and share the work of cutting and transporting. It's easy once you get started. In fact, the biggest problem is taking home way more than you'll use. All the wood I use is from the dump or a small sawmill where it would be cut into barn lumber and railroad ties. With green wood I can shake the squirrels out one day and sell it the next (well, almost).

One of the most important advantages to me is that unlike precut bowl blanks or planks, I make all the decisions with regard to how the piece is oriented. I can very carefully orient the grain patterns, colors, defects, etc., and since there is little expense involved, I don't need to feel guilty about wasting wood. I'm concerned only with the piece at hand, and I'll waste as much wood as needed to get the initial blank just like I want it. It is this ability to control the orientation during cutting and on the lathe (by initially working between centers) that can elevate one's work to another level.

The following discussion will generalize to some extent; to cover the subject thoroughly would require a book. Also, the examples apply to straight-grained, sound, fresh wood. Crooked limbs, crotches, burls, and such can present challenges but are fairly predictable with experience.

A typical log might have a beginning moisture content of 80 percent; it can vary considerably, but it doesn't really matter. At 30 percent moisture content, the wood has lost what's known as "free water." This is the water that slings out as the wood spins or visibly wets the surface. The remaining moisture is what's known as "bound water"—it holds the cells of the wood fully swollen, and as it's lost, the cells shrink and problems can begin.

If this log is cut on a nice warm day, the ends of the log will rapidly dry below 30 percent and shrink. However, just under the surface the wood is still fully swollen at 80 percent, and the stress created by this differential causes the wood on the surface to check (or crack) as it shrinks. If there were some magic way to even out the moisture loss, it would be fairly easy to dry large blocks of wood. This is basically what a kiln does—it reintroduces moisture on a schedule to keep the outside of lumber as moist as the inside, and all drying evenly.

One of the basics of green wood turning is this: *Uneven moisture loss causes wood to check and crack.* If we can keep the drying rate or loss of moisture even, it will virtually elimi-

Figure 1: Dynamics of wood shrinkage

The amount of shrinkage depends on grain orientation. Percentages indicated are typical.

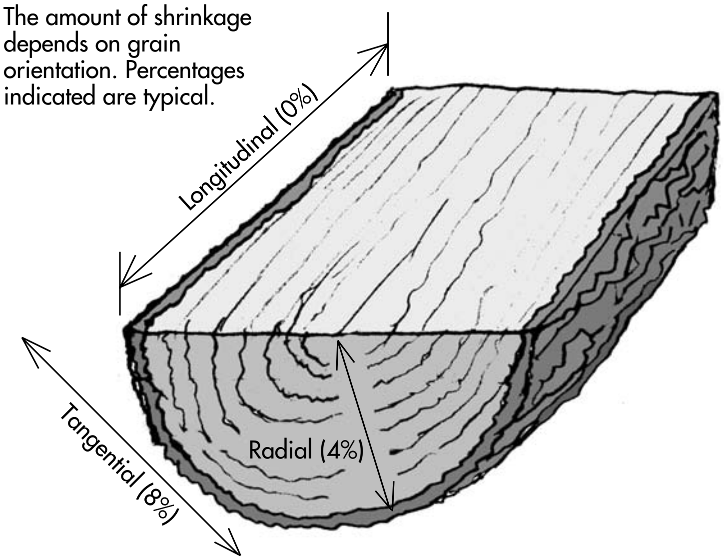
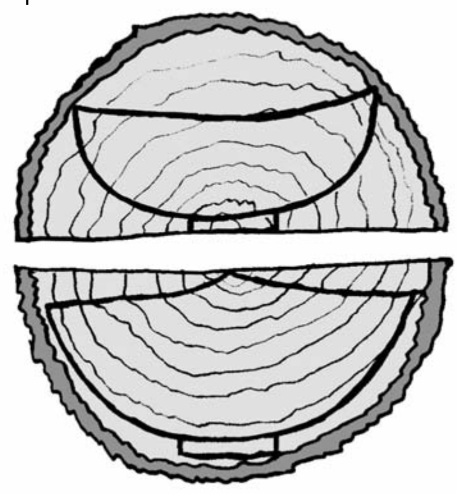


Figure 2: Side-grain bowls

Rims distort in drying. They can be left as is, flattened, or shaped.

