Wood:
Kiln-Dried, Green, or Air-Dried?

Joshua Friend

There is one truth that all woodturners come to understand: When freshly cut, trees are full of water and the moisture-laden lumber is unstable as it dries. This fact determines much about the working properties of our raw material and dictates some processes woodturners employ.

To explain in simple terms, in freshly cut (green) wood, water occurs in two forms: *free* and *bound*. The free water resides in the cell cavities and is first to evaporate—or be slung about your shop while turning green wood. The loss of free water does not cause wood to change shape or crack.

Bound water exists within the cell walls and evaporates after the free water is gone. When the bound water begins to evaporate, the wood does most of its shrinking (as the cells collapse), causing the wood to change shape and possibly crack. Thus, high moisture content necessitates some form of drying process to stabilize wood, either before or after turning on the lathe.

Although wood is not alive after being cut, it may seem so because wood is hygroscopic—it continues to absorb and lose moisture as the relative humidity changes. Understanding the nature of wood will help you understand the options available for acquiring this material we enjoy turning.

(Above) The inside of a vacuum kiln (top has been removed), shows slab material that has been dried. This kiln at Berkshire Products in Sheffield, Massachusetts, can dry up to about 2,000 board feet of lumber in only a few days. Boards are layered in the kiln and separated by heated aluminum plates.

Kiln-dried lumber

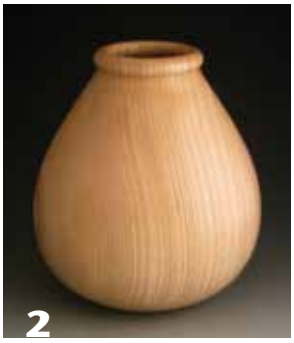
When you buy lumber from a lumberyard or hardwood dealer, most often it has been dried in a kiln. This is the fastest way to dry wood after it has been rough sawn. In as short as a week, depending on the type of wood and the kiln being used, dimensional lumber will be ready to turn. Kiln-dried lumber is dried to about 6 to 9 percent moisture content, which makes the wood stable. Even so, the wood might need to be acclimated to the humidity of your shop before working it.

Wood kilns operate much like a convection oven, making use of some type of heat source and a fan to move the air. There are a number of different types of kilns—vacuum, dehumidification, and solar—but the purpose is the same for all of them: to speed up the process of evaporation of bound water from the wood, thereby stabilizing it *(Page 22)*. For woodturners, the stability of dried wood—whether kiln-dried or air-dried—makes it suitable for all kinds of glue-ups prior to turning, such as in segmented work. Kiln-dried wood is also used for spindle work and for small projects, such as pens.

Some kiln operators also infuse water into the process, commonly when drying walnut. Doing so moves some of the dark color of the heartwood into the sapwood, thereby making the overall color of the board more uniform, which many furniture companies prefer. This process also increases the amount of wood that can be used. On the downside, the process tends to homogenize the wood, making it less interesting. Also, applying heat and steam changes the quality of the wood, making it harder and more brittle. This is why turning kiln-dried wood dulls tools faster and produces a "dusty" cut.

One key limitation of kiln-dried stock for woodturners is the thickness of the wood that can be dried: It is difficult to dry timber sufficiently much thicker than 4" (10cm). Kiln-dried lumber is well suited for woodworkers who use boards (planks or slabs) to make projects that do not require thicker material.

Carl Ford, untitled (natural-edge bowl), 2003, Ash, 6½" × 12" (17 cm × 30 cm)



Carl Ford, untitled (beaded-rim big-mouth vase), 2009, Ash, 7" × 6" (18 cm × 15 cm)

But for turners, using kiln-dried lumber limits faceplate work to shallow bowls and platters (unless you glue-up stock to make thicker turning blanks).

