

FROM THE WOODS

# Paper!



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AN EDUCATIONAL SERIES ABOUT FORESTRY FOR YOUTH

**P**aper! It's everywhere. It's all around us. You are looking at paper right now. No other manufactured material is so widely available, versatile, and so important to our everyday existence. We read books. We print out Web pages and computer files. We dry our hands on paper towels. We wrap gifts. We take notes. These are just a few of the ways we use paper. You may have heard that paper comes from trees, but that's just part of the story.

### HISTORICAL WRAP

The ancient Egyptians developed a paperlike substance nearly 4,000 years ago.

By weaving together the reeds of papyrus plants into mats, and then pounding them, they produced a thin, tough sheet for writing on.

This product was called *papyrus*, and our English word "paper" has its origin in that Egyptian name. Before papyrus, people used clay tablets, stones, wooden boards, cloths, animal skins,

wood fibers

**When a piece of paper is torn, you can see tiny wood fibers along the ripped edge.**

metal tablets, and even leaves to write on.

The Chinese invented the first true paper about 2,000 years ago. Their paper was made from a watery paste of ground-up mulberry bark, hemp, and cloth rags. They pressed this paste to remove the water, then sun-dried the resulting mat of compacted fibers to make a sheet



**Hand-copied text on cloth rag paper from a 15<sup>th</sup> century Italian manuscript**

of paper. It wasn't until an invading army captured a Chinese paper mill 600 years later that the papermaking process was carried west to the Middle East, Africa, and Europe.

For many years throughout the Western world, paper was only made from discarded rags and clothing. Cotton and linen fibers produced a fine, strong paper, and the use of other plant fibers for papermaking was forgotten during the Dark Ages. However, paper was always in scarce supply due to the constant shortage of used cloth. The first paper mill in America, established outside of Philadelphia, Pennsylvania, in 1680, also used old rags to produce paper. By 1802, there were nearly 200 such mills in the United States.

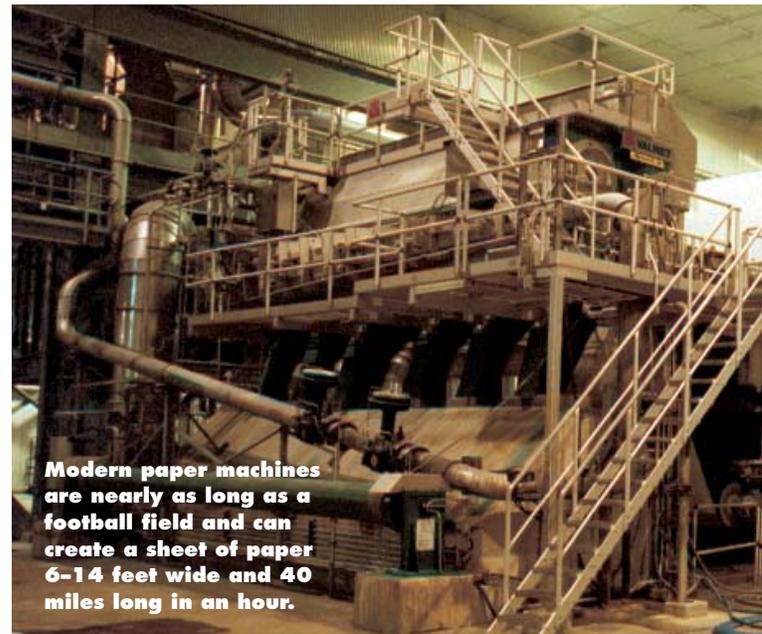
During the mid-1800s, European papermakers rediscovered the use of tree

fibers for papermaking. Also during this time, various types of machinery and processes were developed in Europe and America for grinding or chemically breaking down wood and producing paper.

