

Program 8 - TREES --SOLIDIFIED SUNLIGHT - November 11, 1940SOMETHING TO DO AND TALK ABOUT FIRST

Bring a block of wood which shows the cross section of a tree trunk to school. Select one which shows the annual ring structure, radial (medullary) rays, heartwood, and sapwood rather distinctly. Oak serves the purpose excellently. Become familiar with the parts of this section. Count the rings on each end of the block. Do they differ in number?

DO YOU KNOW THESE WORDS?

cambium	lenticels	chlorophyll	stomata
carbon dioxide	synthesis	inner bark	

LISTEN FOR THESE IDEAS

1. Why may a leaf be called "a tree's food factory?"
2. If "photo" means light, and "synthesis" means putting together, what does "photosynthesis" mean?
3. Where do the materials that make up the structure of the tree come from?
4. What causes rings to form in the trunk of a tree?
5. Why is the spring wood full of little holes (pores) while the summer wood is solid?
6. What part does the cambium play in the growth of a tree?
7. What is meant by "girdling" a tree?
8. When a tree is grafted, as apple trees are grafted, what parts are placed in contact with each other?
9. When a whole tree is burned, is there much left? Where does the rest of it go?
10. How do trees purify the air?
11. Why do ground fires almost always injure trees?

SOMETHING TO DO AND TALK ABOUT LATER

1. What materials do plants need to make food?
2. Where do these materials come from?
3. How do minerals enter the plant? What part of the tree do they go through to enter the leaf?
4. How does carbon dioxide get into the leaf?
5. What part do chlorophyll and sunlight play in making plant food?
6. Where does the food go from the leaf?
7. What is the only really live part of the tree?

Wisconsin School of the Air
Afield with Ranger Mac
November 11, 1940

TREES - SOLICITED SUNLIGHT

Hello Boys and Girls:

Today we are going to talk about a great friend; a thing of nature that has been a friend to man for many thousands of years, since long before history became history. This thing of nature has been furnishing to man the material for warming his bones, for building his shelters, for constructing his boats and bridges and countless articles of human workmanship. This thing of nature that has been such a necessary friend to man is the Tree. But you have learned from your studies in conservation that we have not been as friendly to the tree as the tree has been to us, and have in the short time since we set foot on this soil laid waste much of the most gloriously wooded countries in the world. Of the original forested area which we found here 43% has been cut away for farms, 30% has been cut for man's needs, and 10% has been laid waste and left completely barren. It is a rather grim story to read about or hear tell.

They began in the East hewing the white pines and spruce for masts of ships and the frames for their houses, felling the oaks for the hulls of ships. For a hundred years they sacked New England without a halt, planting not a single seed, and heeding not the simplest law of forestry. Then they moved westward into New York. That was about 1850. Saw-mill towns sprung up and communities grew like mushrooms. Finally when there was no more fodder for the humming buzz saws, the loggers and lumbermen continued their westward march. This time they came into the region of the Great Lakes. It took them sixty years to remove the trees from this region, and when they had finished they left behind vast areas of treeless, sandy land, which was made even poorer by fires that consumed the slashings. And now, after the best has been cut from the south, from Virginia to Texas, and the best from the Rocky Mountain region, the sawmills are humming in the last uncut area of the Northwest. And this is as far as they can go, for beyond is the Pacific Ocean. And so now,

from the Atlantic to the Pacific, one must journey far to find any traces of the stately trees which by a little intelligence and control could now have been our heritage.

Well, it is not a pretty tale to tell, and there is not much we can do about it except to look out upon the land upon which we live and say to ourselves, that trees will grow now as ever and we might do worse than go out and plant a tree.

Most of Ranger Mac's Trailhitters have studied some physiology in school. In this subject you study about the structure of the bones, about the digestive system, the circulation of the blood, the heart and lungs and the rest of the organs, and how they work. Today we are going to talk about the physiology of the tree, about the parts of the tree, and what each part does to make the tree grow.

Trees are a great deal like people. A forest is a large number of trees living together, just as a city is a number of people living together. In a forest we see some of the same struggles going on that take place in cities. There is crowding for space; and scarcity of food, and lack of sunlight and early dying for trees in forests, just as there is for people living in crowded cities. Those trees that have the advantage of good browns, spreading to the giver of all energy - the sun, and have a good hold on Mother Earth - those trees have an advantage and they keep it, and prosper and become the trees we admire, while the trees that are forced to live beneath other trees often have a rather hard time of it.

If the forest is like a city of people, so is the single tree much like an individual person. Let's see in what ways we are like a tree. A tree has a skeleton that is lifeless which holds the tree upward, just as we have a skeleton that supports the tissues in our body. We call that skeleton in the tree the heartwood, because it is the center of the tree, and not because it has any life. The tree has a circulatory system corresponding to ours. The

tree has a digestive system, as we have; it breathes, it grows, it rests. So a tree does about what we do, except travel around, and this it does by means of its seeds. The tree requires the same kinds of food we do, but here we find the great difference between trees and us, in fact, between all plants and animals, and that difference is that all green plants manufacture their own food, but animals must get theirs by eating plants or devouring the flesh of other animals which, in turn, obtain their food by eating plants. So in a real sense green plants are the factories of all the foods that are needed by every living animal upon this earth. And here is the important thing, these foods are manufactured out of the substances the plant finds in the earth beneath it, in the air above it and in the sunlight.

Now if you will take out pencil and paper Ranger Mac wants you to write down some very simple ways in which a tree is like a person. You can call it "How a tree resembles me." This would make a fine subject for your next composition. Are you ready?

