



Eco-Link

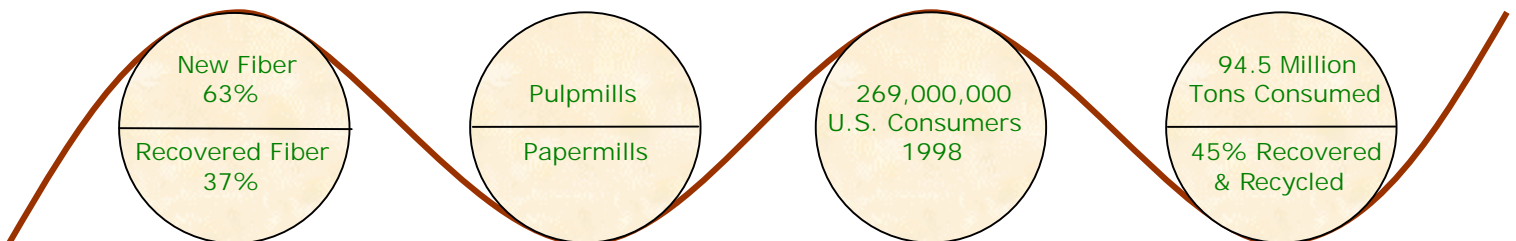
Linking Social, Economic, and Ecological Issues

Pulp & Paper

Volume 8, Number 2

Before the invention of paper, a variety of different materials were used to record written information. Stone, metal, wood, papyrus, clay, parchment, vellum, cloth, tree leaves, and rice-pith have all filled this role. The first cuneiform writing was done by Sumarians in the form of pictographs on clay in 4,000 BC. The oldest written papyrus rolls date back 5,000 years, and the word “paper” is derived from the Greek and Roman words for papyrus.

Papermaking is an invention (105AD) credited to Ts'ai Lun, an official of the Imperial Court in China. Early Chinese paper appears to have been made from a suspension of hemp waste in water; washed, soaked and beaten to a pulp with a wooden mallet. Eventually, tree bark, bamboo, and other plant fibers were used in addition to hemp. The craft of papermaking was not established in Europe until the 12th century, probably due to the investment of landowners in sheep and cattle for parchment and vellum respectively. The rise of the printing press in the mid 1400's changed European attitudes towards paper.



The first papermill in America was established in 1690 by William Rittenhouse in Germantown, Pennsylvania, where the essential ingredients of a large population, rags (cotton & linen) and fresh water, were present. By 1810 there were 185 papermills in the United States and rags had become scarce. The first US newspaper to be printed on groundwood pulp was the January 14, 1863 edition of the Boston Weekly Journal.

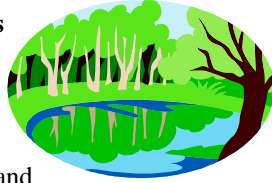


**Americans read 350 million magazines,
2 billion books, and 24 billion newspapers annually!**



Wood Fiber

Paper is made from natural fibers called cellulose, and the primary source of cellulose fibers is wood.

Softwood fibers are over twice as long as hardwood fibers. Softwood fibers are best used for paper and paperboard requiring strength such as grocery bags and boxes. Short fibers, on the other hand, help make paper smooth. A blend of hardwood and softwood fibers is ideal for making printing and writing papers, which need to be strong and smooth. It all comes down to cellulose, which is a polymer chain carbohydrate (a chain of sugar molecules). About 28% of the trees harvested in the US are used to produce wood pulp for making paper and paperboard. Wood is often debarked and chipped right in the forest or at a satellite chipping facility. Other wood is brought to the paper mill in the form of round logs.



steel disks (thermo-mechanical) that literally tear the wood apart, or by pressing debarked logs against grindstones to produce groundwood pulp. Mechanical pulp is ideal for products such as newsprint where a higher lignin content and shorter life is acceptable.

