Timber & Timber Products - Structure

Tree Anatomy and Growth

Wood fibres can be very different and the patterns of these differences (the grain) can work in our favour or against us if we are not careful. As a tree grows from a sapling into a mature tree we can start to see differences in structure in the cross-section of the tree.

The oldest part of the tree, at its centre, is called the pith. The pith is useless to woodworkers as it tends to crack very easily. Adjacent to the pith is the heartwood - the region of the interior of the tree that is dead. Chemicals called extractives build up in these dead wood fibres and they serve to protect them from fungal decay and insect damage. It is the heartwood that woodworkers build with. Next is a lighter coloured region known as the sapwood. The sapwood is alive and is resistant to decay and insect as long as the tree lives, but once the tree is cut down or dies, it loses this ability, which is why you should avoid choosing timber with

sapwood. The next layer is very thin and lies between the sapwood and the bark. It is called the cambium layer and is the fastest growing part of the tree. Every year a new growth ring develops at the cambium, and every year the oldest ring of sapwood dies and turns to heartwood. The year's growth is evident in the form of growth rings.

Each ring is composed of two distinct parts; the earlywood and the latewood. Earlywood, the inner portion, is formed in Spring and is typified by cells with larger cavities and very thin walls which grew very quickly as the tree came alive in anticipation of the summer ahead. Latewood is comprised of cells with small internal cavities and thick walls. Also called Summer wood, they tend to appear darker due to the higher concentration of cellulose. In fall, the tree retreats into dormancy to repeat the process again next spring.

This seasonal pattern of growth produces the distinctive growth rings we see in the cross-section of the tree. Growth rings are important as they provide visual indication of the grain of the wood. We cannot see the wood fibres themselves, but the variation in the appearance of the wood caused by growth rings allows us to quickly see the direction in which the grain runs when looking at the face of a board. When looking at the end grain, they provide us with even more information. From the end we can tell from what part of the trunk the board was cut and use that information to anticipate how dimensionally stable, or unstable, that piece of lumber might be.

