



What's in a Tree?



Everyone loves trees. Their tall sturdy trunks, long graceful limbs, and lush canopy of leaves add beauty to our countryside. You can climb trees, build a play house in their branches, picnic in their cooling shade, or just enjoy walking among them. But trees are valued not only for their beauty; they are an essential part of our natural environment, and provide mankind with an important natural resource.

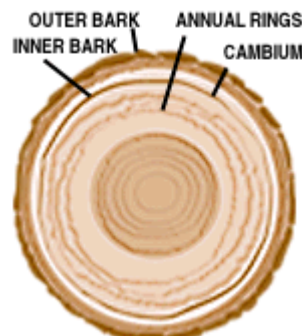
We all know that a tree has a trunk, branches, leaves, and roots. But what's inside a tree? Let's take a look.

The main building blocks of trees are **cellulose** fibers. Measuring between about 1/32 - 1/4 inch in length (depending upon the species of tree), these fibers are held together in parallel formation with a natural "glue" called **lignin**. Other natural chemicals, such as sugars, resins, and oils, are also contained within a tree.

Surprisingly, almost all of the material in a tree is nonliving. Only the leaves, the tips of the branches and roots, and a thin layer of cells just under the bark are actually alive. When a tree grows taller, the growth takes place only at the tips of the stems. For this reason, the birdhouse you've mounted on the trunk of a tree will always remain at the same height, and the swing you've hung from a lower limb will never grow too high to reach!

Trees grow in diameter, too, by the division of cells in the outermost layer. Called the **cambium**, this microscopic layer is only three to four cells wide! As cells in the cambium divide, the old outer bark splits, and cracks develop in the surface of the tree, giving bark its rough texture.

Under a microscope, wood fibers resemble strands of hair. Wood fiber is the main component of paper.



Cross-section of a tree trunk showing outer bark, inner bark, cambium, and annual growth rings. You can find a tree's age by counting the growth rings - one ring for every year.



What's in a Tree?

Why are trees important?

Trees are important to people and our environment in many ways. They provide precious habitat for birds, squirrels, insects, and other creatures. Their branches provide natural shade for houses, animals, and smaller plants, and they help control erosion by holding soil in place. The leaves they drop in autumn decompose into new soil that's rich in nutrients. Their leaves and roots act as natural filters to cleanse particles from the air and water. And trees remove carbon dioxide from the air while adding valuable oxygen to our atmosphere.



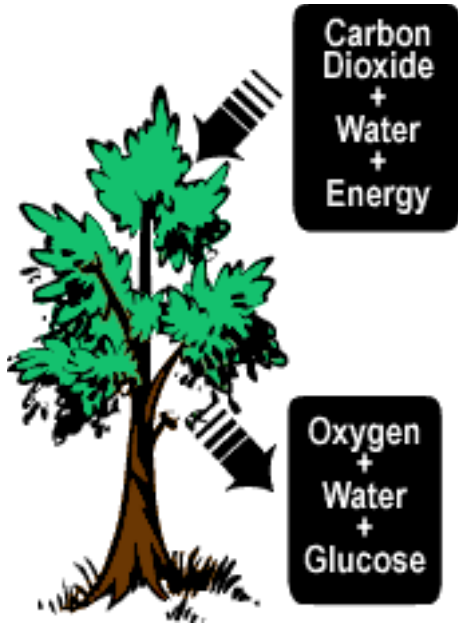
Trees are important to people in other ways, too. They provide the raw material for thousands of valuable products. Wood is used for building materials and furniture, and wood fiber is made into paper products. Even wood chemicals are valuable. These natural oils and resins are used to make products we all rely on, such as medicines (like asthma and cough remedies), detergents, cosmetics, vitamin tablets, soap, roofing shingles, food flavorings, and toothpaste!

People use forests for hiking, camping, photography, and bird-watching. Trees planted in our communities help make our streets, schools, and yards more beautiful. And trees are fun to climb and play in!





