MARYLAND
DEPARTMENT OF
NATURAL RESOURCES

Robert L. Ehrlich, Jr., *Governor*
Michael S. Steele, *Lt. Governor*
C. Ronald Franks, *Secretary*

Maryland Roadside Tree Care Expert Exam Study Guide

For Exam Domain:

Chapter 2: Biology

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Before one can care for and manage trees there needs to be an understanding of how trees grow. Trees are made of cells, just like other living beings. These cells divide in meristematic zones of the tree and then differentiate to form various tissues such as wood. If the meristematic tissue is where cells elongate, such as the tips of branches and roots, then this is called apical meristem. The tissues then form the five main components that make up a tree: roots, trunk or stem, leaves, fruits and flowers. Each component has specific roles in the process of tree growth.

Trees need light, water, air, nutrients and space to live and grow.

Roots serve multiple functions including anchoring the tree in the ground, storing excess starches (food), absorbing water and nutrients from the soil, producing hormones that regulate growth, and conduction. The roots system of a tree can be 1/3 to 1/2 of its total biomass.

If you look at a cross-section of the trunk of a tree the center is heartwood and consists of nonliving tissue. The heartwood has the function of structural support. It holds the tree upright. Sapwood (xylem) is outside the heartwood and is living tissue. It contains the vascular system of the tree and is a place where excess starches (food) are stored.

To determine the age of a tree count the annual growth rings. Each light and dark ring together is one year. The light, usually wider ring is the early or springwood. The dark, usually thinner ring is the late or summerwood.

Cambium, a meristematic zone, is the thin layer of dividing cells just under the bark between the xylem and phloem. When the cells in the cambium divide they form new xylem and phloem that become the vascular system of the tree. Phloem is formed on the outside of the cambium, xylem on the inside. The division of the cambium, or “laying on of new wood,” is what makes the tree grow radially.

The outermost layer of the cross-section is the bark and protects tissue underneath. It moderates the temperature inside the stem, offers defense against injury, and reduces water loss. Bark is composed of nonfunctional phloem and corky tissues.

Moving up the tree from the trunk are the branches. Twigs can be arranged on the branches in either an alternate or opposite pattern. The terminal bud is the growth point at the end of the twig. You can tell how much a tree has grown by measuring from the current terminal bud back to the scarring where the previous year's bud occurred. Twigs support the leaves and are yet another place the tree stores excess starches (food).

The leaves are where photosynthesis occurs. Photosynthesis is the process by which the tree transforms carbon dioxide and water into starches and sugars needed as food. Oxygen is another product of photosynthesis. The chemical process is driven by the energy from the sun. The sugars and food are then carried from the leaves to the rest of the tree by the phloem.

When there is insufficient water, such as in a drought, the process of photosynthesis slows, the leaves start to wilt and the stomata cells in the leaves close to reduce transpiration of water from the leaves. Stomata, usually on the underside of the leaf, are important openings for other reasons too. Through them gases are exchanged. Carbon dioxide needed for photosynthesis is absorbed and oxygen, a product of photosynthesis, is released.

Water is transpired through the leaves. This means that water is released into the air through the leaves as water vapor. This evaporation of water creates a "transpirational pull" that draws water up through the tree in the xylem and is one reason why it feels cooler near trees. Transpiration is influenced by temperature, humidity levels and water availability.

Compartmentalization of Decay in Trees (C.O.D.I.T.) is a model used to describe the response made by a tree when injured. There are chemical and physical processes that occur in response to a wound to compartmentalize the injured site and seal it off from the rest of the tree to stop the spread of decay. Four "walls" of defense are generated by this process. First the tree tries to stop the spread of decay up and down through the vascular system. The second defense wall helps stop progression in the annual growth rings. The third wall tries to keep decay from progressing into the ray cells, and finally, a fourth wall forms callus wood to prevent the decay from spreading outward to the new wood as it is generated at the injury site.

Trees are living organisms and their growth and health influenced by a range of biological, physiological and environmental factors. It is important to understand these factors and how they interact before providing care and management.