MECHANICAL 	CHEMICAL 
Heat & Pressure	Chemicals, Heat, Pressure
Higher Yield Lower Quality Higher Lignin	Lower Yield Higher Quality Lower Lignin
Shorter Life Paper	Longer Life Paper

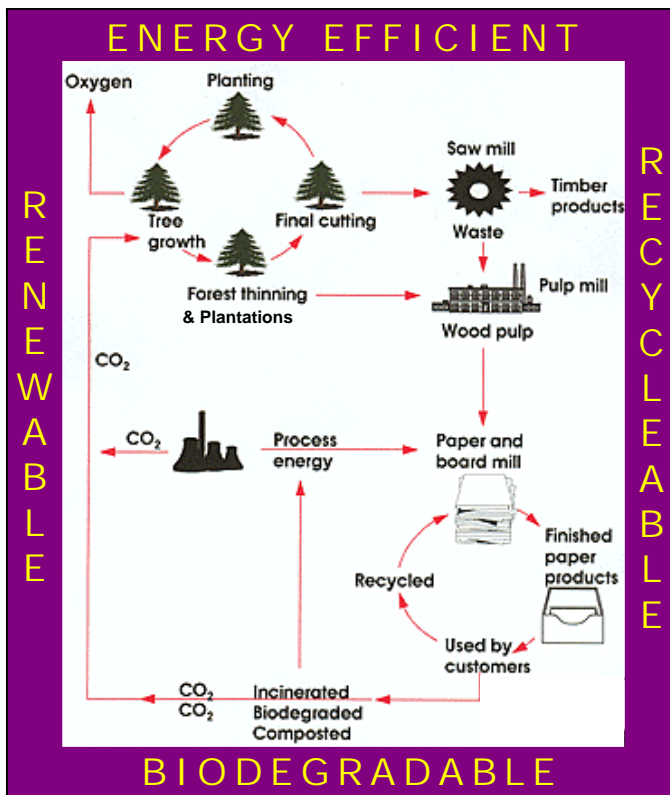
Chemical pulp is made by feeding wood chips into a digester (pressure cooker) where they are cooked to remove the lignin from the cellulose. Since a lot of lignin is removed, the pulp is easier to bleach and produces stronger paper with a longer life. Important by-products such as tall oil and turpentine come from the chemical pulping process. A third process, **Chemical Thermo Mechanical Pulp** combines these two pulping processes.

Sulfate Process

Alkaline (PH 7-12)
"Kraft Process"

Sulfite Process

Acid (less than 7 PH)



WHAT'S THAT SMELL ANYWAY?

That rotten egg smell emanating from some paper mills is sulfur, just like you would experience at the hot springs in Yellowstone Park. It won't hurt you, but mills are spending many millions to reduce or eliminate it.

Cool Facts

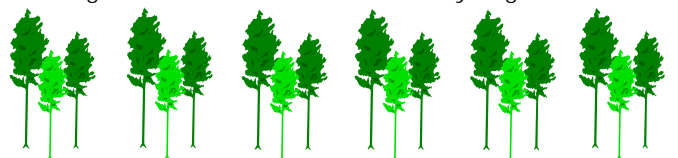
- ❖ Toilet paper rolls were introduced in America in 1871.
- ❖ Paper bags were produced by hand until 1876.
- ❖ Canada imports 2 million tons of recycled paper from the US annually.
- ❖ Canada produces 29% of the world's market wood pulp and 49% of its newsprint.
- ❖ Canada pulp mills get 67% of their fiber from sawmill residue and recycled paper.
- ❖ US paper recovery saved 120 million cubic yards of landfill space in 1996, enough to fill 67 Empire State Buildings.
- ❖ Every day a paper machine in Selma, Alabama, running at speeds up to 48 mph, produces a 30' wide sheet of paper that would stretch from Mobile, Alabama to New York City.
- ❖ More than 97% of the stationery and other fine paper recovered in America is recycled into tissue products.
- ❖ Today more than 20 million paper bags are used annually in supermarkets.
- ❖ On average, when a tree is harvested for making paper, five more are planted in its place.
- ❖ In 1996, 63% of all the newspapers and 70% of the corrugated boxes were collected for recycling.

Nothing Wasted

Today virtually 100% of every tree harvested can be utilized. Larger trees may go to a mill for manufacturing into lumber, panels or engineered wood products. The residues from these mills are an important source of fiber to pulp mills. In fact, more than half the fiber used for paper comes from woods and mill residues and the paper recovered for recycling. Some pulp mills exist just to produce market pulp or fluff pulp for sale on the open market, but pulp and paper mills are commonly joined in one seamless operation.

The Pulping Process

Wood can be reduced to pulp either mechanically or chemically. Each process has advantages. **Mechanical** pulp is produced by forcing wood chips between enormous rotating





Recycled Fiber

Americans now recover 45% of all the paper and paperboard used, one third more than goes to landfills. When recovered paper arrives at the paper mill it goes into a “re-pulper” where water, chemicals, heat and agitation turn the paper back into a pulp slurry. It’s screened, cleaned, de-inked, refined and fed to the paper mill along with the primary (virgin) fiber from the chemical or mechanical pulping process.