What's in a Tree?



Green plants take in carbon dioxide and give off oxygen during photosynthesis

How do trees help our atmosphere?

When petroleum and other fossil fuels are burned, as in automobiles, factories, and your furnace at home, **carbon dioxide** is released into the atmosphere. Trees improve the quality of our atmosphere by consuming carbon dioxide and releasing **oxygen** during photosynthesis.

Young, rapidly growing forests are generally the most efficient at absorbing carbon dioxide and producing oxygen. Because older trees do not grow as rapidly, and because dead trees actually use oxygen and release carbon dioxide as they decay, old overcrowded forests tend to use more oxygen than they produce.

Foresters help by systematically thinning overcrowded forests and removing dead and dying trees. This makes forests healthier, and reduces the likelihood of wildfires which can release huge amounts of carbon dioxide and particles into the atmosphere.

Did you know?

To grow a pound of wood, a typical tree consumes about 1 1/2 pounds of carbon dioxide and releases a little over a pound of oxygen. Altogether, U.S. forests remove about 9% of the country's total carbon dioxide emissions from the air.

Is harvesting trees harmful to our atmosphere?

No, not as long as we continue to plant more of them. When trees are harvested for forest products like lumber and paper, there is no net loss of trees. That's because the forest products industry plants new trees for the ones it harvests, often creating new tree plantations on lands where no forests had existed.

This type of forest management is called **sustainable forestry**, and it guarantees that forests will continue growing indefinitely. Unlike the permanent clearing of trees for farming, housing, new malls, and other commercial development, sustainable forestry practices allow trees to grow back, and encourage new growth through planting and caring for new trees.



What's in a Tree?

How many of the world's trees are used to make paper?

You may be surprised to learn that less than one-sixth of the wood harvested throughout the world each year is used to make paper, and much of this wood actually comes from the “leftovers” from sawmill operations.

Over half of the wood harvested in the world is used for fuel, mostly for cooking and home heating. In developing countries, as much as 80% of the local wood is used for these purposes.



In the United States, recycled paper and paperboard, along with residue from forest and sawmill operations, provide roughly two-thirds of all the fiber used in pulp and paper mills. The remaining one-third comes from **round wood** (whole tree trunks). Much of this wood is grown and harvested on plantations called **tree farms**, which are actually forests created specifically to produce raw material for wood and paper products.

Trees which are dying from factors such as old age, disease, insects, or forest fires are also used in papermaking. Foresters must remove these trees to improve the health of the forest, and using them for wood pulp makes good economic sense.

Some 1.5 billion seedlings are planted in the United States each year by the forest community. That's an average of more than 4 million new trees planted every day! Millions more regenerate naturally every year.

How much of a harvested tree is actually used? Is there any waste?

The forest products industry has found uses for nearly every part of a tree, so virtually nothing is wasted.

Trees larger than 8 inches in diameter, if they are of suitable quality, are normally used in the production of solid wood products like lumber and veneer. Large trees unsuitable for solid wood products along with small trees between 4 and 8 inches in diameter, sawmill trimmings, and sawdust can be used to make paper, particle board, and many other products.

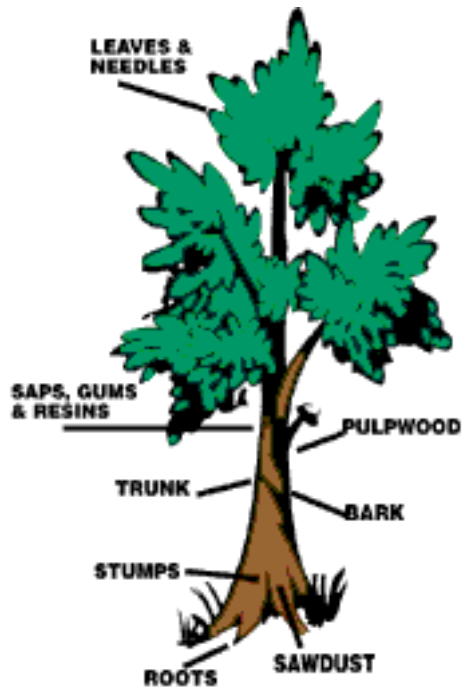
Cellulose and natural wood chemicals are extracted and used to make everything from plastics and food flavorings to photographic film and chewing gum. Bark is useful for producing dyes, adhesives, and medicines. It also can be ground or chipped to make garden mulch, or burned in furnaces to generate energy.