1. A tree has a skeleton, called the heartwood. That's enough to write on this, but I want to add that the heartwood is the part of the tree that makes the lumber and the best fuel.

2nd. The tree has a circulatory system, which is made up of the sapwood and the inner bark.

3rd. It has a digestive system, which is the leaves.

4th. It has a part that uses the food for growth and energy called cambium. Now you can stop writing for we should have a word of explanation. Just as the food we eat is prepared in the stomach and intestines to be carried to the tissues of the body and there used for growth and heat and energy, so is the food prepared by and in the leaves carried to the cambium and there used by the cambium for growth.

5th. A tree breathes. This is done by the leaves and the lenticels. These lenticels are the little light spots that you can see plainly on twigs, but they are all over the tree even though you cannot see them beneath the

rough bark.

6th. A tree perspires, but it is call transpiration. Ranger Mac wishes to explain this. We perspire in order to keep our bodies at normal temperature. And this transpiration in the leaves keeps them cool. Some trees give off as much as 150 gallons in a summer's day. Without this the leaves would wither and die because of the heat of the sun's rays. A dog perspires through its tongue; we through our pores in our skin; a tree through the openings in the leaves and the lenticels.

7th. A tree gets sick and has diseases.

8th. A tree rests. This it does at night partially, and in winter almost completely.

9th. A tree has offspring; that is, it has children.

10th. A tree grows old and dies, and you might add, if you wish, it becomes in time the soil and the air from whence it came.

So you see that a tree has and does much that we have and do. It has a skeleton, a circulatory system, a digestive system, it grows by using the food it manufactures, it breathes, it perspires, it gets sick and has diseases, it rests, it has offspring, it gets old and dies.

Now let's see what takes place in a tree to make it grow. You remember I said that a tree, like all plants - all green plants, manufactures its own food, and the things out of which it does this are water and minerals from the soil and the carbon dioxide from the air. Just these three, but out of two of them - water and carbon dioxide - the tree makes a substance which man cannot make - and that is starch. Now, the water comes from the soil, and is taken in by the little mouths at the roots. This water, soil water, is not pure. It contains many mineral substances, some of which are necessary for the growth of the tree. You cannot see the minerals any more than you can see sugar in sweetened water. It is in solution. This water with minerals in solution is pulled or pumped through the sapwood of the trunk and branches and twigs and into the leaves. No one seems to know exactly how the tree is able

to get the water from the roots to the leaves.

In the leaves a remarkable thing takes place. The leaves have little openings called stomata. There are thousands of them on the underside of every leaf. The air containing carbon dioxide gas, passes into the leaf through these minute openings called stomata. Carbon dioxide gas is always present in the air. We expel it from our bodies when we breathe and it comes from burning, the rotting of vegetation and many other sources. It is a poisonous gas to us, but plants use it in the manufacture of their food. Without plants to use this gas it would collect in such quantities as to poison us.

Well, this gas with the water brought to the leaves is made into sugars in the leaf. The green part of the leaf, called chlorophyll, together with the sun's rays, does this wonderful work of making sugar in the leaf. That word chlorophyll looks like a big word, but it is the Greek for leaf-green. It is called the most important substance in the world, for all food in the world depends on it, and without it all plants would die. This chlorophyll traps the energy of the sun's rays, and performs the miracle of changing water and carbon dioxide into sugars. That performance is given a big name also. It is called photosynthesis. Photo means light, and synthesis means putting together. So sugar is made in the leaf by the light and energy of the sun's rays uniting water and carbon dioxide gas. In this process of making sugars, the tree gives off oxygen, purifying the air - oxygen that we must have. What a friend is the tree! You know that the sun is the source of all energy and activity on this whirling planet of ours. Without it no leaf could manufacture food and all living things would perish from the earth. Even the coal we burn today is the imprisoned sunlight of bygone days - energy taken from the sun's rays in the earlier days of the world by the leaves of trees long dead.

This sugar manufactured in the leaf is food for the tree. Dissolved in water it passes through the stem of the leaves and is carried all over the tree by the inner layer of the bark, called the inner bark. Here it feeds the cambium. The cambium lies just beneath the inner bark and covers the whole

tree like the skin covers your body. The cambium thus fed by food from the leaves, grows and adds a soft wood to the trunk of the tree. Because it grows very rapidly in the spring, the wood is full of little holes called pores. This is called spring wood. As the summer comes on, the cambium gets less and less active, and the wood gets denser. This is called summer wood. So each year there is added to the tree a ring of wood with little holes and a ring of denser wood. This is called the annual ring. All of Ranger Mac's Trailhitters have seen these annual rings on the stump of a tree and have counted these rings to find out the age of the tree. So the trees were the first to keep diaries. You can count the years. You can tell the dry years in its life; you can tell when an injurious fire occurred in its life, you can tell when a horde of insects may have eaten all the foliage.

Sometime on one of your rambles in the open, you stop at the stump of a tree and examine it closely. Count the annual rings and notice that the tree had some years in its life when it grew more than others. Those were years of plenty. Notice that that there are rays that come from the center to the outside. These are places for the storage of food. These are called medullary rays. In our bones the marrow is called medulla. This is another way in which a tree resembles me.

And now our little trip for today comes to an end. The clock keeps ticking on and tick by tick the spring of the year turns to summer and summer to fall; and tick by tick babyhood turns into childhood, childhood into boyhood and girlhood, then to manhood and womanhood, followed by old age when the hair turns white and time leaves its trace upon the face. And so it is with the trees. They are very much like human beings in their ways of living. And that is why they make such good companions for Ranger Mac's Trailhitters.

May the Great Spirit,

Put Sunshine in your Heart

Today, and forever more

HEAP MUCH!