

Forest Fun

Wyoming Science, Social Studies

Objectives:

- Students develop a connection between paper and forestry.
- Students learn about the origin of paper and how it has progressed and changed through the centuries.
- Students get hands-on experience making their own paper.

Background:

When we talk about forest, we talk about trees. Some forests are mostly pine, some are a mixture of hardwood and pine and others are mostly hardwood. They provide habitat for a variety of wildlife and they help clean the air. Trees also provide us with many products that we use everyday....our books, the paper for our homework, and wood for our homes. There are also products and by-products used to make things like chewing gum, adhesives, and food preservatives. We even grow trees to produce food like oranges apples, pears, figs, and pecans.

But trees are valuable even if we don't use them for their wood, nuts or fruit. In our urban and suburban areas well as our rural area, trees are a critical part of the environment. They provide shade and cool the air. They make our homes and businesses more attractive. They help clean the air we breathe. They hold the soil in place and prevent erosion. Trees absorb loud noises and buffer sound. An acre of trees can reduce noise pollution by 50 percent.

Fun Facts:

- On average it takes 60 years to grow a 100 foot tree.
- One acre of forest land gives off 4,280 pounds of oxygen over the course of a year.
- A large tree can evaporate up to 88 gallons of water per day, creating the cooling effect of 5 average room air conditioners.
- One acre of trees can remove 13 tons of dust and gases from the surrounding environment.

Did you know?

One cord of wood equals a pile of wood measuring 4'x4'x8' or 80 cubic feet of solid wood, allowing for air space. One cord of wood will yield one of the following products:

- 7.5 million toothpicks
- 942 one-pound books
- 460,000 personal checks
- 89,870 sheets of letterhead bond paper (8 ½ x 11)
- 12 dining room tables (one table seats eight people)



Standards

Science

History and Nature of Science:
3.1A, 3.1B, 3.2A

Social Studies

Time, Continuity, & Change:
4.1, 4.2
People, Places, & Environment:
5.4

Materials

- Scrap paper torn into 1"x1" pieces
- 1 large bowl
- A wooden frame, 5"x7" or 8"x10"
- Nylon or wire screen to fit the wooden frame
- Staples or tacks
- A 2.5+gallon basin
- Cloth dish towels
- Blender (not used for food after this lesson)
- Sponge
- Household iron
- Strainer
- Piece of dried flowers, herbs or colored paper (optional)
- Blotter paper

Estimated Time

2 Hours

Grades 3-4

notes:

Paper Background:

When we think of the origins of paper, our minds might wander back over 5000 years ago to the Nile river valley in Egypt. It was there that a marsh grass called Cyperous Papyrus flourished. The Egyptians cut thin strips from the plant's stem and softened them in the muddy waters of the Nile. These strips were then layered in right angles to form a kind of mat. The mat was then pounded into a thin sheet and left in the sun to dry. The resulting sheets were ideal for writing on. Since they were also lightweight and portable they became the writing medium of choice of Egyptians, Greeks and Romans for record keeping, spiritual texts and works of art. It is from papyrus that the word paper comes from. Although papyrus sheets were similar to paper in terms of function, being laminated sheets they were technically more like a mat and therefore not the same as the papers of today. Similar processes were developed in other lands - in Central America during the 2nd Century AD the Mayans fashioned a similar product for bookmaking. In the Pacific Islands, a paper was made by beating a fine bark over specially shaped logs to make clothes and ritual objects. However, none of these sheets would qualify as true paper today.

The Father of True Paper - T'sai Lun:

Paper as we know it today comes from another source - China. Excavations of tombs of the former Han Dynasty (207BC-9AD) have revealed silk cloth bearing the texts of Lao Tzu - the father of Taoism (born in 604BC). In 105 AD, Han Emperor Ho-Ti's chief eunuch T'sai Lun experimented with a wide variety of materials and refined the process of macerating the fiber of plants until each filament was completely separate. The individual fibers were mixed with water in a large vat. Next, a screen was submerged in the vat and lifted up through the water, catching the fibers on its surface. When dried, this thin layer of intertwined fiber became what today we call paper. T'sai Lun's thin, yet flexible and strong paper with its fine, smooth surface was known as T'sai Ko-Shi , meaning: "Distinguished T'sai's Paper" and he became revered as the patron saint of paper making.

Spread of Paper making , A Million Prayers:

It wasn't until the 3rd century that the secret art of paper making began to creep out of China, first to Vietnam and then Tibet. It was introduced in Korea in the 4th century and spread to Japan in 6th. There, during the 8th century, the Empress Shotuka undertook a massive project consisting of printing a million prayers - dharani - on individual sheets of paper, with each mounted in its own pagoda. With such a profound inception, it is not surprising that the fine art of paper making has continued in Japan to this day, garnering deep appreciation and ever increasing sophistication.