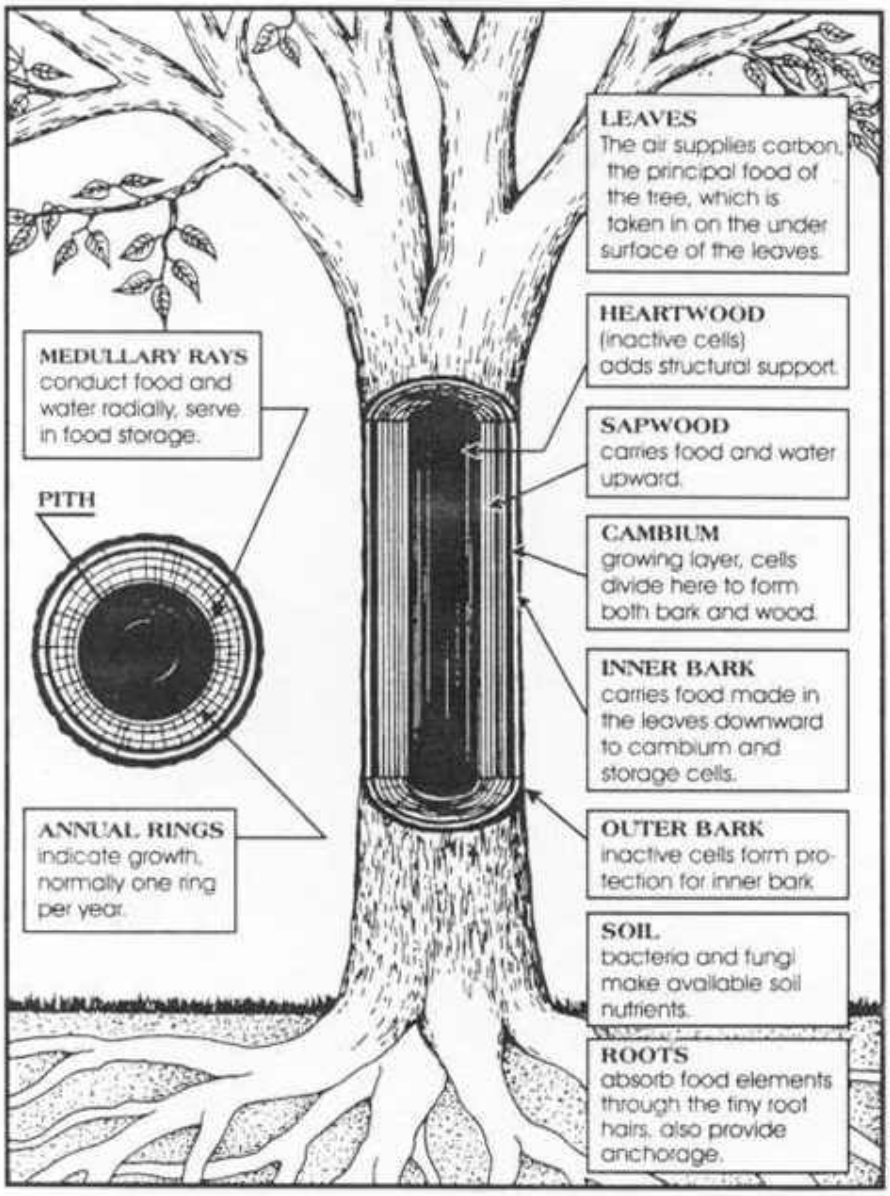
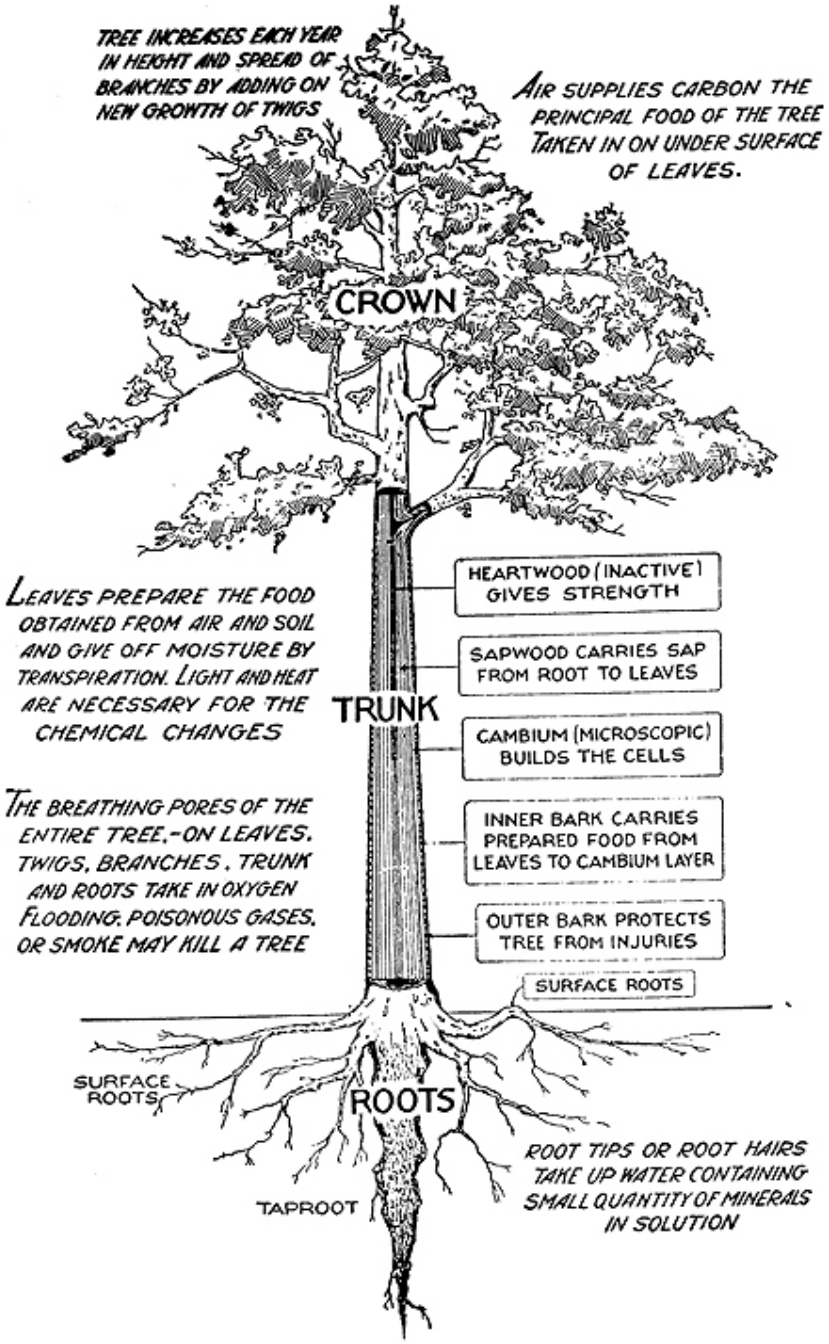


