

FORESTRY IN MINNESOTA.

BY SAMUEL B. GREEN.

THE TREE.

A tree is a woody plant with a single stem which from natural tendencies divides into two or more main branches at some distance from the ground and takes on what is commonly known as the tree form.

The most evident parts of a tree are stem (commonly called trunk), branches, twigs, roots, buds, leaves, flowers, fruit and seed.

The stem, branches and roots are made up of inner bark, outer bark, sapwood and heartwood. The outer bark, sapwood and heartwood are made up of concentric circles termed annual rings. During each period of growth two new rings are formed—one on the outside of the sapwood and another on the inside of the outer bark and as we seldom have more than one season of growth each year but one ring is formed on the wood in a year; so that by counting the rings of wood in the stem we can determine very closely the age of trees. In very rare cases we have two periods of growth in one year, as in 1894, when the drouth of midsummer ripened up the wood of the trees by the first of August and the rains of autumn started a new growth, and caused some trees and shrubs to flower in October, but such occurrences are very uncommon and the extra rings formed are readily detected by their being smaller than adjoining rings and less distinctly defined. The age of trees could be told by the rings of the outer bark nearly as well as by those of the wood were it not for the fact that the outer layers of bark fall off as the tree grows older.

In some experiments the bark of rapidly growing branches was peeled back in the spring for a few inches, the wood covered with tin-foil and the bark replaced. At the end of the season there was found a ring of wood outside of the tin-foil, thus showing where the annual growth of the tree was made.

The bark covers the whole exterior surface of the trunk, branches and roots and serves as a protection. It is made up of two parts, the outer or corky layer which is dead bark and the inner or live bark. These vary much in appearance and thickness on different kinds of trees. For instance, on the white birch the corky layer is pure white, very thin and tough, while on our white pine it is very dark brown and often an inch or more in thickness and quite brittle.

The sapwood is the portion of the wood next to the bark. It varies much in thickness in different species and in trees of the same species; the most rapidly grown trees contain the largest amount. It is the most active portion of the wood in the growing tree, and contains considerable plant food and more water than the heartwood.

The heartwood is the wood in the center of the trunk and is generally dis-

tinguished from the sapwood by its more compact structure and darker color, though in some cases it may be lighter colored than the sapwood. It is also harder and more valuable for fuel, shrinks less in drying, and is more durable in contact with the soil than the sapwood. There is very little movement of the sap in the heartwood, and it contains less water than sapwood.

The roots furnish water and nourishment that the plant receives from the soil but only the young roots have the power of taking up the water and plant food; the older roots are most useful in holding the tree in place. It is common to classify roots into surface roots and tap roots depending on their shape and the depth they go in the ground. Some trees have nearly all surface roots, as the birch and spruce; others have nearly all tap roots which often go to a great depth on dry land as those of the bur oak, white oak, black walnut and butternut. Most of our trees have a combination of the two kinds, as the maple, hackberry and ash. Seedling trees of most kinds have a decided tap root when young but in many species it ceases to grow downward when a few years old. This is true of the red and scarlet oaks which often have a tap root extending four feet in depth before the tree has attained a corresponding height above ground but after about five years large lateral roots develop and the growth of the tap root nearly ceases.

Root growth is relatively less to the extent of ground occupied in moist and fertile soil than in dry and poor soil but the roots are proportionately more branched. In wet seasons the root development is less for a given plant than in dry seasons because the roots may get their needed food and water from a small area. Nursery trees grown on moist rich land have a more compact root system than those grown on poor land.

At the Minnesota experiment station a small bur oak growing on dry, gravelly soil had a tap root that was evidently 20 feet long, while on moist fertile clay land in the same section such trees probably seldom have tap roots more than six feet long.

Buds are placed regularly on the young branches and are said to be either alternate or opposite. When they occur on the stump or on roots they are not arranged in any regular order. There are two kinds of buds; flower buds which develop into flowers and fruit, and leaf buds which develop into leaves and branches. These can generally be distinguished from each other by their shape and size and by cutting through them and noting their construction. Flower buds are generally more liable to injury from climatic changes than leaf buds.

The leaves of our trees vary much in size and shape. They are simple when composed of but one piece as the leaves

of the oak, maple and birch, and compound when composed of more than one piece as the leaves of the locust, ash and black walnut. Leaves are made up of a framework filled in with cellular tissue and covered with a thin skin. This skin has very many small pores in it called stomata, through which the plant takes in carbon dioxide from the air and gives off oxygen and water.

All our trees shed at least a part of their leaves each year. All the broad leaved trees and the tamarack shed their entire foliage yearly while our so-called evergreen trees lose a part of their leaves each year. The length of time leaves remain on this latter class of trees varies from two or three years, in the case of white pine growing in very severe locations in this section, to perhaps eight years, in the case of red cedar favorably located. The time that leaves remain on the branches in the case of evergreens depends to some extent on the location and age of the individual tree.

Flowers are parts of the plant especially modified for the reproduction of the plant by seed. Both sexual organs may be located together in the same flower as those of the basswood, mountain ash and cherry; or in separate flowers on the same plant as those of the birch, oak and black walnut, or they may be separate on entirely different plants as in the willow, poplar, box elder and ash.

The fruit, botanically defined, is the seed containing area derived from a single flower. As used in nursery practice the term is generally applied to seeds having a fleshy covering or an adjoining fleshy part.

The seed, botanically defined, is the ripened ovule, but as the term is used in nursery practice it often includes the ovary and other parts that may be attached to it. What is commonly called the seed of maple, ash, elm, walnut and basswood is really the fruit.

The seeds of plants are distributed in various ways, the most common of which are (1) by means of floats or wings which buoy the seed up in the air or water and (2) by animals. The seeds of ash, arbor vitæ, box elder, catalpa, elm, maple, pine and spruce have wings which allow them to be blown great distances by the wind, especially when they break loose from the upper branches of high trees during severe winds. The seeds of the honey locust are not shed from the pod until after the pod has fallen and as the pod is ten inches or more long and spirally twisted it may be blown long distances on level ground or snow crust. The seeds of the poplars and willows have a cottony float attachment which buoys them up in the air. In the case of the basswood, the parachute-like bract attached to the seed cluster aids in spreading the seeds by carrying them through the air or along the snow crust. The seeds of mountain ash, wild black cherry,