"A Tree's Story – From Seed to Finished Product"

Forestry Week 2007

Topic – Following the story of a tree from seedling to wood product.

Materials:

- Lesson Plan
- Display board and pictures for Part I
- Set of 3 flowcharts related to sawmill, pulp & paper mill & plywood plant for Part II
- Samples of: cone and seed, log (tree cookie), lumber, finger joint, pulp (4 stages), veneer, plywood, LVL (Golden) for Part II
- Cruiser's vest and equipment
- Grab Bag for Part III – soap, cement, non-breakable glass, ping pong ball, pencil, wooden ruler, paper, sponge, rayon, Kleenex, battery, bamboo, rock

Classroom handouts:

- Activity sheets… set of woodlands pictures (black & white) for each school
  Quiz and answer sheet for wood products
- Website list handout.

We have requested that each class have the following:

- A table for you at the front of the room to hold your resources.
- An area at the front of the room where you can put up your display poster.
- An area where you can display the pictures…. Chalkboard ledge or table against the front wall, etc.
- Overhead projector

Lesson:

Introduction: (About 3 min.)

- Come dressed for the bush… vest, flagging tape, tools, hard hat, etc.
- Introduce yourself … who you work for and what your job is.

Setting the Hook:

- "When I work in the bush, I often have to wear my cruising vest and carry along some equipment." Briefly explain what 2 or 3 items are used for. (hardhat, whistle, compass). I use these items when working in the woods. Today, I am here to tell you "A Tree's Story".
- "When you are very young you are called a baby. What do we call a very young tree?" *Seedling*
- "Seedlings can grow naturally in the forest. When a tree drops its cones and the seeds fall onto the ground, the seed can sprout and a new tree will start to grow. This is called Natural Regeneration. (&) A new forest can also start from seedlings that people plant."

Part I – The Tree: (12 min.) – Place the woodlands pictures on the display board one at a time… talk about each picture as you put it up.

Picture #1 – Nursery

- A tree nursery is made up of very large greenhouses and is a place to grow seedlings. Tree cones are collected and the seeds gathered from them are planted into containers. The containers are labeled with the tree type and location of where it came from. The seed grows into a seedling and is cared for by forest workers for 1-3 years. What do seedlings need to grow? *Food (nutrients), sun, air, water, soil, space.* **(show cone & seed)**
- Explain: By law, companies must replant or be certain that natural regeneration takes place after a site has been harvested. (cut down)

Picture #2 – Reforestation (Planting seedlings to grow a new forest.)

- Seedlings used for reforestation are generally 1-2 years old.
- Forest workers have been reforesting harvested areas for more than 75 years.
- The "5 Billionth Tree" was planted in Prince George in 2002
- The "6 Billionth Tree" will be planted next year.
- Before harvesting an area, cones are gathered and the seeds collected from them are sent to the nursery. Later the seedlings from those seeds are used to reforest the harvested site. This is important because the seedlings will be used to the weather conditions of the area. eg. A seedling grown from a Southern BC pine cone will not grow well in the north where the winters are longer and colder.
- Older Students: Reforestation takes place in the spring and summer which makes tree planting an excellent job for university students. The work is hard but the pay can be quite good.

Picture #3 – Brushing and Weeding

- Just as your garden needs care and attention, planted sites must be looked after.
- Any plants growing up around a new seedling might be robbing the seedling of food, water or sunlight so forest workers will remove the competing brush using special tools. One tool is called a brush saw and another is a weed whacker.

Picture #4 – Spacing and Thinning

- Trees need to have space to grow. What do you do in your garden to help your carrots grow large and straight? Why? *Thin the carrots - Thinning cuts down on the competition for food (nutrients), soil, water, sunlight and space to grow*.
- Forest workers will sometimes thin a young forest.

Picture #5 – Protection

- Forest companies manage (look after) and protect a new plantation until it reaches the "Free Growing" stage. This means the young tree is bigger and stronger than the bushes around it. This can take 7-15 years.

- Companies managing a forest are responsible for protection against fire, bug infestation and diseases. Once the forest is "Free Growing" the Ministry of Forests (Government) is responsible for its protection.
- What bug is a very big problem in BC? *Mountain Pine Beetle*
- How much of BC's Forests have been affected by the MPB so far? *15% or approximately 1/6.* (Have the students stand up and then have every 6th person sit down. The people sitting represent the trees killed by MPB)

Picture # 6 – Pre-Harvest Planning

- Who do the forests belong to? *You and me.*
- Before companies can cut down trees, they must prepare a set of plans that the Ministry of Forests and Range (government) approve.
- These plans must include the needs of other users of the forest. Who else uses the forest? *People, animals, etc*.
- These users all have different needs that must be thought about when planning to harvest an area. Some people want the forest for recreation like hiking, skiing and mountain biking. Some areas need to be protected because they are special to certain animals… Eg, - caribou corridor and calving area needs to be protected.
- This planning and approval stage can sometimes take several years.
- Older students: What events might change a planning schedule? *Fire, bug infestation, etc.*

Picture #7 – Harvest

- Harvesting can involve many different types of machines. Can you name some of the machines used to cut down trees and pull them to a spot where they can be loaded onto trucks? *Take a few answers and add any key machines that are left out.*
- Sometimes large areas of trees are cut down and other times only a few may be taken. This depends on the site, the age of the trees, and the reason the trees are being cut down. Eg. The mountain pine beetle is killing large areas of lodgepole pine which means a large area of trees must be harvested. In a healthy forest with different types of trees and different ages of trees, we may go in and take out single mature trees.
- Older Students: Technology allows us to leave a smaller imprint on the environment. For example, the processor can do 3 jobs. It can delimb a tree, cut it into set lengths then lay the log onto a pile. One machine replaces many machines… smaller footprint.

