



Science Unit: *Renewable & Non-renewable Resources*

Lesson 2: *Properties of Wood*

School Year: 2009/20010
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Grade level: Presented to grade 4/5; appropriate for grades 2-7 with age appropriate modifications
Duration of lesson: 1 hour and 20 minutes
Notes: Exotic woods can be purchased at Windsor Plywood. Specific species (2 by 4s and other size samples) can be purchased at many lumber suppliers including Windsor Plywood and Nucassa.

Informational posters on the Pine Beetle can be obtained free of charge from the Geological Survey of Canada Bookstore in Vancouver.

Objectives

1. Discover why some tree species in B.C. are harvested while others are not.
2. Discuss properties that make tree species desirable for lumber and other products.
3. Test and/or examine the physical properties of different species of wood.

Background Information

Forests cover approximately two thirds of British Columbia and forestry is the leading sector of B.C.'s resource economy. The majority of the trees in B.C.'s forests are needle leaf trees. The lumber from needle leaf trees is referred to as softwood. This is because in general, wood from needle leaf trees is less dense and thus softer than that of broadleaf or hardwood trees. The purpose of this lesson is to introduce students to the idea that not all wood is created equal – and thus not all trees have the same economic value. For example, cottonwood is relatively plentiful in B.C. forests but is not logged in proportion to its abundance. This is because the properties of cottonwood make it unsuitable for many applications; its main market is as pulp. On the other hand, alder makes up less than 0.1% of B.C. forests yet accounts for almost 3% of the annual harvest. This is because alder is a very durable (hard) and attractive wood and is utilized extensively in the production of flooring, furniture, cabinets and other decorative items.

Vocabulary

Native species: Species that occur naturally in a specific area are said to be native to that area.
Broad leaf tree: A tree with broad leaves.
Needle leaf tree: A tree with needles (specialized kind of leaves)
Softwood: Wood obtained from needle leaf trees.
Hardwood: Wood obtained from broad leaf trees.
Deciduous tree: Trees that lose all their leaves on an annual basis, in B.C. this occurs in the fall.
Evergreen tree: (conifer) Trees that retain their leaves year round. (They lose and replace leaves continually, not all at once)



Materials

- Strips of wood (1 cm by 50 cm and 0.5 cm in thickness). cedar, spruce, fir, pine (2-4 per group)
- bucket (2)
- 200-400ml container for scooping water into buckets
- scale
- clamp(s) to affix wood to table
- pictures and samples of wood, bark and foliage from as many native tree species as possible
- heavy weight that is similar in diameter to the PVC pipe (below) - such as a large lead fishing weight (2)
- cedar, spruce and fir 2 by 4's cut into 5 cm lengths. (1 piece of each species per group)
- 1 m length of PVC or ABS pipe (2)
- Safety goggles (minimum 2 pairs)
- pieces of pine beetle affected wood (blue stained) (2 minimum)
- towels (in case of spills)
- straight-grained red oak cut into 1cm by 1 cm by 10 cm long sticks. Should be able to blow bubbles through the wooden "straw"
- A variety of wood samples from species native to BC
- Samples of exotic woods with interesting properties (2 samples of each)
- Tree "cookies" of alder and fir (2 of each)
- student worksheets
- pencils

In the Classroom

Introductory Discussion

1. Today we are going to continue our section on forestry. Last week we learned about different methods of logging that are used in B.C. We also discovered that some methods have the potential to cause harm to nearby streams and fish habitat (see Temperate Forest, Lesson 6, Trees and Erosion, Scientist in Residence Program web site, Science Lesson Plans <http://www.scientistinresidence.ca>). Today we are going to learn more about the most important part of logging, trees.
 - What are the two different types of trees? Hint – think about the difference between Christmas trees and cherry tree. Will likely say evergreen and deciduous. Introduce broadleaf and needleleaf instead. Explain that some "evergreen" species, for example larch, lose their leaves while some deciduous species do not (e.g. some species of oak, ebony – used in this lesson).
 - Mention the make up of BC forests (94% needleleaf; 6% broadleaf trees).
 - What kind of trees grow in BC? What kind of trees have you seen? (Write down all suggestions even if they are not species native to B.C. but discuss how some on the list are non-native and are planted for ornamental reasons. (Circle native species)
 - Species that naturally grow in a particular location (such as B.C.) are called native species. It is these native species that grow naturally in BC's forests and are available for the forest industry.
 - Add additional native species that were not mentioned. Have pictures or samples if possible.
 - Show chart of the predominant species that grow in BC forests, or write in order from highest to lowest depending on grade level of students:



