

Annual Growth Rings

Life can be pretty tough on a tree! Drought, excessive rain, fire, insect plagues and disease epidemics, injuries, thinning, air pollution, all leave their mark on a tree's annual growth rings.

Trees are top-notch biological indicators. Their annual rings reveal the events that have occurred in our environment.

Would you like to know more about annual rings?

To the heart of the tree!

1. The *outer bark* protects the tree from extreme temperatures, bad weather, insects and fungi. Very thin in [birch trees](#), the outer bark may be one foot thick in the [Douglas fir](#).
2. The *phloem* (bast) is also called the inner bark. It conveys the food-bearing sap developed in the leaves down to the various parts of the tree.
3. The *cambium* is a thin layer of cells which produce phloem on one side and sapwood on the other.
4. *Sapwood* is the living wood in the tree through which the raw sap rises from the roots to the leaves.
5. The *heartwood* consists of old cells. This is the dead part of the tree that nevertheless provides structural strength. If air could reach these cells, the heartwood would rot quickly.
6. The *pith* is the central core of the tree.

Would you like to know more about trees' growth in diameter?

Diameter Growth



Each year, the tree forms new cells, arranged in concentric circles called annual rings or annual growth rings. These annual rings show the amount of wood produced during one growing season.

In Canada and the North United States, the growing season begins in the spring. At first, the cambium produces numerous large cells with thin walls that form the springwood (earlywood). If you look at a cross section of a tree, this is the light-coloured ring.

Then, towards the end of the summer, growth slows down. The cells manufactured at this time of year are small, with thick walls. They form the summerwood (latewood) which appears as a darker ring on the tree cross section.

One year of growth is therefore represented by a ring consisting of a light part and a dark part. The darker wood is not formed in winter, as some people believe, because the cambium is completely inactive in the winter.

The following year, a new two-part ring is added. The older rings are closest to the centre of the tree. The tree grows in diameter because it manufactures new cells around its circumference, not because the old cells get larger.

The old annual rings form the heartwood of inactive cells: this is the dead part of the tree. The live portion includes only the most recent rings. Depending on the tree's age and species, this portion is 1.5 to 7.5 cm wide. The dead wood is the largest part of the tree. Often, it takes on a darker colour.

What happens in places with the same climate year-round, where the seasons do not stop growth?

Trees in Tropical Countries

Annual rings generally exist in trees where the climate halts growth at some point during the year. In our country, winter causes this shutdown. In other countries, it is the dry season. Growth begins again in the spring or rainy season.

But what happens to trees growing in countries where there is no alternation between



growth and rest periods?

For example, a country where it rains all year long! Remember that all trees grow by adding successive rings. So in such an area, the beginning and end of the growth period may occur any time during the year, depending on the local conditions.

Some trees in tropical forests, like the okoumé (Gaboon), manage to create several dozen very thin rings in a year, and never the same number from one year to the next. It is often difficult, even impossible, to distinguish them with the naked eye. In such cases, it is extremely hard to determine the age of the tree.

What do you know about tree growth?

Tree Growth

Trees grow in two directions

Tree growth is not the same from spring until the end of the summer. Growth is faster in the spring. Also, stem elongation and diameter growth begin and end at different times, with diameter growth continuing longer.

Not all species of trees grow at the same rate

Oaks and all other long-lived species grow slowly in our climate. Willows and aspen, on the other hand, have a short life cycle but compensate with intense growth. Their annual rings are wider.

Often we talk about reading between the lines. This means that someone can understand things that are not clearly stated. Can you read between the rings and explain the conditions that have affected a tree throughout its lifetime?



Reading between the Rings

A cross section of a tree shows much more than its age! Diameter growth is particularly sensitive to fluctuations in the environment: moisture in the soil and air, temperature, and sunlight. Very broad rings generally indicate a good growing year. The tree apparently received everything it needed.

The growth rate of a tree can be compared to the growth of a child. A young sapling grows much faster than an adult tree. A cross section of an older tree shows rings that are quite broad at the beginning of its life (in the centre) but that become progressively smaller. An old tree produces very narrow rings and its diameter and height growth are considerably slower.

Look carefully at the pictures and read the explanations to understand what may have caused the cross section.



Narrow rings do not only signify a lack of sun or water. A forest fire may have damaged the tree's crown and slowed its growth. Defoliation by insects or fungi can have the same effect.

After several years, the tree gained strength and returned to normal growth.





This tree had a rough time during its first ten years! Maybe someone helped it by cutting the large trees around it to give it more light.



Trees don't all have their heart in the right place! This tree shows off-centre growth. If the tree was in a location exposed to high winds, its wood would grow faster (wider rings) on the side away from the wind than on the side facing the wind.

This cross section may also come from a tree that was leaning. The tree formed reaction wood (compression wood) that enabled it to straighten up. The wider rings are on the underside of the leaning trunk because growth was faster there.





Do you see waves? Look at the outer bark. Wasn't there a branch here?