Wood was in abundant supply, and the use of wood rather than rags made it much cheaper and easier to make paper. This was the beginning

of the mass-produced paper industry, an industry that played an important part

and linen fibers (for printing things like money and maps). But what exactly is wood pulp? When wood is broken down, either mechanically or chemically, two main things are left: *fibers* (composed mostly of two kinds of cellulose) and *lignin*. The fibers are actually the remains of the tree's cells. They are small, about 1/8 of an inch in length and 1/150 of an inch in width (about 1/10 the thickness of a human hair). When a piece of paper is torn, you can see tiny wood fibers along the ripped edge. Lignin is the glue, or cement, that held the fibers in place in the wood. Wood pulp is nothing more than a huge



**Modern paper machines are nearly as long as a football field and can create a sheet of paper 6-14 feet wide and 40 miles long in an hour.**

in the development of our country and the world, and still does!

### SIMPLY PULP

Today, almost all paper is made from wood pulp; however, some specialty papers are still produced using cotton

quantity of individual wood fibers with the lignin removed. The natural color of wood pulp ranges from dark brown to light gray.

Before wood pulp is produced from a tree, several steps must be taken. First, trees are cut and transported to a paper

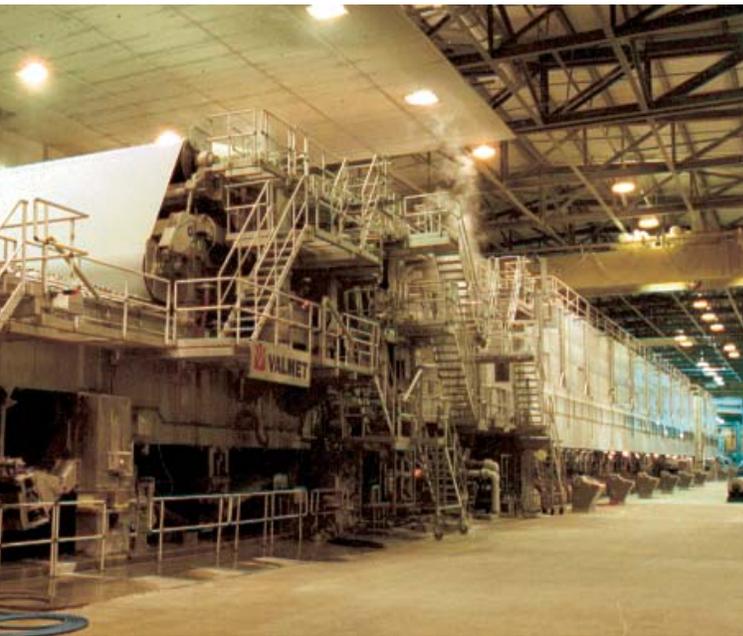


**Naturally dark brown wood pulp (right) is useful for making paper bags and boxes. After bleaching and softening (left) pulp produces higher grades of paper and other products.**

mill. Most of the trees used for papermaking in Pennsylvania are smaller trees that have little potential for making lumber. At the mill, the bark is removed from the trees.

fibers. However, chemical methods are more widely used and are more energy-efficient. The chemical methods involve cooking wood chips in large tanks. These tanks, called *digesters*, are similar to pressure cookers. Various chemicals, called the *cooking liquor*, help break down wood chips into a mushy mass of fibers. Regardless of the method used to produce pulp, it is always washed and screened (to remove impurities) before it becomes paper.

Wood pulp is also made from chipped sawmill waste wood or from used paper. The recycling process for used paper is similar to making “virgin” pulp



Lastly, the fibers are either mechanically or chemically extracted from the wood and then separated from the lignin.

In the mechanical method, grindstones tear wood fibers apart in water, or the trees are chipped up into small pieces first and then ground down to

directly from wood. In recycling, the wood fibers in the paper must be separated again or “repulped” in water. It is also necessary to remove the chemicals, such as adhesives and ink, on used paper. The recycling process shortens the length of the individual fibers,