In 1996 each American recovered on average 295 lbs. of paper for recycling, a 38% increase over 1988.

In 1996 recovered paper provided just over 37% of the entire raw material fiber used at US mills, up from about 25% in 1988.

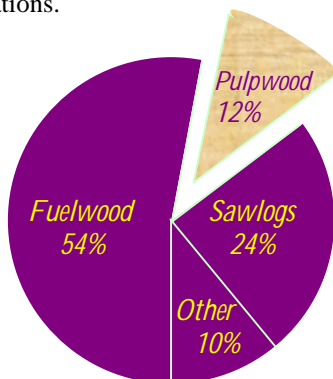


Every day, US paper manufacturers recycle enough paper to fill a 15 mile long train of boxcars.

Bleaching Pulp

Bleaching is used to remove more lignin, which brightens and strengthens the paper. It improves absorption, softness, flexibility and resistance to aging. Traditionally chlorine gas (Cl) was used to bleach pulp, raising concerns about organochlorine (dioxin and furan) emissions. Now the industry is evaluating **Total Chlorine Free** processes, and is moving strongly to the **Elemental Chlorine Free** (ECF) process, which replaces chlorine gas (Cl) with chlorine dioxide (ClO₂). ECF produces no measurable dioxins or furans, and is cost effective. Some overseas mills and one U.S. sulfate mill are using TCF processes that use hydrogen peroxide. Hydrogen peroxide and sodium sulfite are bleaching processes used more for mechanical pulp.

Pulp mill emissions, whether in the air or water (effluents), are very strictly controlled and monitored under such laws as the National Clean Air Act and National Clean Water Act. The EPA, state, regional and local pollution control agencies issue rules (regulations), give out permits, monitor results, and provide enforcement. The EPA just posted a tough new Cluster Rule that aggregates and coordinates air and water quality regulations.



The Paper Industry uses 12% of the wood harvested worldwide.



Making Paper

The equipment for making paper in a modern papermill would be unrecognizable to an early craftsman. However, the procedures for preparing the stock, forming the paper web, drying the sheet, and applying coatings and additives have remained the same.



Paper Making Machine

A typical paper machine is about 100 yards long, the length of a football field. The watery pulp (99.5% water) is discharged from the **headbox** onto a **wire** (actually plastic) screen where water drains out leaving the wood fibers in a web on the screen. This paper mesh goes on to the **press** section where more water is pressed out and removed by suction. Then it’s on to the **dryer** section where the paper rolls around steam-heated drying cylinders until it is completely dry. In the dryer section there may be a **size** press where a solution of water and starch can be added to improve the surface for printing. Next comes a **calender** section where a stack of polished iron rollers consolidate, polish and glaze the surface of the paper. The paper is then **reeled** up on large reels that are then **slit** and wound into smaller ones to meet customer demands.

Corrugated board boxes are used to ship 95% of all manufactured goods in the U.S., including paper itself! They are much lighter and more recyclable than the wooden crates of yesterday.



Products

Each American, on the average, consumes 750 lbs. of paper and paperboard products annually. To put that in perspective, a 20 year old Southern Yellow Pine tree that contains 500 pounds of wood can yield 120 lbs. of paper, enough to produce 3,600 (12-pound) grocery bags.

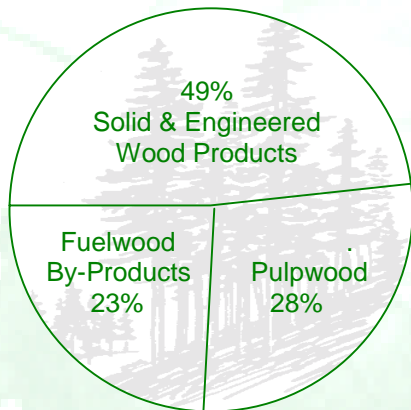
We can place the products made from paper in three broad categories. The first is **reprographic** paper for printing and copying. These can be coated or uncoated. The second category is **tissue and towel** papers for personal care and cleaning. The final category is **specialty** papers, used primarily for wrapping and packaging. Containerboard is used to make corrugated boxes. Paperboard (cardboard) is used for packaging everything from food to shoes. Paper can be recycled 5-7 times before the fiber is exhausted. As the fiber is recycled it moves toward a use requiring less and less strength and brightness. It may end up as a bathroom towel, a pot for a plant, or an egg carton.