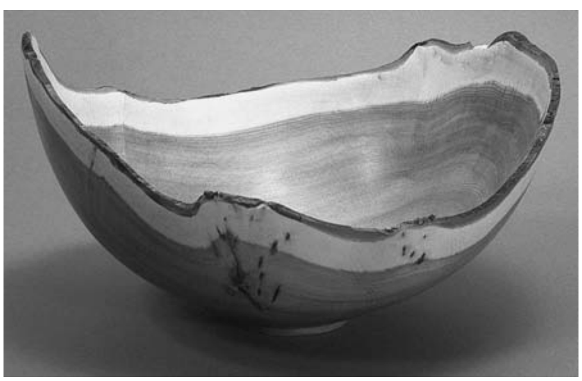


nate cracking. This is done by turning the pieces relatively thin and relatively even, ensuring that the wood below the surface dries at a rate similar to that at the surface.

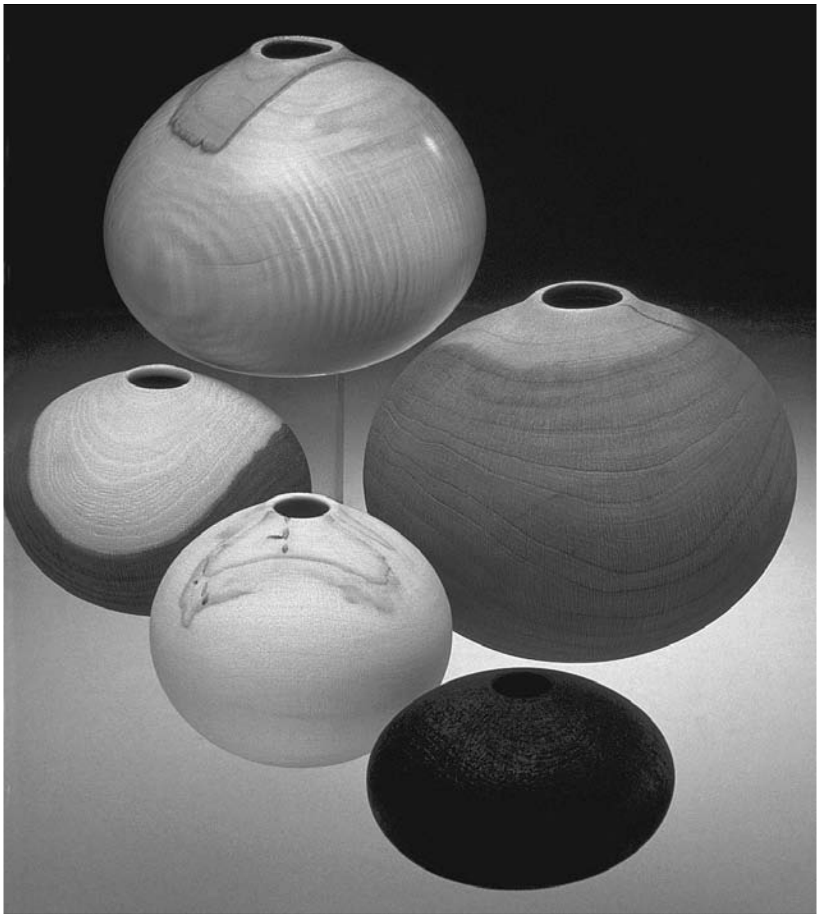
Shrinkage rates in a typical wood depend on grain direction. Longitudinally—along the length of the grain (Figure 1)—it will shrink close to 0 percent; tangential to the growth rings, maybe 8 percent, and radially, about half that, or 4 percent. The smaller the values and the less difference between them, the more stable the wood. When you see real percentages in a chart or table, they are expressing green to oven-dry values, which we will obviously never see. As with moisture content, absolute values are not important; rather understand the relationships and the relative amount of movement of a particular wood.