## Here’s how paper is made...



**1** Pulpwood yard stores the raw material



**2** Pulpwood is debarked and chipped



**3** Wood chips are cooked in a digester and broken down into pulp



**4** Pulp is washed, bleached, and softened



**5** Pulp is mixed with water and pumped onto a moving screen



**6** Paper machines rapidly press, dry, and smooth the pulp



**7** Computers monitor the entire process



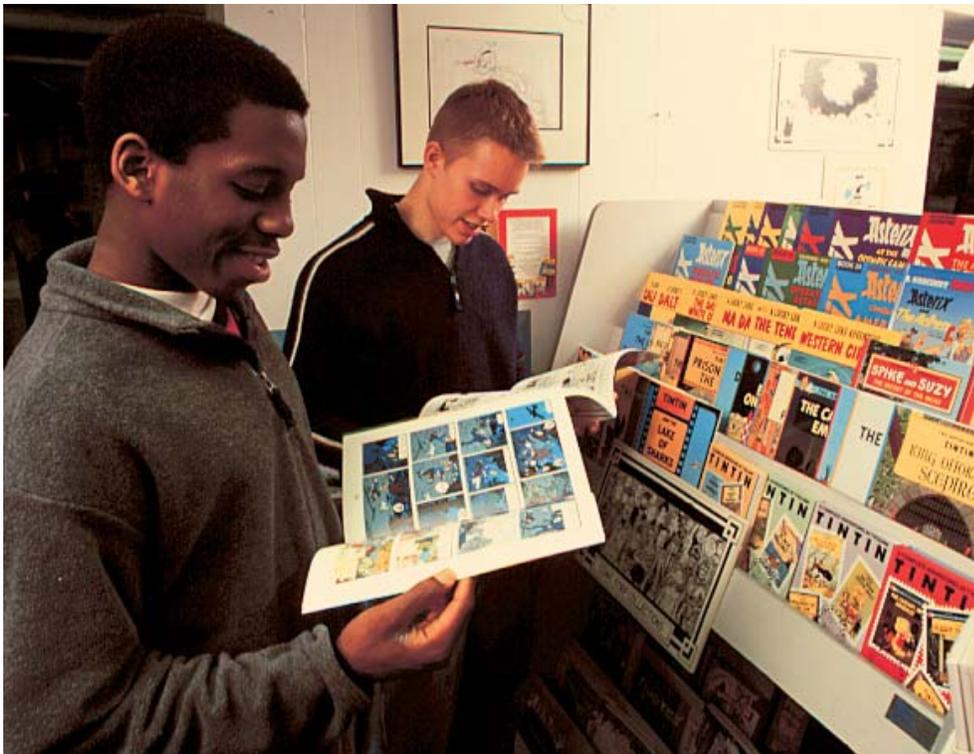
**8** Paper machines produce large rolls of paper



**9** Rolls of various weights and colors are stored in warehouses



**10** Sheets of paper are shipped to buyers



**Paper products are all around us, including your favorite comic books and magazines, newspapers, boxes, office paper, envelopes, paper towels, toilet paper, packaging, gift wrap, and so much more.**

so wood fibers can only be recycled several times before they are too short for making paper. That's why it is necessary to mix new pulp with recycled pulp to make paper products.

### **MODERN PAPERMAKING**

The papermaking process begins by washing, bleaching (to whiten or "brighten" if necessary), and beating (to soften) wood pulp. Starches, colors, and other chemicals added at this early stage create different types of paper. After mixing the pulp and chemicals with water, this "slush" moves into large papermaking machines. Here, the slush is pumped evenly onto a fast-moving (58 feet per second), fine-meshed screen. As water drains off,

the slush moves along on the screen and then through a series of heated cylinders to press, dry, and smooth it, ensuring uniform thickness. Rolls of paper are the finished product. They are

**It's easy to recycle paper and it makes good sense!**



usually rewound and cut into smaller rolls or packs, then shipped to printers and manufacturing plants to become products. There are thousands of different paper products—everything from coffee filters to facial tissues and magazines. Throughout the papermaking process, tests ensure paper quality. If a roll of paper does not meet quality standards for the desired finished product, it is recycled back into the process.

That's the whole story of papermaking. Paper is material that's similar to the air we breathe. It's all around us, we use it continuously, and we yet we never think about it! Can you imagine a world without paper?

Prepared by Sanford S. Smith, natural resources and youth extension specialist; James C. Finley, associate professor of forestry; and Lee R. Stover, wood products extension specialist, Penn State School of Forest Resources.

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