

## **How trees work**

From the moment it germinates a young tree in woodland has one job, to survive long enough and to grow tall enough for its leaves to reach the canopy layer. It is in the canopy layer that the leaves will receive enough light to photosynthesise efficiently. If a tree germinates in the open, this will not be a struggle. If however a tree germinates within a woodland on the shady floor, this task will be a life and death struggle that requires more than a little luck. If a tree falls or the canopy opens up then the saplings have enough light to keep them going.

Leaves use the energy in sunlight to make its own nutrients, which it uses to build its tissues. In order to create this food, it needs to absorb large quantities of light therefore it needs large quantities of leaves. Leaves contain a chemical, chlorophyll which is used to catch the sun's energy. During photosynthesis the leaves use the sun's energy to turn water and carbon dioxide into glucose.

Wood is a very strong material enabling such huge structures as trees to stay upright. However all of this wood is produced almost entirely by one layer of living cells called the vascular cambium. When they divide, they produce new wood cells. This living layer covers the entire surface of the tree and is protected from damage by the bark. It grows in a burst every year adding a new layer of wood (the growth rings that can be seen in a section of tree trunk). At the same time the bark grows and expands ensuring that the living cells and the new wood are protected. The outer bark is almost entirely dead cells, protecting the tree against heat and cold and forming a barrier to the living wood. The inner bark is a layer of cells that carries sap up and down the tree. Because the sap is full of sugar, the inner bark is often under attack.

The roots anchor the tree to the ground and help the tree absorb water and minerals from the surrounding soil. A strong central tap root acts like a buttress and a network of lateral roots brace the trunk. Nutrients are taken in by the tiny hairs that grow on each root tip.

Pollen is made by trees and is spread by the wind, insects or animals. Once a tree has been pollinated it can make seeds and prepare for the next generation.



It is during the summer that most broadleaved trees are actively photosynthesising. Water is pulled up the tree from the roots, and in the summer the bright light opens the pores or stomata on the leaves. High temperatures and humidity can cause a massive loss of water from the leaves. An oak tree can 'breathe' as much as 680 litres of water a day. In winter the trees could not afford this kind of water loss as it is much more scarce, so they shed their leaves (abscission). At the end of the summer the leaf enters 'senescence', photosynthesis slows down, there is a gradual loss of chlorophyll, the cells start to disintegrate and the minerals are taken out of the leaves. At the base of the leaf a layer of cells begins to change, they become thinner, some dissolve until the leaf is only attached by the woody cells at the centre of the stalk. Eventually this is broken by the action of the wind and the leaf falls. Between October and December three tonnes of leaves per hectare can be shed. By March only a third remains, the rest having been broken down by the actions of the decomposers, the nutrients returned to the soil to start the growth cycle again.