Picture #8 – Site Preparation

- Once a site has been harvested, the area may need to be prepared for planting. This will normally take place 1-2 years after harvesting. Like a garden that must be tilled to make it ready for planting, the forest may need some scarifying (like tilling) or mounding to create the best site for a seedling so that it has the best chance of living.
- What comes next? *Planting… the cycle starts again…The story is a circle that repeats itself over and over again.*

Part II - The Log (Flowcharts) (10 min.)

- The harvested tree will have its branches removed and it will be cut to a planned length. It is now called a log **(show tree cookie)** and it will be sent to a mill. Today we are going to look at 3 different mills - a plywood plant, a sawmill (lumber mill), a pulp and paper mill
- Plywood Story: Explain the flowchart and **show the veneer pieces and then the plywood.** Talk about how the veneer is layered and glued together with the strength of the veneer flowing up and down for one layer then across for the next… alternating to give the plywood strength. (**Golden**: take this to the next step and explain the difference between LVL and regular plywood… show a sample of LVL.)
- Sawmill Story: Explain the flowchart. **Show the end products.** Explain that even small pieces of lumber can be made into very strong large pieces of lumber by finger-jointing them. Use your fingers to show how the pieces fit together and are glued into a stronger piece of wood than what it was before. This means we can have less waste.
- The Pulp and Paper Mill Story: Explain the flowchart and **show the examples**. Explain that poor quality wood and sawmill waste goes to pulp.

Part III - The Products (10 min.)

- Grab Bag Game – Explain: When you make a cake, you have a number of ingredients like flour, sugar, salt, eggs, butter, etc. Wood, like a cake, also has a number of ingredients, for example: cellulose and lignin. If you think about the pulp process, wood chips were cooked down into a mushy mixture (like a cake mix before it is cooked). We can use science to separate the pulp into its many ingredients and then use those ingredients to make other things. For example, we can use the cellulose from wood to thicken things. Lignin is a natural glue.
- In my bag I have a number of items, some of them have an ingredient from wood in them and some don't. As I pull the item out, I want you to raise your hand if you think it might have an ingredient from wood in it. I will group the items that have something from wood in them in one pile and those that don't in another.
- Pull the items out one at a time and let the students vote by raising their hand.
- When you are finished, tell the students to watch carefully. Move the items to the correct place. Explain what ingredient from wood is in the item.

soap - wood oils
Artificial sponge - cellulose
paper – pulp
pencil & ruler- wood
rock *– non-wood*
kleenex - pulp
Rayon - comes from processed cellulose
ping pong ball - cellulose nitrate plastic
flashlight battery - heavy paper casing (pulp)
bamboo *– world's largest grass – not wood*
cement - sawdust is used as a filler
shatterproof glass – chemicals from cellulose

Conclusion: We use wood for many things. We build with it, we write on it, and we use it to make new things. If we want to have all of these wonderful things, we need to take good care of our forests. We want to be sure that a new forest is growing so that we will always have wood. Wood is very special because it can grow back… it is renewable.
- Mention handout pages to teachers.

**Any extra time can be used for discussion or perhaps dressing one of the students in your gear.

PLYWOOD PLANT

1. **Barker and Cutoff Saws**: Claws take bark off the logs and cut logs → different lengths.	2. **Hot Water Vats**: Logs are softened in hot water to make it easier for peeling.	3. **Lathes**: Logs are peeled, like unrolling paper towel. The clipper cuts the peeled veneer → different sizes.
6. **Veneer Welders**: Veneer pieces are recycled and glued together.	5. **Dryer**: Veneer pieces are put into huge dryers that are heated by steam, using waste wood.	4. **Stackers and Green Chain**: Sheets of peeled veneer are removed and sorted → piles.
7. **Lay-Up Line**: Sheets of veneer are glued together to make plywood.	8. **Hot Press**: The plywood is heated and pressed so that the glue sticks and the plywood is strong.	9. **Automatic Sizing Saws**: The plywood is cut to the right size.

LUMBER MILL

1. **Tree Deck**: Large loaders pick up & carry logs to a pile where they are sorted → plywood or lumber logs.	2. **Debarker**: High speed barker tips remove the bark from each log.	3. **Slasher Saw**: Saws cut the logs to 101 ". They are then sorted → bins according to size.
6. **Gang Edgers**: The cant is cut into lumber and sorted by size. 7. **Denis Line**: Small logs are handled separately, but in a similar way.	5. **Twin Band Saws**: Two vertical saw blades cut a plank off each side of the cant.	4. **Endogger**: Larger logs are fed through chipping knives that produce a square edge, called a cant.
8. **Kiln**: Lumber is stacked, leaving spaces, allowing warm air to evenly dry the	9. **Planing & Grading**: The dried lumber is now planed to make each side smooth, then trimmed and graded	10. **Packaging**: The packaged wood products travel by boat, rail and truck to other parts of

wood (35 hours).	for quality.	the world.

