# Tree Ring Guide

Tree cookies are cross sections of tree trunks. They can be used to study the growth of a tree. As trees grow, they add growth rings every year, which can be seen as a layer of light and dark wood.

The lighter coloured wood is called "early wood", as it grows in spring and summer. The darker coloured wood is called "late wood", as it represents growth that takes place during fall and winter.

Together, the light and dark rings represent one year of growth.
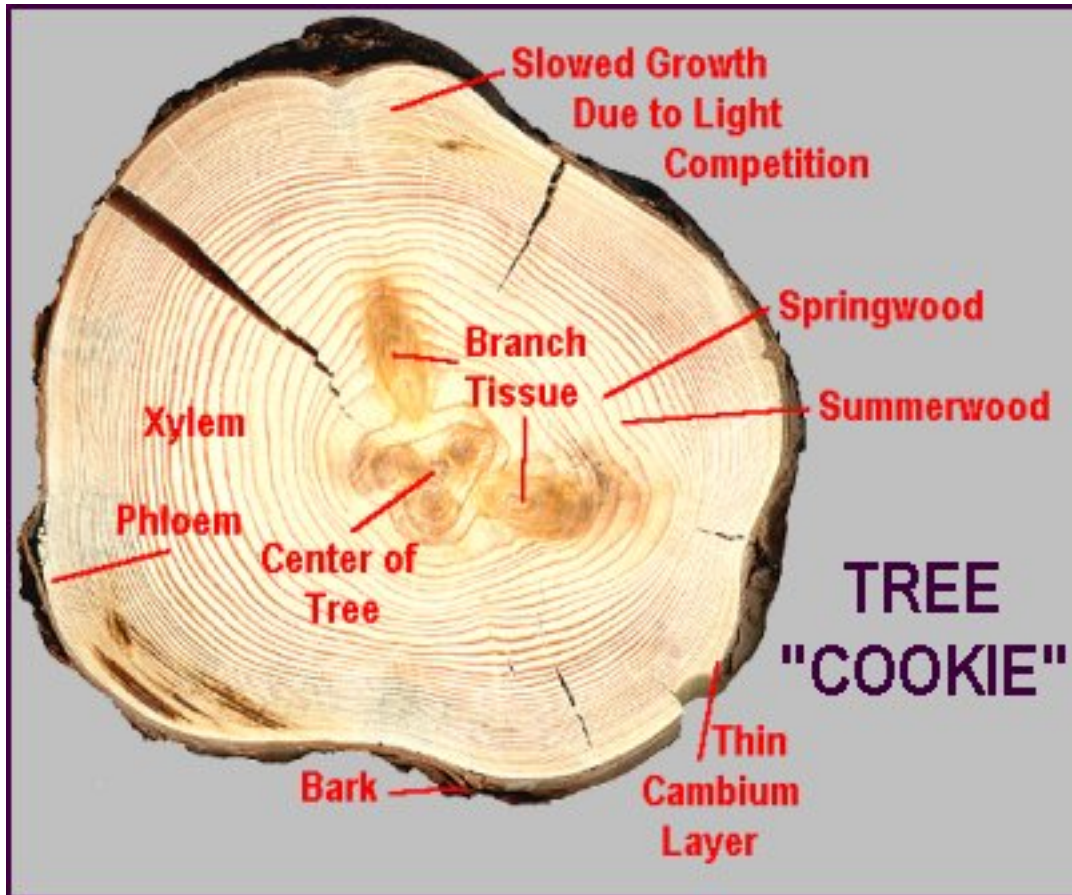
Tree growth occurs in the "cambium" (a thin layer of cells between the bark and the wood of the tree)

When spring comes, the cambium cells divide – this creates new tissue on both sides of the cambium. The new outer cells become part of the "phloem", which carries food produced in the leaves down to the branches, trunk and roots. Some phloem cells die every year to form bark. Inside the cambium, the new inner cells become "xylem" (which carries water and nutrients up from the roots to the leaves.

When a tree grows quickly, the xylem cells are large with thin walls – this early wood is the lighter coloured part of a tree ring.

In late summer, growth slows and the xylem walls are thicker – this late wood is the darker coloured part of a tree ring.