For example, I know that white oak has a fairly high rate of shrinkage; ash, on the other hand, shrinks moderately. I don't know the actual percentages, but if I look them up, the tables will confirm what I know from experience. If I have some wood that I'm not familiar with, I don't want to invest major time in a piece until I know the wood's characteristics. I can look up the shrinkage rates, but I'm more inclined to do a couple of small pieces and get first-hand experience.

If a bowl is turned out of the log as shown in Figure 2 and allowed to dry, it will obviously be oval in shape, and the rim will no longer be flat. What most people find objec-



The natural distortion that a green-turned piece incurs in drying can be handled in several ways: author's yew bowl, upper left, was left to dry naturally (with little change). Alan Stirt turned and carved green the butternut bowl, left, flattening the rim after it dried. Stirt's "African Series" bowl, above, was roughed out wet, dried, and re-turned and carved.



Side-grain vessels, left (clockwise from top), are of maple, cherry, dyed walnut, box elder, and walnut (the maple has a reshaped rim). End-grain vessel, above, is of red maple. All were turned from green wood, start to finish, and carved and textured after drying. The lid was rough-turned, dried, and re-turned.

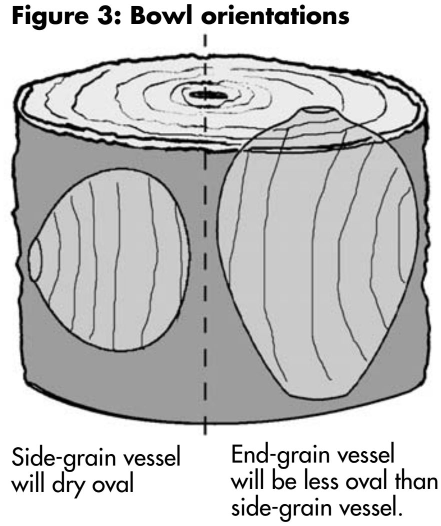
tionable about this is not the fact that the bowl is oval, but that the rim is now vague, sort of wavy and undefined. One solution is to flatten the rim or intentionally reshape the rim, which could be subtle or dramatic.

If you want, or need, a truly round bowl, then the solution is to rough-turn the bowl somewhat thicker, allow it to dry and re-turn it. This is a good way to work for many people. The roughed-turned blanks can be dried pretty quickly compared with trying to dry large, solid bowl blanks, and there's probably no single better way to gain skills than to rough-turn green wood. Get a bowl gouge and a green log and go to it!

On the other hand, natural edge bowls lend themselves very well to green turning since they usually look oval anyway, so it doesn't matter that they are in fact a little oval, or that the rim has changed a bit. It doesn't change the *intent* of the piece one bit.

Side-grained hollow turnings will

Figure 3: Bowl orientations



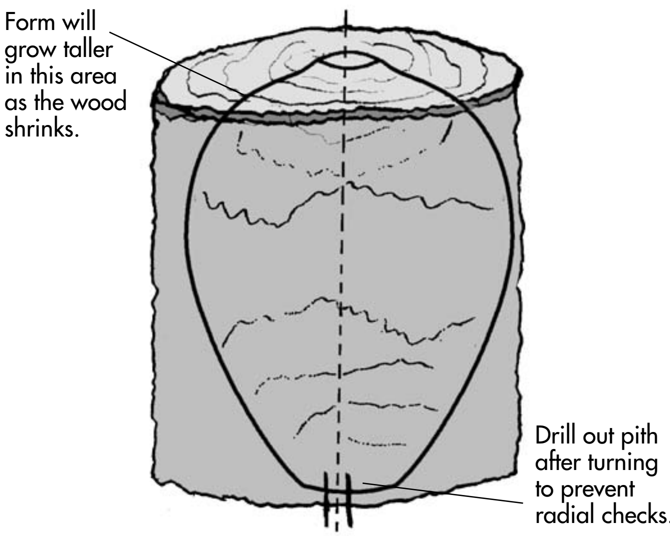
likewise go oval, a lot or a little, depending on the rates of shrinkage of the particular wood. This can lend a nice organic quality, and sometimes I emphasize the oval shape by carving the lip more oval.