DIAGRAM SHOWING FUNCTIONS OF DIFFERENT PARTS OF A TREE

Courtesy of the *New Tree Experts Manual* by Richard R. Penska


TREE INCREASES EACH YEAR IN HEIGHT AND SPREAD OF BRANCHES BY ADDING ON NEW GROWTH OF TWIGS
AIR SUPPLIES CARBON THE PRINCIPAL FOOD OF THE TREE TAKEN IN ON UNDER SURFACE OF LEAVES.
CROWN
LEAVES PREPARE THE FOOD OBTAINED FROM AIR AND SOIL AND GIVE OFF MOISTURE BY TRANSPIRATION. LIGHT AND HEAT ARE NECESSARY FOR THE CHEMICAL CHANGES
THE BREATHING PORES OF THE ENTIRE TREE,-ON LEAVES, TWIGS, BRANCHES, TRUNK AND ROOTS TAKE IN OXYGEN FLOODING, POISONOUS GASES, OR SMOKE MAY KILL A TREE
TRUNK
HEARTWOOD (INACTIVE) GIVES STRENGTH
SAPWOOD CARRIES SAP FROM ROOT TO LEAVES
CAMBIUM (MICROSCOPIC) BUILDS THE CELLS
INNER BARK CARRIES PREPARED FOOD FROM LEAVES TO CAMBIUM LAYER
OUTER BARK PROTECTS TREE FROM INJURIES
SURFACE ROOTS
SURFACE ROOTS
ROOTS
TAPROOT
ROOT TIPS OR ROOT HAIRS TAKE UP WATER CONTAINING SMALL QUANTITY OF MINERALS IN SOLUTION

Sapwood: The wood formed just inside a tree's cambium layer. May comprise the first one to three inches of radial thickness beneath the bark and contains mostly living cells that carry sap from the roots to the leaves.
Heartwood: The portion of the tree contained within the sapwood; this term is sometimes used to mean the pith. The heartwood is dormant and unnecessary for the tree's continued life; the living part of the tree is contained in its outer parts. Usually slightly darker in colour and more resistant to decay than sapwood.
Earlywood: In a tree's annual growth ring, the portion formed in the spring, which is light in colour.
Latewood: In a tree's annual growth ring, the darker portion, which is formed later in the growing season. Latewood is generally denser and stronger mechanically than earlywood.
Cambium layer: A thin-walled layer of cells beneath the inner bark of a tree, made of living cells that continually divide and account for the tree's growth. When this is left in tact and the bark is removed, it will dry to a shiny dark finish.
Growth ring: Any of the concentric rings formed in the trunk of a tree by the annual growth of wood.
Pith: The soft tissue about which the first wood growth in a tree takes place.
Xylem: the water conducting tissue found in woody plants. Xylem transports water, stores nutrients and provides structural support for trees and woody plants.
Phloem: A vascular tissue in land plants primarily responsible for the distribution of sugars and nutrients manufactured in the shoot.
Bark: tough protective covering of the woody stems and roots of trees and other woody plants.
Photosynthesis: The process by which plants generate carbohydrates and oxygen from carbon dioxide, water, and light energy in chloroplasts.