NOTE: trees that grow in tropical areas may have more than one growth ring per year or may appear to grow continuously, or have no rings at all.
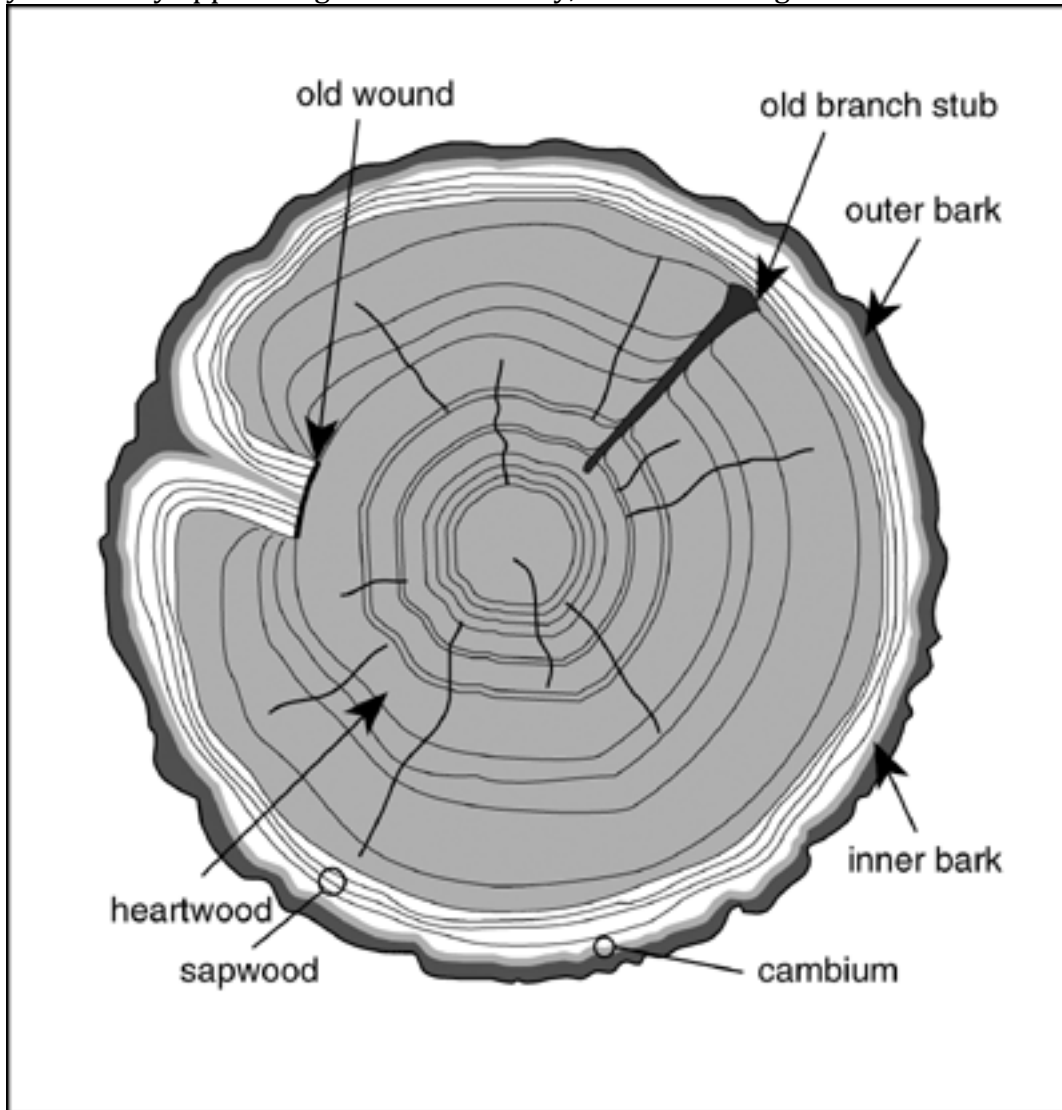
The environmental conditions can affect a trees growth. When the conditions are not optimal, the affects can be seen in the tree's cookie.

Optimal growing conditions – rings that are wide and evenly spaced
-   these include a long growing season, low competition from other trees and vegetation, low chance of animal or insect damage, gentle slopes, plenty of moisture

Forest fires – trees capture evidence of forest fires through fire scars. Fire scars are found on trees that have survived a fire hot enough to damage the tree, but not hot enough to kill it.

- the ability of a tree to withstand fire damage is based on the thickness of the bark, how deep its roots are, needle length, bud size, and how badly it is damaged by fire.
- Lodgepole pines are unique in that they have "seritonuous" cones, meaning that the cones have a resin coating keeping them sealed. During a fire, the cone's coating melts away, allowing the cone scales to open and release the seeds.

Drought – Tree that grow during drought conditions will show tighter growth rings. If the narrow rings begin further out on the cookie, this is a likely sign of drought.

- lack of water or moisture is one of the key limiting factors in tree growth. Lack of water creates strong competition among trees where stronger, more established trees will survive. Older trees with more extensive root systems are more drought resistant.

Infestation – mountain pine beetles feed on the phloem (food transporting layer) of the tree. Mountain pine beetles also introduce blue-stain fungi during their attack, which has a negative effect on the tree as well.

- the mountain pine beetle attacks trees by tunneling under the bark to lay eggs. Eggs hatch and the larvae continue to tunnel and feed on the tree.

Competition – High competition creates a shortage of resources and results in slower growing trees and tighter growth rings. When the narrow rings are seen from the earliest years of plant growth, this is a sign of competition.

Slope – Tree that have been bent during their growth will have rings that are narrower on one side than the other.

- The narrow part of the growth ring is called "tension wood" and will indicate the inside of the tree bend. The wider part of the ring is called "compression wood" and is found on the outside of the bend. Tree can be bent by growing on a slope, being pushed over by wind, trees, rocks, etc.

Can students detect any different growing conditions?

Can students estimate how old the trees are?