

# The Anatomy of Trees & Shrubs



Like the human body, the “body” of a tree or shrub is complex. It’s an operating machine that is designed to grow, take nutrients, breathe, recover from disease and injury, reproduce and die. It would take volumes to describe everything involved – but here are some basics:

## Foliage

Trees and shrubs have leaves or needles of all shapes and sizes. Most species can be identified by the characteristics of their foliage. They are deciduous (seasonal) or evergreen. Major functions of leaves are to produce food for the tree and to release water and oxygen into the atmosphere.

*Chloroplasts* are chlorophyll-containing bodies within cells where *photosynthesis* occurs. This is the synthesis of carbon dioxide and air in the presence of radiant energy to form carbohydrates as food for the rest of the plant. *Stomata* are pores that allow carbon dioxide to enter and water and oxygen to leave the leaf. *Stomates* have the ability to open and close depending upon the availability of water.

During drought conditions *stomates* close to conserve moisture. This reduces food production. With less food the plant becomes weak and susceptible to pests. Insects and diseases also affect foliage. As a consequence, food production is further impaired. This can lead to a decline of the entire tree.

Over-pruning the crown of a tree will severely inhibit a tree’s ability to *photosynthesize*. That is why a responsible arborist never performs the practice of *topping* trees. *Topping* destroys the health, beauty and safety of trees. With dense canopied trees thinning the crown to let air and sunlight in can be good practice.

## Buds

Buds are points on twigs where future growth will occur. They produce new shoots, leaves and flowers for the next period of growth.

A *terminal bud* appears at the end of a twig. If the *terminal bud* is removed, one or two *lateral buds* may grow to replace it. Again, proper pruning practices are required to maintain good growth patterns.

Every year’s new growth can be identified by a color change on a twig. New bark is usually smoother in texture and lighter color or green. *Terminal bud* scale scars from the last year’s *terminal bud* also provide a means of measuring growth.

## Branches

Branches support the foliage and provide water transport from the roots to the leaves and also transport photosynthates to other locations in the plant. The branching habit provides the basic shape of the crown. Every species has its own distinctive shape and can be identified that way. Tree shape is also influenced by available space that may be limited by adjacent trees, buildings and other infrastructures. Individual trees and shrubs follow this “genetic imprint” and grow according to their species. Of course, every so often a mutation occurs that is a little different from the others – this is what’s called evolution.

Species are noted also for the strength (or weakness) of their wood, fragrance and pliability. Common phrases such as “mighty as an oak” or “thin as a willow” have woven themselves into our vocabulary.

# The Anatomy of Trees & Shrubs



## Trunk

Stems and branches consist of *bark*, *phloem*, *cambium*, and *xylem*. *Bark* is like the skin of human beings, an external protective layer. An inner layer called *phloem* carries the food produced in the leaves to other parts of the tree where it is utilized. The *cambium* is a thin layer between the *phloem* and the *sapwood (xylem)*. Cells in this layer divide producing *phloem* to the outside and *xylem* to the inside. If the *phloem* and *cambium* layer is cut all the way around the circumference of a tree, the tree will die due to a lack of food movement. The *sapwood (xylem)* carries water and nutrients up the tree from the roots to the leaves. This gravity-defying trick relies on a number of forces acting together within the tree. No feat of engineering has ever equaled this process.

*Heartwood* is the inner *xylem*. While this area is generally considered inactive, there may be *ray cells* that act as conduits to move waste and defensive materials into it for storage. *Heartwood* also adds structural integrity to the tree.

When a tree is wounded by insect infestation, disease, weather or other circumstances it does not actually “heal” as we understand it. New, healthy cells don’t replace old ones. Instead, the site of the injury is sealed off from the rest of the tree through a series of chemical and physical changes in existing and new tissue that develops after wounding. This process is called *compartmentalization*. Just as you can tell the history of growth from the rings of a tree, you can tell its medical history as well.

## Roots

A tree’s root system can be quite extensive. It was once thought that a tree’s roots extended only to the drip line, but now it is known that a root system can extend over three times the drip line distance in some instances.

A *taproot* begins to grow vertically down into the earth after seeds germinate. The taproot usually ceases development early in the life of the plant. *Lateral roots* spread out from the trunk horizontally to form a network for water and nutrient absorption. *Buttress roots* become visible as roots grow, providing structural integrity and anchoring the tree.

*Fine feeder roots* and their miniscule *root hairs* grow from the *laterals* to absorb water and nutrients. Fine roots may be surrounded by protective and symbiotic mycorrhizal fungus. The mycorrhizal fungus increases nutrient and water absorption and may protect the root from certain disease agents.

Urban and suburban environments are hard on trees and shrubs in general. Root systems are particularly affected. Conditions like soil compaction, nutrient deficiency and root damage occur when we modify our landscape.

There are many other differences between the natural forest environment and our landscapes. In the forest the ground is not raked or cleared of debris. This organic matter breaks down in the soil releasing nutrients that are used again by the tree. Our landscapes are swept clear of leaves and debris, eliminating a source of protection and nutrition from our plantings. Mulch and fertilization aid in making root conditions more like they are in the forest.

Mulch is one of the best practices that we can provide for our landscape trees. It provides a barrier of protection, holds moisture, and supplies a layer of warmth in winter or cool in summer. These conditions promote root growth and water uptake. Healthy roots are the foundation of healthy trees.

Mulch applied overzealously, however, can actually cause damage to the trunk by retaining moisture and promoting insect and disease problems. When it comes to the lower trunk and buttress roots of the tree, they need to be kept visible so their bark can dry and be inspected regularly for problems.

# The Anatomy of Trees & Shrubs



Trees require 17 different nutrients to grow and fully develop. Fourteen of these elements are derived from the soil. Not all soils have an adequate supply of all of these elements. Soil analysis is recommended to determine the condition of the soil around different plantings. A program of Prescription Fertilization uses soil nutrient analysis to determine the nutrients that are missing and the rates that they should be provided to keep plantings healthy.

When building around trees heavy equipment will compact soil – removing oxygen and making it difficult for trees and shrubs to grow. The construction of driveways, septic systems, parking lots, walkways and buildings can interfere with existing tree roots, cutting them and severely limiting the ability of the tree or shrub to absorb water and nutrients. Extensive root damage cannot be overcome. Planning in advance can help to reduce or eliminate root damage from construction. On the remaining trees, Root Invigoration can loosen soil compaction, add nutrients and create a near ideal environment for root growth. It is often the best way to reinvigorate declining trees.

Trees and shrubs are complex organisms. There is much that scientists are still learning about the way they interact with their environment and how to maintain them for maximum health. The study of arboriculture will continue to yield information about the care of trees. There is much we don't know. Bartlett has been conducting tree and shrub research for over 100 years and we'll continue to expand this knowledge in the years to come.