PULP AND PAPER

	Wood Chips Wood waste from sawmills and wood from poor quality trees are used to make pulp and paper.	**Screen and Cooking** Chips are moved on a conveyor belt to be cooked in the digester until most of the wood glue (lignin) is dissolved.	**Washing** The pulp mixture (or slurry) is washed to separate the lignin and chemicals from the cellulose fibres (or pulp).	**Screening** The slurry is screened to remove uncooked pulp fibres.
PULP BALES The sheets of pulp are baled, wrapped and stored in a warehouse before shipment around the world.	**Cutting** …and cut into sheets.	**Drying** …and dried…	**Sheet forming** The bleached pulp slurry moves onto a mat on the pulp-making machine, where it is formed…	**Bleaching** The slurry is bleached in the bleach plant to make it white and then cleaned.

PAPER ROLLS The rolls of paper are wrapped and stored in the warehouse before shipment around the world.	**Cutting** …and cut into rolls.	**Drying** …and dried…	**Sheet forming** The unbleached pulp slurry moves onto a mat on the paper-making machine, where it is formed…	**No bleaching** The slurry that will become brown paper is not bleached.

Flowcharts: Try to ask questions as you walk the students through the flowcharts. Do not read from your notes, instead, pre-read the information provided and then during your presentation, try to share the basics from memory. Below is a very simplified version of the background already provided but it will help you to see how to simplify the material so that even a student in kindergarten can understand. **Remember**: try not to read as you walk them through the flowchart. Eye contact and interaction will keep the students focused.

Plywood

1. What would be the first thing that has to be done to a log before we can make plywood? Remove the bark and cut it into lengths.
2. Now we have to soak the log to soften it up.
3. Next we are going to peel layers off the log…. Just like peeling an apple or unrolling paper towel. You do this until you have a small core of wood … the core can later be used for fence posts.
4. As the wood is peeled, it is cut into lengths and stacked up.
5. This is wet wood. What will we want to do next? Dry it.
6. Smaller parts of veneer are joined together to make larger sheets.**(veneer sample)**
7. Many layers of veneer are glued together to form plywood. **(plywood sample)**
8. When you are gluing things, do you sometimes have to push down on what you are gluing to hold everything in place as the glue dries? The same thing happens when making plywood… plywood is heated and pressed so that the glue sticks.
9. What would have to be done to make all of the edges of the plywood look neat and tidy? Some cutting to even out the edges.

Sawmill/Lumber Mill

1. The logs are stored in piles ready for the mill.
2. What was the first thing we did to the log when making plywood? Remove bark.
3. Once the bark is removed, what will we do with the log? Cut it into lengths and sort according to how big around they are. Large logs are kept together to go through one set of saws while the smaller logs go through another set.
4. How do we make a round log into square pieces of wood? First the log goes through chippers to square off the edges… it is now called a cant.
5. Then the cant has thin slices or planks cut off 2 sides
6. Then the planks are cut into lumber and sorted by size. Smaller logs are handled the same way but by machines that can handle the smaller sizes.

7. Remember that we had to dry the veneer? We have to dry the lumber. Do you know why? If you don't dry the lumber slowly and evenly, it can become warped or bent. Could we build a straight wall with bent wood?

8. Now we have rough lumber and we want to make it smooth by planning or shaving off the rough edges. The lumber is then graded and separated piles that are really good pieces (clear wood, no knots) and lesser pieces (have some knots)… Clear pieces sell for more. **(lumber sample)**

9. The lumber is packaged and sent to buyers all around the world.

What do you think happens to the small pieces that are left over?...**Explain Finger joint sample.**

Pulp and Paper

1. We use wood chips to make pulp and paper. Wood is made up of lignin (glue) and cellulose (pulp). **(Wood Chip Sample)**

2. The wood chips are cooked down to make a mushy substance or mixture. If you tear a newspaper into tiny little pieces and add water, you get a mushy pulp mixture called slurry. The cooking process dissolves the lignin (glue).

3. The slurry is washed to separate out the lignin (glue) and the chemicals (added when cooking the mixture) from the pulp fibres (cellulose fibres).

4. The Pulp is then put through a screen (sieve) to remove any uncooked pulp pieces.

5. Then the pulp can go to two different places.

i) It can go to be bleached…. If we bleach something, it loses its color. The bleached slurry or pulp becomes white and clean. **(White pulp sample)**

It is then formed into long, flat sheets and dried before cutting it into smaller sizes and packaged to go to a buyer. **(White paper sample)**

OR

ii) It can miss the bleaching and remain a brown color. **(brown pulp sample)** Then it is formed into long flat sheets, dried and cut into smaller sizes ready for packaging. **(brown paper sample)**