Green wood

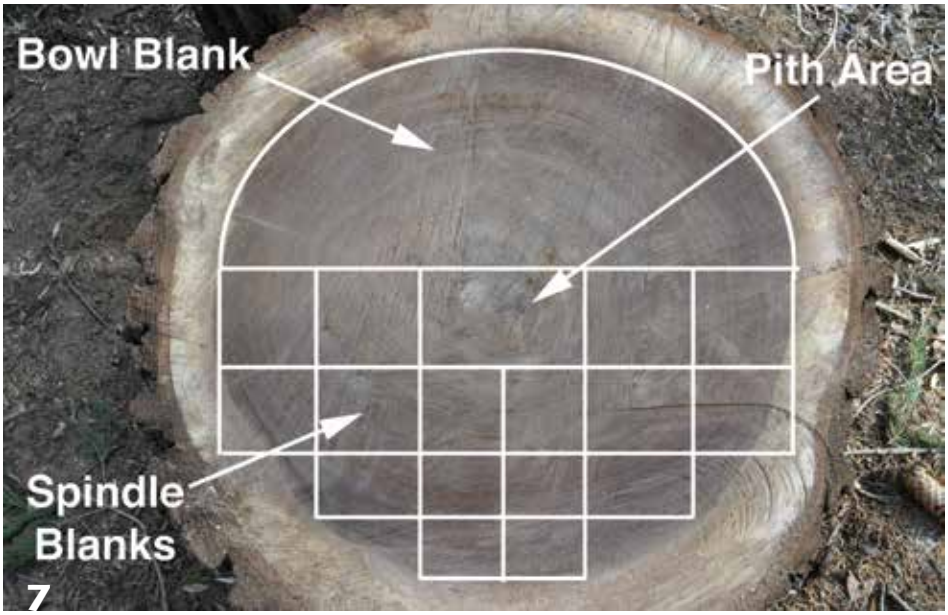
If you have not yet experienced the joys of turning green wood (freshly cut timber saturated with moisture), you are missing out on a fantastic experience. Many woodturning projects become fun by using green wood instead of dimensional lumber. For example, if you want to turn a large, deep bowl without laminating layers of boards together to create sizable turning blanks, using green ▸

I used the crotch grain in this black walnut log as a feature in a turned platter.

The finished platter, 2011, walnut, 1½" × 15"

A freshly sawn log shows natural wonders with great potential for a bowl!

The dark streaks in this maple resulted from the unique mineral content of the soil.



Endgrain of a log illustrates a typical approach to harvesting bowl and spindle-turning stock. To maximize the size of a bowl in this orientation, the log should be cut at least as long as its diameter. The pith and its surrounding area should be cut away since it is unstable during drying and often results in cracks.

wood is the answer. A natural-edge bowl with the bark remaining on the rim is best made from green wood. Turn it green, let it warp, and bask in the glory of your family's compliments. They will truly wonder at your creative use of nature's bounty *(Photos 1, 2)*.

The size and scope of hollow vessels would be severely limited if only kiln-dried wood were used. Woodturners can take a whole section of a green log, mount it directly to the lathe, shape the outside and remove the wood inside (including the pith), and create a hollow vessel. With this process, the wood can move without cracking while drying.

The process of turning green wood is easier on tools because the water in the wood lubricates the cut—shavings easily peel away, many in long ribbons. Cutting tools stay sharper longer and tools leave a smoother surface.

Working with green wood requires some investment of time, effort, and money up front. For example, you will need some means of cutting logs into usable pieces for turning. This can be done effectively with a chainsaw, bandsaw, or portable bandsaw-type sawmill, all of which can be expensive. Also, woodturners require room to process and store wood properly. If you live in an apartment or your neighborhood association has strict codes, chainsawing lumber on your driveway is probably not conducive to being neighborly. Ideally, processed spindle blanks and roughed-out bowls should be stored in a warm dry place for air-drying. Do you have the room to do so?

If you have the knowledge, space, and equipment, harvesting green wood can have significant benefits. Top on the list is the cost of wood. Kiln-dried lumber is relatively expensive. By the time you buy it, the wood has been handled many times: the tree felled, log rough sawn in a mill, and boards dried in a kiln, perhaps even planed to a uniform thickness. During this process, the wood likely has been transported several times, and that cost is built into the final price. Conversely, you can acquire freshly cut logs for free, either from a local tree surgeon or from trees that have come down around your neighborhood. Even in urban settings, there will be tree pruning and removal periodically, so friendly communication with public works or botanical gardens personnel could prove beneficial.

