Weighty Matters

ALL YOU NEED TO KNOW ABOUT THE WATER IN WOOD

Q: *What is the **moisture content of wood** and what does it have to do with log homes?*

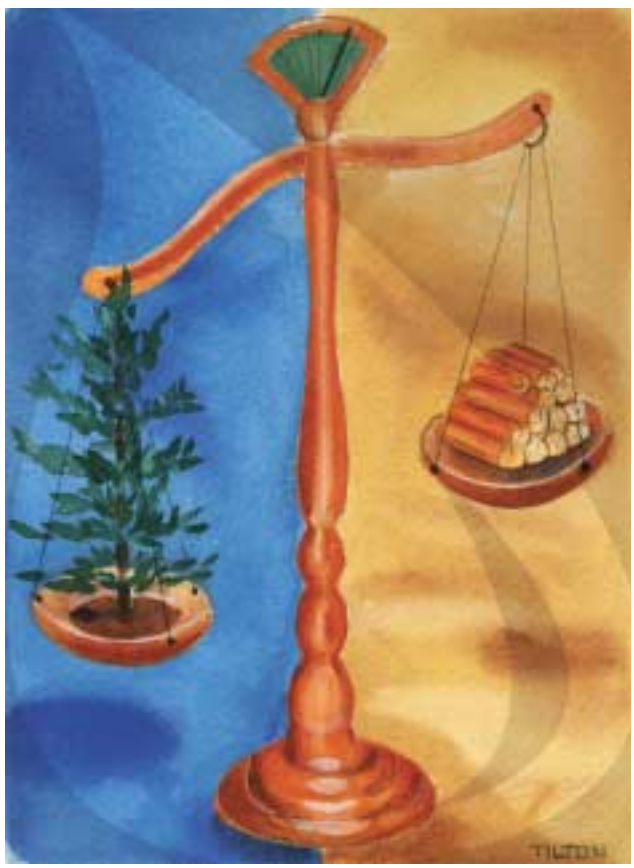
The primary function of wood in a tree is to carry the water needed by the leaves to convert sunlight and carbon dioxide into the organic components of the tree. Without wood, or secondary xylem as it is known by those in the white lab coats, plant life would be very simple. Few organisms would reach more than mere inches above the ground. Without wood's incredible strength and capacity to move water, there would be no forests on earth.

A quick view of the end of a log through a microscope shows that more than 90 percent of the wood cells are arranged with their long axes aligned with the length of the log, like thousands of closely packed drinking straws. These long, hollow, dead wood cells are either actively involved (outer shell of sapwood) or were formerly involved (inner core of heartwood) with conducting water collected by the roots to the leaves in the tree's crown. Evidence of the movement of water in a tree's stem is easily seen during the collection of sap for making maple syrup.

When trees are harvested and used for wood products, including logs for log homes, the water present in the tree at the time of harvest is collected, along with the xylem that holds it, in two distinct places in the individual cells. The liquid water, known as free water, is found in the central cavity, or lumen, of the wood cell. It normally moves upwards in the sapwood to supply the needs of the leaves. This free water can add a tremendous amount of weight to the stem of a tree but does little to the physical and mechanical properties of that tree.

However, the water found within the thin walls of the wood cells, known as bound water, has a tremendous impact on the properties of the wood. It is responsible for the shrinking, swelling, mechanical, thermal, electrical, chemical and combustion properties of wood.

The measure of the amount of water in wood is known as its moisture content (MC). The MC is the ratio of the weight of the water compared to the dry weight of the wood, expressed as a percentage. For example, if a log sample weighed 10 pounds at the time of harvest and 6 pounds after being thoroughly dried in an oven, the weight of the water, 4 pounds, would be equal to 40 percent of the original weight of the log.



Theodora Tilton

The weight of water contained in a freshly cut tree is often greater than the weight of only the wood of the log. In these situations, the logs' moisture content is said to be greater than 100 percent.

The moisture content of an individual cell where the free water has evaporated and only the bound water in the cell wall remains is known as the fiber saturation point (FSP). Wood moisture content can also be measured with a moisture meter that uses electrical resistance or capacitance to estimate its moisture content. Meters are only useful for moisture contents between 7 and 30 percent. At higher moisture contents, the only thing the meter can tell you is that the wood has a moisture content

above 30 percent.

Logs begin drying as soon as the tree is harvested and will continue to dry until its moisture content reaches equilibrium with the atmosphere in which it is stored. This equilibrium moisture content (EMC) ranges between 5 and 30 percent, depending on the temperature and relative humidity of the air surrounding the log. For example, the lowest moisture content for wood inside a home usually occurs in the winter, when cold, relatively dry air is brought inside and heated.

The relative humidity of the air inside the home can be as low as 15 percent in western and northern climates, while the temperature is generally kept between 60 and 70 degrees. This results in an EMC of approximately 4 percent, while the EMC for wood outdoors in temperatures near freezing and relative humidity of 75 percent is 13 percent.

It must be emphasized that logs dry from the outside to the inside. Even when logs show a very dry surface and seasoning checks have appeared, the core moisture may still be at the same level it was at in the living tree. Moisture content studies have shown that the average moisture content of a log or piece of lumber is best estimated to be that found at a depth of a quarter to one-third the diameter of the log. As time passes and the log dries, the difference between the surface and the center of the log will diminish. If the log is in a wall, the moisture gradient from inside to outside will fluctuate but will be present nonetheless.

Once wood has been dried and the initial shrinkage has taken place, the most efficient means of water re-entering the cell walls is through absorption of water vapor from the air. Remarkably, it is relatively difficult for wood to take in liquid water, as the natural pathways for liquid water are generally much less effective after the wood has been dried.

Finishing wood with a high-quality exterior finish will further inhibit liquid-water uptake by coating the exposed wood cells with a material that repels water in a fashion similar to a freshly waxed car in the rain. The water-repelling surface causes the water to form droplets too large to fit into narrow drying checks. These coatings, however, still allow for the moisture found in the center of the log to migrate to the surface and escape. This is a process that can take as many as five years or more, depending on the species of log, its moisture content at time of placement and interior and exterior EMC.

In summary, wood is designed to contain and move water and is very effective in doing so when in the tree. Composed of numerous microscopic tube-like cells, wood holds liquid water inside the cell cavity, as well as in the cell wall. The free water in the lumens is the first to leave the wood during drying, followed by the water bound within the cell wall, until equilibrium with the surrounding atmosphere is reached. Wood moisture content is expressed as the percentage weight of the water compared to the weight of the dry wood, and once dried and in a log home, will average between 5 and 15 percent. Wood's strength properties begin to increase when the wood dries below 30 percent, the moisture content where wood begins to shrink, with checks appearing in logs containing the center of the tree.

Wood's relationship with water is a topic for a future column that will educate log-home buyers about the various methods of drying logs and the effects of those drying methods on the wood in your home. Stay tuned.

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