SCIENTIST IN RESIDENCE PROGRAM

Top 10 species available by volume
spruce
lodgepole pine
balsam and true firs
Western Hemlock
Douglas fir
poplar & cottonwood
cedar (red and yellow)
birch
western larch
maple

- Based on this chart/list which species do you think are harvested most in B.C.? Do you think the amount harvested always depends on how much of a particular species exists? I.e. common trees are logged often and rare trees hardly ever?
- Show chart/list of actual species harvested. (or just discuss differences)

lodgepole pine
spruce
Douglas fir
western hemlock
cedar (red and yellow)
balsam
larch
alder
maple
birch
poplar & cottonwood

- Point out a few differences: LESS poplar and cottonwood; MORE cedar, alder and maple.
 - **Why are some species of trees preferred?** (brainstorm and write ideas on the board)
 - Is all wood the same? Introduce concept of different wood properties and relate to different uses. Show examples of a few types of wood. (can do this while mentioning each species above) Discuss the properties of the above mentioned species and relate to why they are logged more or less often.
2. Short description of other items to discuss or review.
 - Review safety issues discussed below.
 - The scientist should demonstrate each station activity.
 3. Briefly describe science experiment/activity.
 - Students will visit three separate stations to investigate various properties of wood.
 4. Briefly describe the processes of science that the students will focus on: For this activity the students will focus on good experimental design and execution (stations 1 and 2) as well as making observations, recording results and using their results and observations to come to conclusions (all stations).
 5. Briefly describe safety guidelines.



- For strength test, look out for splinters, wear safety goggles. Also, take turns and move slowly and carefully). The teacher or scientist will clamp the wood for you.
- Hardness test – be careful with heavy objects.
- All samples, watch for splinters and keep resinous samples on the protective trays. Wash hands with soap when finished.

Science Activity

Activity Title: Not all wood is created equal.

Purpose of Activity: To observe/test various properties of wood and compare them between species.

Methods and Instructions: Each station will be run in duplicate thus two sets of materials will need to be prepared.

Station 1: Wood should be cut into 50 cm long strips. 3 or 4 species should be tested, but if time is limited each group does not need to test each species.

Station 2: The wood samples (cedar, fir and spruce) must be cut into 5 cm lengths. The scientist will need to obtain some plastic pipe (PVC or ABS) and cut it to length (~1 m). The scientist should select an appropriately sized weight to ensure that it fits well in the tube and is also heavy enough to create noticeable dents in the wood. The weights should also be easy for the students to handle. When the lesson was originally conducted we used heavy brass handles from old fireplace pokers. However, large, elongated lead fishing weights should work equally well.

Station 3: obtain samples of blue stained pine beetle affected pine and unaffected pine. Most lumber yards will have 2 by 4s with blue staining, just sort thorough those on hand to find a suitable one. Cut small samples that the students can examine. Make the samples of affected and unaffected wood identical in size/dimensions to facilitate more equal comparisons.

Obtain samples small chunks of alder and fir trunks (or another slow growing species if fir is not available). Cut the trunk pieces into tree “cookie” so that the rings are clearly visible. If tree cookies are unavailable the grain ends of dimensional lumber can also be used.

Purchase or obtain samples of a variety of native and non-native wood species. Look for those with unusual properties – prominent knots, resinous, pleasant odor (cedar), interesting grain patterns, different colors and patterns etc.

Obtain a piece of very straight-grained red oak and cut it into small straws. If the grain is good the students should be able to blow bubbles through the straws. Test this beforehand. If you are unable to cut a new stick for each student, have the scientist or teacher use lab ethanol to disinfect the sticks between students. The straws can be dipped in ethanol and then rinsed several times in water to clean them for the next set of students. Do not let students handle the ethanol.