When you learn to process your own turning stock from logs, you can choose which parts of a tree to harvest, such as crotch grain or a section that

The half logs of black walnut reveal a richly colored treasure. A small amount of pith can be seen in the upper part of the logs, but that will be cut away later.

A bowl blank can be rough-shaped with a chainsaw, or by using a bandsaw. Both bowl blanks will become large, deep, one-piece bowls, which could not be accomplished using kiln-dried stock.

Rough turning the outside of a maple bowl from green wood reveals mineral streaks and ambrosia markings.

After air-drying this walnut bowl blank for several months, it can be finish-turned.

appears to have figure in it. Often, I am happily surprised with the interesting characteristics I find within the logs I harvest *(Photos 3, 4, 5, 6)*. A maple log from a neighbor's tree may have beautiful ambrosia markings, mineral streaks from the soil, or spalting—qualities that generally are too unusual or cost-prohibitive for hardwood dealers to handle.

Harvesting and air-drying bowl stock

When you harvest wood from a log, it is best to do so as quickly as possible after cutting the log to length, before endgrain checking has had a chance to occur. First, locate the pith *(Photo 7)*. This is the original strand within the stem or trunk around which the annual growth rings form. The pith is not necessarily located at the center of the tree—growth rings can form quite out-of-round. The wood closest to the pith tends to be unstable when the wood dries, and if not removed, that area can cause unnecessary cracking throughout the entire turning blank. Unless you intend to incorporate the pith into a project for dramatic effect, it should be cut away, either during blank preparation or at the lathe.

Cut the log in half, at or near the pith, essentially splitting the log lengthwise *(Photo 8)*. This can be accomplished with a typical chainsaw setup, but make sure you use a sharp chain. Special chains made for ripping along the grain can make this process easier. Another way to cut a log along the grain is with a portable bandsaw-type sawmill.

To harvest bowl-blank material, mark a circle on a half log using chalk, and then rough-shape the bowl blank with a chainsaw *(Photo 9)*. Alternatively, you can cut the log in half and form the bowl blank using a bandsaw if you have one with enough capacity *(Photo 10)*.

Drying wood much thicker than 4" (10cm) thick is not feasible, so it is best to turn bowls right away from green blanks. To rough-turn a bowl, shape and hollow it, but leave the walls extra thick for safe, slow drying and to ensure there is enough wood left to re-turn the bowl round after the wood warps *(Photos 11, 12)*. The rule of thumb for wall thickness of a rough-turned bowl is 1" (2.5cm) per 10" (25cm) of rim diameter, so a 15"- (38cm-) diameter bowl, for example, would have walls that are 1½" (4cm) thick.

It is important to make the wall thickness as uniform as possible from rim to bottom so drying can occur evenly, which further reduces the chances of cracking. Immediately after rough turning, coat the bowl with a wax emulsion sealer, which will slow the drying process and even out moisture loss from endgrain and side grain wood—moisture loss is greater from endgrain than from side grain.

Set aside the bowl for several months to a year to air-dry, preferably in an environment that is not too hot and dry. As the wood loses moisture, the bowl will change shape and go out-of-round—wood shrinks more across the grain than along the grain. After the bowl blank is dry, remount it onto the lathe for final turning, sanding, and finishing. This is what is commonly called a twice-turned bowl.

It is also possible to turn a bowl from green wood directly to its final thickness, and this is a lot of fun! The walls can be turned quite thin, so the wood will dry faster than for a rough-turned bowl. The bowl will also warp and change shape, often leaving a wavy rim.

Spindle-turning stock

To harvest spindle-turning stock, make additional rip cuts in the freshly cut ▸

Spindle stock can be cut using a chainsaw, or, alternatively, a bandsaw.

half-log to create blanks of various dimensions *(see Photo 7)*. These rip cuts can be made with a chainsaw *(Photo 13)*, but are more easily accomplished on a bandsaw *(Photos 14, 15)*. Spindle blanks do not need to be cut exactly square—eventually they will be turned round when mounted between centers, so it is sufficient to make these rip cuts freehand. Seal the ends of spindle blanks with a wax emulsion to minimize endgrain checking, and set them aside for air-drying, stacking them so air circulates around each piece.

