



## HOW TREES GROW

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The growth of new wood in any year forms a complete layer over the entire tree. That is why we can determine the age of a tree from the number of rings on the stump, in a "cookie", or from an increment boring. Height growth occurs only in the new wood of any one year. If a nail is driven into the trunk of a ten-foot tree at five feet from the ground, it will still be five feet from the ground when the tree is 100 feet tall.

The form of trees depends on the growing space. We generally recommend a spacing of 40-50 square feet when planting pine seedlings. The lower limbs should be shaded as soon as possible so that they will die and fall off, leaving taller, straighter, cleaner stems, which are more valuable for timber. Shade trees, which have room to spread out, have a large crown with spreading limbs and a short stem. Notice the trees at the edge of a forest opening. They have branches on the side toward the open, while the other side is more free of branches.

All trees are composed of three parts: (1) The roots which anchor the plant and contain the rootlets necessary to absorb moisture and nutrients from the soil; (2) A stem or trunk which give rigidity to the structure; and (3) A crown bearing the leaves or needles which manufacture food used by the tree.

The growth process is complex. Moisture, containing mineral nutrients, is absorbed by osmosis from the soil through the very small root hairs. Absorption is often accelerated by mutual relationships with root fungi called mycorrhizae. The nutrient bearing moisture travels up the fibrous roots and the trunk of the tree to the leaves essentially through the last annual growth ring. The leaves manufacture a simple sugar by the process of photosynthesis. The sugar solution travels down through the inner portion of the bark on the trunk and roots to supply the very thin growing cambium tissue located between the bark and the wood.

The tree grows in diameter by cell division of the cambium layer adding one layer of growth annually, but two distinct rings. The larger ring of annual growth is constructed during the spring. The smaller, denser, and darker ring results from slower summer growth. When we count "rings", it is usually the darker late-wood ring that is counted.

The tree grows in height and crown spread by the elongation of the buds on the branches. The same is

true for the roots. Roots tend to grow for a longer period of time each year than the crown.

### Requirements for Growth and Survival

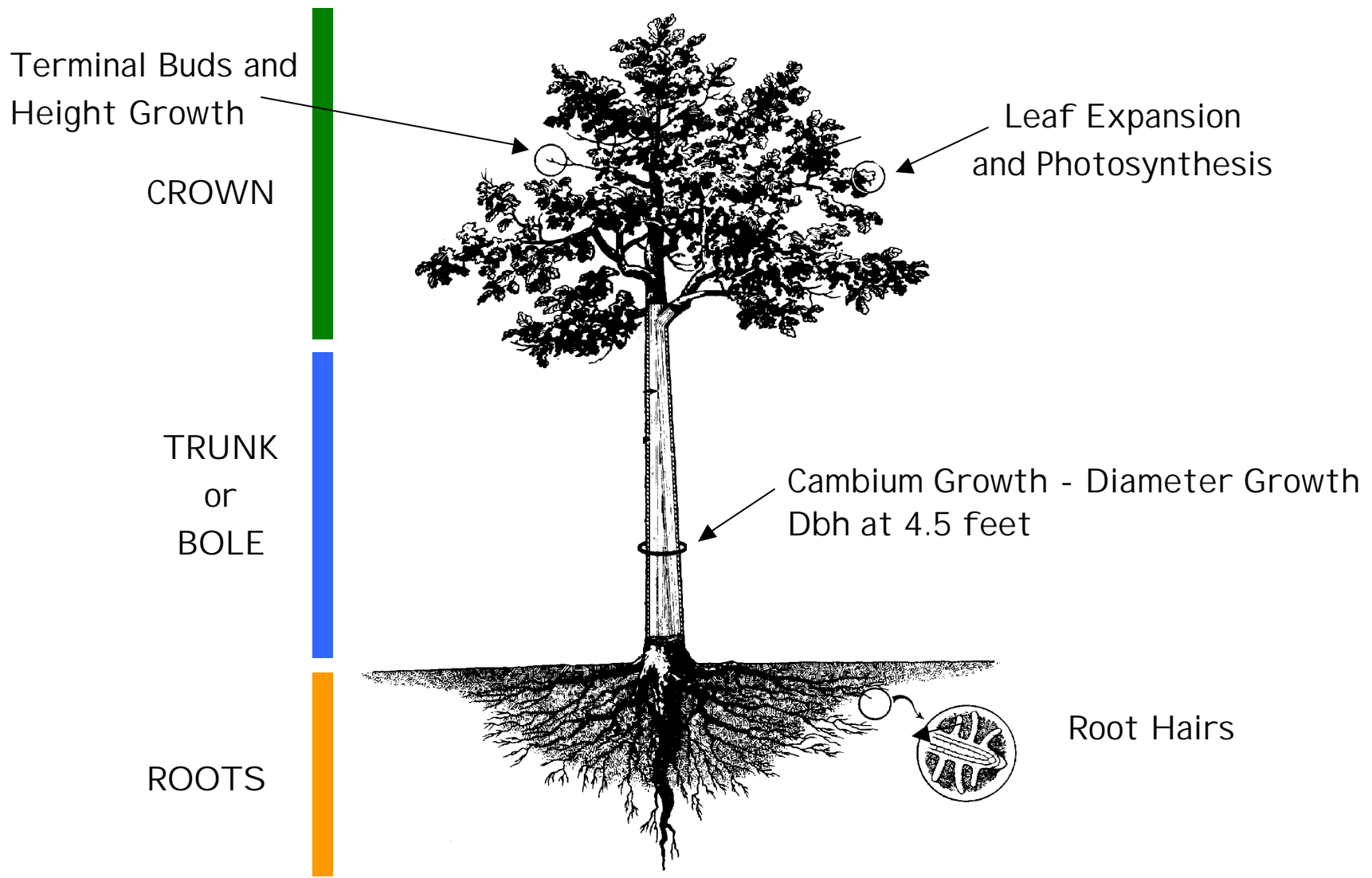
Each species of tree has specific requirements for the type of soil, mineral nutrients, amount of ground moisture, humidity, tolerance to shade, sunlight, temperature, length of frost-free growing season, and resistance to insects and diseases. These factors, individually and collectively, will determine growth rate, cutting practices, and which species will survive.

### Effect of Sunlight

Shade tolerance, the ability of a tree to survive and grow in the shade of other trees, may be considered one of the most important factors, which determine basic forest management practices. A tree may be defined as a woody plant having a single well defined stem, a more or less definite crown, a height at maturity of at least twenty feet, and a diameter at breast height (4.5 feet from the ground) of not less than two inches. In the United States, there are over 1,000 kinds of native trees. About sixty or seventy are native to Michigan. Probably less than 15 species occur on any given acre.

Trees may be identified by their fruit, flowers, buds, bark, twigs, habitat and sometimes special characteristics such as thorns, method of branching, and general shape and outline. When most of these means of identification are available, especially leaf identification, it is not too difficult to determine the species of a tree.

Since form and size, or color and character of bark vary with size and growing conditions, too much importance should not be placed on them in identifying trees, unless you are familiar with these changes. The leaves from the lower branches of a tree may have a different outline than those from the tip of the tree. While leaves on the sprouts form a tree which was cut, may be excessively large and of unusual shape. Notice the difference between the twigs and needles of balsam fir trees when one has had full sunlight and the others have grown in the shade.



Original Drawing from U.S. Forest Service, modified by the MSU Upper Peninsula Forestry Office, 7/98.