The Journey to the West:

Paper making spread slowly throughout Asia to Nepal and later to India. It made its true push westward in 751AD when the Tang Dynasty was at war with the Islamic world. During a battle on the banks of the Tarus River, Islamic warriors captured a Chinese caravan which happened to include several paper makers. They spirited them away to Samarkand, which soon became a great centre for paper production. Gradually paper makers made their way further west through the Muslim world - to Baghdad, Damascus and Cairo. Finally, when the Moors from North Africa invaded Spain and Portugal they brought the technology with them and so it was that paper making entered Europe in the 12th century.

Spreading the Word:

In Europe, the use of papyrus had dropped out in the 9th century. The preferred medium for the artists and literati of the time was the smooth and lustrous parchment. However, parchment - made from animal skin - was extremely expensive. In fact, it has been estimated that a single bible hand written on parchment required the skins of 300 sheep. The notion of paper being used as a practical everyday item did not occur until the 15th Century. When Johann Gutenberg perfected movable type and printed his famous bible in 1456, he not only spread the word of Christianity, but also sparked a revolution in mass communication. The birth of the modern paper and printing industry is commonly marked from this date.

Paper Becomes an Industry:

The age of experimentation

Printing technology rapidly developed and created an ever increasing demand for paper. The early European papers were made from recycled cotton and linen - and a huge trade quickly developed around the trading of old rags. It is said that the black plague entered England from Europe on these old rags. Yet soon this source became insufficient and some curious attempts were made to source new materials - the most macabre of which was the recycling of Egyptian mummies to create wrapping paper! Others experimented with fibers such as straw, cabbage, wasp nests and finally wood, resulted in inexpensive - and replaceable - materials for paper making. Today, the long soft fibers of softwoods such as spruce have become the most suitable source of pulp for mass production.

Mass production

The demand for paper also created the need for greater efficiency in production. In the late 18th century the labors of Nicholas Luis Robert resulted in the creation of a machine that could produce a seamless length of paper on an

vocabulary:

- *bi-product*
- *forest*
- *erosion*
- *parchment*
- *evaporate*
- *fiber*
- *mass communication*
- *mass production*
- *recycled*

notes:

endless wire mesh with squeeze rollers at one end. Perfected and marketed by the Fourdrinier brothers, the new machine made papers soon replaced traditional single sheets made by hand. In Europe and America, the mass-production of paper became a thriving industry supplying huge volumes of paper for the production of newspapers, books, magazines, paper bags, toilet paper, money and a huge variety of other purposes - including clothing, chimney's and even coffins! Today, the increasing volume of paper consumption has become a complex environmental matter - and the need for new materials increasingly urgent. While recycling has done some good, a lot of paper is still wasted.

Basically, paper is a flat mat of fibers that cling together because of their "roughness", the fibers "snag" onto each other. Paper can be made from almost any fibrous material. Used and discarded paper can be collected and then recycled to make new and useful paper. That's how simple paper recycling can be.

***CAUTION! This is a wet (and messy) project.
Protect surfaces and yourself.***

Activity Preparation:

- Prepare the scrap paper: remove staples and tear into small pieces
- Soak the pieces in the large container for at least thirty minutes
- Buy or build wood frame
- Staple or tack screening tightly to the frame to make a "deckle."

Activity Procedure:

1. Fill the blender half full of warm water and add a handful of soaked paper.
2. Cover and blend at medium speed until the individual pieces of paper are gone and the pulp has the consistency of thick soup.
3. Pour the pulp into the deckle and then rinse this material with water to remove inks and films that were originally used in manufacturing the paper.
4. Pour the pulp into a basin and mix thoroughly until ingredients are evenly dispersed (adding a few ounces of liquid starch will give "body" to your paper)

5. Blend in a piece of construction paper for color or stir in pieces of thread, dried flowers, or herbs for an interesting texture. (Do not blend these additions – stir only!)
6. Slide your deckle into the basin
7. Hold the deckle under the water and gently move it back and forth to get an even layer of fibers on it.
8. Lift the deckle out of the water keeping it flat and allow it to drain until most of the water has drained off (there should be a layer of pulp on the screen)
9. Press the pulp gently with your hands to remove even more moisture and use a sponge to soak up the water from the bottom of the screen.
10. Place a clean dish towel or blotter paper on a flat surface and turn the deckle paper-side down on the towel/paper.
11. Lift the screen carefully leaving the paper mat behind
12. Quickly cover the paper mat with another cloth or blotter paper and iron it at a medium dry setting.
13. When the paper is dry, pull the cloth gently from both sides of the ends to loosen your paper and carefully separate the two.

Congratulations! You've done it. You've made a sheet of brand new paper from recycled paper fiber!

CAUTION! Do not pour the leftover pulp down the drain! Throw it out or freeze it for future paper making projects.

Questions for Investigation:

- What is the size of one cord of wood?
- How many sheets of paper can be made from one cord of wood.
- Have students devise realistic ways that they as a class could use to reduce the amount of paper they use.
- Have students research the development of paper.

Materials Adapted from Georgia Ag in the Classroom

notes: