

Grade: 6-8

How do we use forest resources?

Lesson #C3: Making Paper: Alaska's Pulp

Time: 2-3 class periods

Overview:

Students read, discuss, and write about the processes and effects of paper manufacture, and make recycled paper.

Essential Questions:

What qualities of wood make it appropriate for various uses?

What are the trade-offs associated with the use of wood?

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Source: AMEREF Forestry Curriculum fu8 Making Paper: Alaska's Pulp

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Assessment

Can students:
Imagine and describe a new source and process for paper-making, and predict its effects.

Vocabulary

- lumber
- cants
- pulp
- cellulose
- lignin
- debarking
- chipping

Alaska Standards

Addressed:

Science GLEs

The student demonstrates an understanding [6] SE3.1 describing the various effects of an innovation on a global level.
[7] SE3.1 recognizing the effects of a past scientific discovery, invention, or scientific breakthrough (e.g., DDT, internal combustion engine).
[8] SE3.1 predicting the possible effects of a recent scientific discovery, invention, or scientific breakthrough. (L)

Writing GLEs

The student writes about a topic by
[6] 2.1.1 Writing a composition of at least two paragraphs with a topic sentence (which may include a lead or hook), maintaining a focused idea, and including supporting details
[7] 3.1.1 Writing a thesis statement that identifies the focus or controlling idea for the entire composition
[7] 3.1.4 Writing a conclusion that supports the thesis or summarizes the main ideas

Teacher information and Procedure

Prior knowledge for students: none

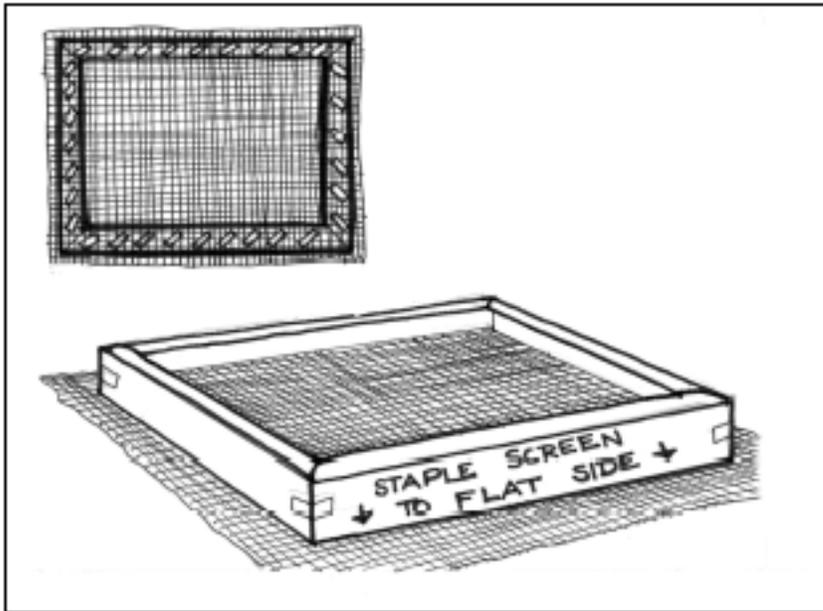
Materials needed:

- wood frame (bought or made) 5"x7" - 1 will work, but 4-6 is best
- wire screen (soft roles are available at hardware stores) - enough to cover all of your frames

- staple gun - 1
- scrap paper torn into 1-2 " squares
- 2 large tubs (a regular size cooler works well. It needs to be at least big enough to submerge the frame.)
- old blender (warning this may wear out your good kitchen blender)
- herbs, flower petals, strings
- cotton balls
- 4-6 sponges
- newspaper for spills
- 8"x11" pieces of felt - 8-10
- iron

What to do in advance:

1. Cut the screen and place it over the frame. The box like part of the frame should be on the inside. Stretch the screen tightly and staple gun it to the screen.



2. Cut or tear your scrap paper into 1-2 inch size bits. Remove all staples and tape.
3. Soak the paper bits in warm water overnight.

What to do during the lesson:

- ***Gear up:***

Ask the class what they know about paper. Where does it come from and how is it made? Have students read and discuss the Background information.

- **Explore:**

1. Tell the students that they will be making paper, not directly from wood chips or cotton fibers today, but rather from used scrap paper. Show them the paper soak you prepared the night before. Explain that you will be helping the students make a pulp from the shredded paper by using a blender to chop it up. You will then cover the screen with pulp and blot out any excess water, lay it on a piece of felt, and dry it with an iron. Show them an example of homemade paper.

2. Fill the blender half way with warm water. Add about a cup of soaked paper. Blend on medium until all of the fibers are smooth. It should look like potato soup. If you want to add texture, smell, or color you can add herbs, flowers, colored paper, coffee, etc.

3. Pour the blended pulp into the second cooler. Add more warm water, enough to submerge the screen. Mix the pulp so that it is evenly distributed. The thicker the pulp, the thicker the paper.

4. Place the frame under water and bring it up slowly, allowing the pulp to gather on the screen. Shake it gently to evenly spread the pulp.

5. Press the pulp against the screen with your hand to remove most of the excess water.

6. Using a sponge, blot out as much water as you can without removing the pulp or disturbing it.

7. Place the screen upside down over a piece of felt on a flat surface. Use the sponge to encourage the pulp to drop in one piece to the felt.

8. Cover the squared pulp with another piece of felt and iron on medium heat until the paper is dry. (If you don't have an iron, you can put the paper on felt and leave it to air dry, pressing it occasionally to keep it flat.)

9. When the paper is dry, carefully pull it from the felt.
10. When you are finished making the paper, use a strainer to remove the pulp from the water before pouring it down the drain. The pulp can also be frozen for later use in a zip bag.

- **Generalize:**

Ask the following questions:

1. How does the process you used compare with the manufacture of ordinary paper?
2. How does the process you used compare to the way that paper is recycled?
3. What waste material comes from making paper?
4. After seeing your homemade paper, how do you think the paper you use every day is made so thin, without lumps or bumps?
5. Why do you think recycled paper has a different texture than non recycled paper?
6. How has the invention of paper impacted the world? What might replace paper in the future?

- **Assess:**

Ask students to imagine and write about a paper substitute that could be made from some type of waste materials. How would it be manufactured? How would be the effects of the invention?

Related Resources in the AMEREF Kit

AMEREF Interactive CD

Links to Geology, Mining, Energy, and Forestry Related Websites

Books

Alaska's Forest Resources: Alaska Geographic

Extensions, adaptations, and more resources:

1. Try making paper out of other materials such as cotton balls or dryer lint.
Compare how they are different than paper made of wood.
2. Write poems or stories on your paper.
3. Visit a pulp mill if possible.
4. Try sculpting or pressing objects using thick pulp.

Background

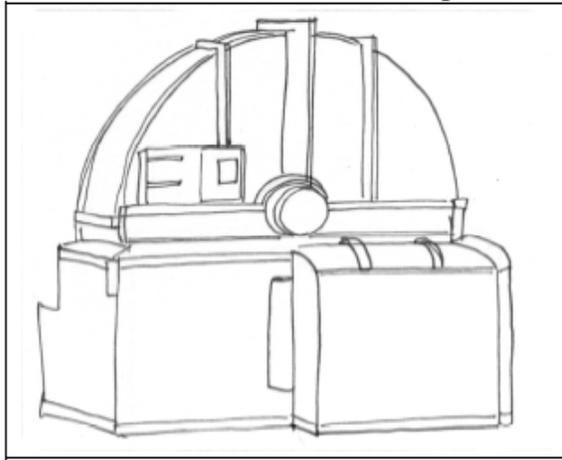
Paper is made from any fibrous material. It can be made from wood, cotton, rice, hemp, or flax.

Paper was invented in China in 200 AD. It was made one sheet at a time for 1500 years! In the late 1700s a machine was created that could make one large sheet of paper which could then be cut into smaller pieces. Sheets of paper today can be 26 feet wide and 40 miles long, and made in just one hour.

Throughout the world, wood tends to be the most popular material used to make paper. It has a longer fiber than other choice making a higher quality product. Other materials which could be used are agricultural crops which take up land already devoted to meeting our food and clothing needs. Forests in the United States are no longer converted into agricultural lands because of the affects of deforestation. Leaving the forest as forest land and harvesting the trees on a sustainable yield rotation has fewer environmental impacts.

Much of Alaska's pulped wood is not directly harvested, but is rather a byproduct of either sawmills and logging processes or a defective logs which are unsuitable for lumber.

In Alaska, most of our wood is pulped for paper, rayon and cellophane production. Once logs destined for the pulp mill are bundled and rafted at the log transfer site or facility, tugboats pull the rafts to the pulp mill. At the mill huge cranes lift the log bundles from the water to the log deck where the metal bands are cut and the bark is removed by hydraulic de-barkers.



The logs are reduced to 4" chunks in a chipper. This is a 30 ton steel disc with knives set in the face. The logs are chipped at about 125 tons an hour. The wood chips are cooked in a digester, a stainless steel pressure vessel which holds 110 tons of chips and 56 thousand gallons of cooking acid. This process separates the lignin from the cellulose, forming a light brown, cotton-like material called pulp.

From there, the pulp flows through the bleachers where it is treated with chemicals, cleaned of any impurities, and washed to produce white pulp.

The bleached pulp is then passed through a machine forming a continuous roll resembling blotter paper. Pulp board is cut from the sheet into specified sizes, stacked and bundled into bales for shipment.

Every effort is taken to minimize the impact of the mill; however, as with any industry, there are more environmental concerns about the condition of the water, air and habitat when a mill is placed in a community than there would be without a mill at all. Smell filters are placed to minimize the odors in the community. Special smoke stacks remove any debris from the air. Any waste water is treated so that chemicals and pulp are not released into the environment. Some mills even use their waste pulp as a fuel source in running the machinery at the mill.

Although paper is recyclable, it can not be recycled indefinitely. Each time the paper is processed it shortens the fibers. After 2 or 3 recyclings, the fiber will not bond to make a new sheet. Fortunately, we make paper from a biodegradable, renewable resource which allow us to keep up with the world's demands for products made from pulp.

Note: There are now no pulp mills within Alaska as the

federal government has canceled all pulping contracts. However, many lower grade logs are still used for pulp being shipped from Alaska as chips or logs to be pulped elsewhere.

Teacher Background adapted with permission from the Great Green Forest, Alaska Women in Timber, 1987, pages 123-124.