Brief description of how students will work in groups or pairs: Students will work in small groups of 4-5 for a total of 6 groups per class.

See worksheets for detailed instructions of each station.

Station 1: The teacher/scientist will clamp the wood samples to the table for each group and clamp the bucket to the free end of the wood. The students will then take turns adding water to the bucket until the wood breaks. The table height and bucket size should be matched to ensure the bucket does not have to fall far to land on the floor (to prevent spills). The students should be instructed to stand to the side of the bucket when they are adding water to it (to avoid being in the path of the breaking wood).

Station 2: Each group will receive one piece each of cedar, fir and spruce. The scientist will demonstrate how to do the hardness test. First place the wood block on the floor, grain end facing upwards. One end of the PVC/ABS pipe is then placed onto the grain end of the wood sample and the weight is dropped



down the tube. Instruct the students to always drop the weight from the same height (i.e. the top of the tube).

Station 3: See worksheet for detailed instructions.

Student observations and results will be recorded on the accompanying worksheets.

Closure Discussion

1. Review station answers. What differences did you find?
2. Which species from station 2 would make a good floor? When else might dents be a problem?
3. Discuss the aesthetics and uses of beetle-killed pine and exotic wood species.
4. Compare the speed of tree growth with the results of stations 1 and 2. Follow up with the density demo if time allows and relate growth speed to density and hardness.
5. Why are valuable/desired species not harvested more? (cost, location, accessibility, density of stands)
6. Why not plant more of these species when reforestation? (climate, precipitation, temperature, soil needs etc. of trees) Compare their knowledge of other areas of BC with Vancouver.

References

1. <<http://www.for.gov.bc.ca/mof/annualreports.htm>> Ministry of Forests and Range. Annual Reports. Accessed December 28, 2009.

Extension of Lesson Plan

1. Density Demo – using wood that is very light and floats well, moderately light (that floats low in the water) and very dense (sinks to the bottom, such as ebony).
2. See Lesson 5, Mountain Pine Beetle, from the Pacific Salmon and Mountain Pine Beetle science unit, Scientist in Residence Program web site, Science Lesson Plans <http://www.scientistinresidence.ca>.

Scientist: _____

Date: _____

NOT ALL WOOD IS CREATED EQUAL

STATION 1 – How strong is it?

The teacher or scientist will clamp each wood sample to the table. Each group member will then take a turn adding 1 scoop of water to the bucket until the wood breaks. Add the water slowly. After the wood breaks remember to weigh the bucket of water.

Type of wood tested: _____

Weight needed to break the wood: _____

Type of wood tested: _____

Weight needed to break the wood: _____

What differences (if any) did you notice between the two types of wood while you were testing them? Describe.

STATION 2 – How hard is it?

Each group will test three types of wood: cedar, spruce and fir. The wood samples can be tested more than once so that each group member will have a turn BUT each test must be done on a different part of the wood.

Procedure:

1. Place the wood block on the floor as shown in the demonstration.
2. Have one group member hold the black tube as shown in the demonstration.
3. The person doing the test drops the weight down the tube as shown in the demonstration.
4. Remove the tube and weight and examine what has happened to the wood block.

Compare the dents made in the 3 types of wood.

The wood with the biggest, deepest dent is the (circle one)

hardest

softest

The wood with the smallest dent is the (circle one)

hardest

softest

List the 3 types of wood from hardest to softest:

_____ (hardest)

_____ (softest)

STATION 3 – Comparing different types of wood

A. Examine the pine beetle wood. Compare it with the regular pine wood. Does the beetle damage change what you could use the wood for? Explain why.

B. Compare the size of the growth rings of the fir tree with those of the alder tree. What difference do you notice? Which tree grows bigger faster? (Remember each ring = 1 year of growing.)

C. Take some time to examine all of the different types of wood on display. Think about the different properties and uses of each type. Discuss them with your group.

D. Red oak sticks. When you have finished all of the questions above ask the teacher or scientist for a red oak stick. Put one end in your mouth and one end in a cup of water. Try blowing into the stick... What happens? When you are finished put the stick into the container labelled “dirty” so it can be disinfected.