End-grain hollow turnings, as most of mine are, will also go oval, but now the ovalness results from the difference between tangential and radial shrinkage, not the more pronounced difference between longitudinal and tangential or radial rates (Figure 3). Cut out the blank as far from the pith as practical, as the most noticeable movement will take place in the tighter growth rings near the pith, and can result in a bulge on that side. The piece will be oval on close inspection, but not enough to affect the *intent* of the piece.

End-grain vessels can also be turned from entire logs with the pith included. This can result in grain patterns and effects that can't be achieved any other way and can be a good use of appropriate sized logs. The logs should be quite concentric with the pith right down the center, with very little or no checking or funkiness in the pith, and the piece should be centered so the pith falls into the opening in top, and close to the center within the foot (Figure 4).

The problem with this orientation is that although the piece should stay quite round, as the piece shrinks, radial checking is likely to occur in the

Figure 4: Hollow form, centered on the pith



Author's "CDX jar," above was turned with a Douglas fir blank centered on the pith. Drilling the pith out after turning, as shown at left, can eliminate radial checking.

bottom. I minimize this problem by drilling the pith out of the bottom with a $^{1}/_{2}$- to 1-inch hole (photo above). The hole will relieve the pressure as the bottom constricts. After the piece has dried, the hole is trued up and a plug fitted. It's not a foolproof method, but I've had good success with it.

Some woods are stable enough to leave the pith in, maybe saturated with a drop or two of cyanoacrylate glue, but the wall thickness will need to be relatively thin and even.

Another problem with turning the entire log is that, as the vessel shrinks in diameter, it will grow taller above the shoulder area of the vessel, possibly ruining what was a good curve. I intentionally flatten this curve a bit, anticipating the additional curve as it dries. Once again, experience will help with this.

A few more things to consider: I've talked about turning the wood relatively thin and relatively even, but it's hard to be specific. Here are some general guidelines: Most woods will dry very well if turned in the $^{3}/_{16}$- to $^{5}/_{16}$-inch range; under most circumstances you would not need to control drying at this thickness. In the $^{3}/_{8}$- to $^{1}/_{2}$-inch range you may need to moderate the drying by keeping the piece in a cooler spot or a paper bag for a few days. Over $^{1}/_{2}$ inch, you probably need to take definite steps to slow the drying for a few days or even weeks.

Also consider the mechanical strength to wall thickness in the $^{3}/_{16}$- to $^{5}/_{16}$-inch range. If you turn $^{1}/_{8}$ inch or less, areas may collapse or distort more than they would with a bit more thickness.

You can use compressed air to blow out the free water from a turned piece, drying the surface enough to sand and/or prevent staining.

Tiny checks become BIG *cracks!* This is the most common problem I see. Be sure when preparing the blank that you saw away end checks. Inspect the work in progress very carefully for small checks and defects—very common near the pith—use a strong light and eliminate the pith and as much of the wood near it as practical.

Don't be misled by elaborate drying schemes and chemical treatments; they are not needed, and many of these complicated processes are based on faulty conclusions. Keep it simple. And keep an open mind. Think of ways to use, emphasize, and enhance these properties of the wood instead of fighting them. You can't know too much about the material you use.

John Jordan turns and teaches turning in Antioch, TN, and demonstrates frequently throughout the world.