Paper and paperboard (thick paper) are essential to our well being. Newspapers, books, magazines, tissue paper, office paper, wrapping papers, and boxes are an integral part of our lives.

Summary

The U.S. pulp and paper industry is on the cutting edge of science and technology. It uses a renewable and recyclable resource to meet our needs for paper, paperboard and thousands of by-products of the pulp and paper making process. Fast growing pulpwood trees are extremely efficient in absorbing CO₂ to make wood while producing pure oxygen. Recovered paper and residues from wood products manufacturing provide half the wood fiber to feed pulp mills. The industry produces 60% of its own power making it energy efficient, reducing the need for purchased non-renewable (fossil fuel) energy. Chlorinated organic compounds are being eliminated. The industry is working with government agencies to ensure tough new air, water, and soil quality regulations are achieved. The industry is reducing its water use. Water and chemicals are increasingly being captured and reused in closed loop systems. The industry employs 700,000 people directly and in related industries with an annual payroll of 47 billion dollars. Because paper is recycled, the solid waste sent to landfills has dropped dramatically. More paper containers are recycled than all the glass, plastic and aluminum combined. A healthy industry keeps land growing trees rather than converting land to other uses. The industry provides outstanding career opportunities for chemical engineers, computer experts, foresters and many more.

*Between stimulus and response is our greatest power – the freedom to choose.
Would you like paper or plastic?*



Tree Usage in the United States

Glossary (Pulp Diction)

Cellulose: the basic raw material (chemical compound) used in papermaking. Cellulose is a polysaccharide and is the main constituent of the cell walls of all plants. It is the most widely distributed organic (carbon-based) compound. It is not water soluble and is extracted by pulping.

Coated: a paper covered with a suspension of china clay, pigment and adhesive.

De-inking: a series of washing and floatation processes in which water and/or soap-like chemicals called surfactants remove the ink from recycled paper.

Effluent: the liquid "leftovers" that result from manufacturing pulp and paper, including chemical compounds and wood fiber fragments.

Fiber: in papermaking this refers to the cellulose fiber. Softwood trees produce long cellulose fibers that are good for strength and hardwood trees produce short fibers that are good for smoothness. Fibers are often blended to create the ideal characteristics for a given paper.

Kraft: a very strong type of wrapping paper made from a special type of chemically treated wood pulp. The Kraft (Sulfate) pulping process produces the best quality softwood pulp. Generally brown natural kraft but can be bleached white. Kraft is the German word for strength.



Lignin: a polymer that binds cellulose together to make wood. The material that gives strength and rigidity to wood cells. Lignin is removed in the pulping and bleaching processes to brighten the paper and prevent yellowing.

NEPA: National Environmental Policy Act (1969) requires Environmental Assessments (EA) and Environmental Impact Statements (EIS). This act is the basic national charter for protection of the environment in the U.S.

Post Consumer: paper that has been recovered from the end consumer for recycling.

System Closure: the concept of reducing pollution at source by developing efficient ways to re-use more water and other elements in the waste stream.

Tall Oil: a paper making by-product commonly used to make soaps, paints, varnishes, printing inks, and water-proofing agents.

Turpentine: a paper making by-product commonly used as a paint thinner and solvent.

Woodfree: a paper that is produced from pulp that has undergone chemical rather than mechanical breakdown and is free of the chips found in groundwood and mechanical pulp.

Sources

American Forest & Paper Association www.afandpa.org

American Pulpwood Association www.apulpa.org

Canadian Pulp & Paper Association www.open.doors.cppa.ca

Department of Energy www.doe.gov

Environmental Protection Agency www.epa.gov

Institute of Paper Science & Technology www.ipst.edu

National Council on Clean Air & Stream Improvement
www.NCASI.org

Paper Age Magazine www.paperage.com

Paper Federation of Great Britain www.paper.org.uk

Paper Industry Research Association www.pira.co.uk

Technical Association of the Pulp & Paper Industry www.tappi.org

*Man shapes himself through decisions
that shape his environment.*

Rene Dubos



CHAIRMAN, DR. ROBERT G. LEE
PRESIDENT & CEO, ROBERT F. LEGG
VICE PRESIDENT, DR. JOHN H. BALDWIN
TECHNICAL MANAGER, ROBERT S. NORTON
OFFICE MANAGER, RENEE K. KING

14780 SW Osprey Drive, Suite 355
Beaverton, OR 97007
Tel: (503) 579-6762 Fax: (503) 579-0300
e-mail: forestinfo@easystreet.com
<http://www.forestinfo.org>

Printed on recycled paper