The rule of thumb for air-drying wood is one year for each inch of thickness, and this applies to both flat lumber (spindle stock) and roughed-out bowls. Drying times vary greatly, however, depending on the type of wood and the humidity level in which the wood is being dried. Ultimately, the goal is for the wood's moisture content to reach a point of equilibrium with the surrounding humidity. Then it will be relatively stable in that environment. If in doubt, a moisture meter can be used to verify moisture content.

Air-dried lumber is often of a much nicer quality, with a gentler cutting response, than kiln-dried stock. It has been dried slower and by a more natural process. For woodturners, kiln-dried lumber certainly has its uses, but if you have only turned kiln-dried wood, you may be missing out on some of the unique joys of harvesting and turning green wood. ■

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Kiln for Drying Wood

Larry Zubke

The kiln is loaded with wood.

To speed up the drying process and improve the odds of successfully preserving wood blanks, I built a drying kiln. A kiln provides a stable environment by maintaining a consistent temperature and humidity. For research, I spoke to woodturners in my local club and also found articles on the Internet. I discovered that there are no hard-and-fast rules for building a kiln, so I took several ideas and combined them into something that would work for me.

A small chest freezer that had quit working began the project. The metal walls with insulation between them help retain heat, making this kiln economical to run, even in wintertime. For safety, I installed a hasp and padlock on the door.

I removed the compressor and mounted casters on one side to stand the freezer up so it can move around easily. The vertical positioning of the door allows easy access. An upright freezer or refrigerator might work better, but this unit takes up less space.

I installed open-wire shelves to support the green wood and to allow air to move freely within the kiln. A watertight light fixture with two 60-watt incandescent lightbulbs mounted on the base of the freezer, provides the heat source. A thin sheet metal plate sits over the bulbs to protect them from dripping water. The metal also retains heat from the bulbs, slowly releasing it after the power is off.

A greenhouse thermostat with a remote sensor monitors and regulates the temperature inside the kiln by automatically turning the bulbs on or off so that a consistent temperature is maintained. I drilled four ½" (13mm) holes in the bottom of the freezer below the lightbulbs and four matching holes in the upper rear wall. Heat convection from the bulbs draws outside air into the freezer through the bottom holes. Warm humid air exits the freezer through the top holes.

After my first batch of wood was dry, I decided to install a 5" (13cm) fan, salvaged from computer equipment. This fan runs all the time and helps circulate the air, which speeds up the drying process. Without the fan, the first batch of wood took approximately seven weeks to dry. The second batch took only five weeks.

I generally start by setting the temperature at 80° for the first week. At week two, I increase the temperature to 85°. The third week, I raise the temperature to 90° and leave it there until the wood is dry. During the first few weeks, the humidity is 70 to 80 percent, so the air exiting the kiln often condenses on the outside of the holes. As the drying process progresses, the humidity continues to drop. The time it takes for the blanks to finish drying depends upon: the time of year the tree was cut, wood species, diameter, rough-turned wall thickness, storage-environment temperature, and humidity.

To measure the wood's dryness, I weigh the largest and thickest blanks with a digital fishing scale and write the weight and date on each blank. At first, I check the blanks monthly, and then weekly as the weight loss begins to slow. When the blanks stop loosing weight (moisture), they can be finish turned. ■

Mounted on the left-hand side of the kiln are the controls, power switch, and outlet, as well as the greenhouse controller. Note the padlock for safety.

A fan is mounted underneath the wire shelf.

The lightbulbs are mounted on the back of the kiln near the bottom, a sheet of metal covers the bulb, and the holes are drilled through the bottom of the freezer.

The sensor for the greenhouse controller is mounted to the ceiling inside the kiln. The four holes drilled through the upper back wall of the freezer can be seen.

A 13"- (33cm) cottonwood bowl, rough turned from green wood, weighed 5.09 lb (2.3kg) June 11 when it was placed in the kiln. It weighed 3.43 lb (1.6kg) July 15, and 3.42 lb (1.6kg) July 22. This bowl stopped loosing weight, is dry, and ready to be finish turned.

Larry Zubke has been an avid woodworker all of his life, learning from his father and other family members. Since joining the Dakota Woodturners, his focus shifted to woodturning.