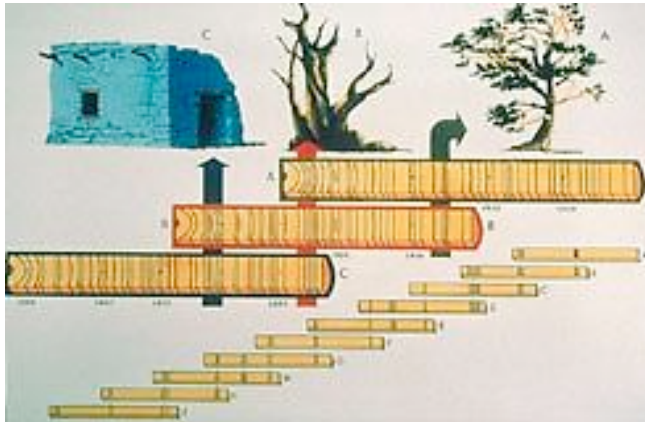


## Tree Ring Investigation -Teacher Background

**Background:** In 1937, the scientific study of tree rings in America was formalized by the creation of the Laboratory of Tree-Ring Research (LTRR) at the University of Arizona in Tucson. Stumps and slices of trees (called “cookies”) are readily available locally to start students on this road to discovery. More commonly, researchers use small cores obtained by boring trees, which doesn’t harm the tree, to examine the rings. There are several official collections of these samples at universities and laboratories around the world that are kept as references for research. For this lesson, simulated drawings will be sufficient.



*Photo Credits:  
Laboratory of Tree-Ring Research, University of Arizona*

Trees of the same species growing in the same area will have similar ring patterns. For example, three years of spring drought will cause slow growth and three narrow springwood rings in the trees in a given area regardless of the individual tree’s age. By matching the distinctive ring pattern, tree rings can be used to date wooden objects made centuries ago. Tree rings have been used to date archeological structures in many parts of Colorado, such as at Mesa Verde.

This lesson begins by familiarizing students with the tree structure and the basic information contained in tree rings. Climate, particularly precipitation and temperature, are major factors of ring development. The primary growing seasons in temperate zones are early (April - June) and late (July – Sept.) summer. Growth patterns in tropical zones have less seasonal climate change and are not as clearly defined.

Some additional facts of interest:

- Standardized tree ring samples by boring (core) are taken through the bark to the trunk center 4 feet above the base of the tree. Consequently, a core does not demonstrate the earliest years when the tree was less than 4 feet tall. Samples taken from different heights of the trunk are not a reliable method to “age” or date a tree.
- Counting the rings of a core will provide an approximate age of the tree. However, to DATE the tree, you need to know when the tree was cut or died or match it to other local samples with known dates.
- The oldest part of tree is the middle, the pith, and the youngest is just under the bark closest to the cambium.
- Two rings – 1 light, 1 dark – equal 1 year’s growth in temperate (4 season) climates.
- Bark is smooth on younger trees but splits and becomes rough because, similar to fingernails, it is not made of living cells and cannot stretch as the tree grows in diameter.

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- Because the phloem is made of living cells, it can form scars to cover damage. These cells become bark when the new phloem cells develop and push the old dead cells outward. The bark will be pushed laterally in an attempt to cover the scar to protect the living cells.
- The trunk branches extend from the tree at the same original height throughout the life of the tree regardless of the tree height because the body of the tree trunk is not growing vertically.
- Lower branches often die because photosynthesis does not occur successfully if there is a lack of sufficient sunlight. An example is Ponderosa trees that “self-prune” in this manner.
- Most species grown in temperate climates produce well defined annual growth rings, which are formed by the differences in cell wall thickness and cell density between wood formed early and wood formed late in the growing season.
- The inner part of the growth ring formed first is called "spring wood," ~ April to June, and the outer part formed later in the growing season is called "summer wood", ~July to Sept. Trees are sustained through cooler seasons by sugars stored in the root system.
- Poor growth ring development is also caused by insufficient water and nutrient supplies. This is particularly relevant in overcrowded forest conditions.
- Trees may be injured or killed by insects in 2 primary ways. Defoliating insects attack the leaves, causing damage and removal of the leaves so photosynthesis is reduced to the point where there isn't enough food produced for normal growth. Invasive insects like Mountain Pine Beetles get under or through the bark and damage the phloem which interrupts the transfer of food. Some beetles also carry a fungus called “blue stain” which “plugs up” or blocks the tree's circulatory systems, causing death.
- To “girdle” a tree means to damage the phloem around the entire circumference of the tree, inhibiting the fluid flow. The tree dies as a result. This technique was used in early settlement to develop crop ground under the dead trees without the labor of removing them.
- Apical dominance is the phenomenon whereby the main central stem of the plant grows more strongly than other side stems. Typically, the end of a shoot contains an apical bud, which is the location where shoot growth occurs. Roots mimic this growth pattern. Tree trunk growth is horizontal and only increases the diameter of the trunk.

Websites for more information:

Laboratory for Tree Ring Research, Univ. of AZ. <http://ltrr.arizona.edu/about/treerings>

Ultimate Tree Ring Web Pages, Univ. of TN. <http://web.utk.edu/~grissino/>