The leaves, needles, small branches, and roots are generally left in the forest to replenish the soil. This valuable organic matter prevents excessive runoff after rain and snow, and adds important nutrients to the soil to help nurture the next generation of trees.



What's in a Tree?

Trees: A valuable and renewable natural resource



Virtually every part of a tree is beneficial to man. Here are just a few of the many forest products that help make our lives better.

LEAVES & NEEDLES: Pine Oil, Cedar Oil

SAPS, GUMS & RESINS: Maple Syrup, Maple Sugar, Adhesives, Chewing Gum, Varnish, Medicine, Printing Ink, Paints, Stains, Shoe Polish, Fireworks

PULPWOOD: Paper, Paper Board, Rayon, Cellophane, Plastics, Photographic Film, Imitation Leather, Imitation Sponges, Sausage Casings, Celluloid, Shatterproof Glass, Artificial Hair & Bristles, Solid Alcohol

STUMPS: Veneer, Charcoal, Pitch, Wood Tar

ROOTS: Oil & Tea

BARK: Tannins, Dyes, Adhesives, Flavorings, Medicines, Mulch, Fuel

SAWDUST: Artificial Wood, Composition Board, Filler for Linoleum, Ice Storage, Livestock Bedding, Plastics, Soil Conditioner, Fuel Briquets, Pulp

TRUNK: Flooring, Toothpicks, Buttons, Furniture, Plywood, Veneer, Baseball Bats, Tool Handles, Shingles, Moldings, Pencils, Ship Timbers, Fence Posts, Railroad Ties, Telephone Poles, Butcher Blocks, Clothespins, Musical Instruments, Shoe Heels, Popsicle Sticks



What's in a Tree?

GREENQUIZ

Take a Closer Look

Find a tree which you especially like, and take a few minutes to really study it. Observe its bark. Is it smooth to the touch, or is it hard and rough? What about its leaves? Does it have needles or broad leaves? Does it have nuts or pine cones? Notice all the different colors that are in the tree. Write down some words that describe the tree. Now think of some words that describe how the tree makes you feel. Write them down, too.

Now use your ideas to do one of the following activities:

1. Write a poem, short story or essay about your tree and what it means to you. Be sure to include lots of descriptions and feelings!
2. Think of the different kinds of organisms (plants and animals) that depend on trees for their survival. How are trees important to these organisms? Write down your ideas. Now write a poem, short story, or essay about the tree from the organism's point of view. [Hint: if you were a squirrel, how would feel about the tree you live in?]
3. Think of all of the different ways that man depends on trees. Write down as many useful products as you can think of that are made from trees. In what other ways does man use trees? What would life be like without them? Now write a poem, essay or short story using your ideas.

Sources:

Towards a Sustainable Paper Cycle, International Institute for Environmental Development, 1996.
U.S. Forests Facts and Figures, American Forest & Paper Association, 1995.
The Life of the Forest, McGraw-Hill Book Company.

These facts are presented by individual scientists, engineers, and researchers who work at universities, research laboratories, and companies across the country. They work at the science of papermaking every day -- researching and testing the facts. It is their full-time job to understand and report the facts concerning the nature of forest practices, the processes involved in papermaking, and how these affect the environment -- good and bad.

TAPPI is the leading technical association for the worldwide pulp, paper, and converting industry. The Association provides a neutral forum for members to come together to share their technical knowledge and expertise in an effort to further advance professional achievement and sound technology.