# SCIENTIST IN RESIDENCE PROGRAM

**Science Unit:** *Resource Extraction and the Environment*

**Lesson 2:** *Ecological Impact of Wood Extraction*

School year: 2008/2009

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Grade level: Presented to grades 4 - 5; appropriate for grades 4 – 7 with age appropriate modifications.

Duration of lesson: 1 hour and 20 minutes

## Objectives

1. Learn how deforestation causes soil erosion

2. Learn strategies for sustainable wood harvesting

## Background Information

As a society we need to extract resources to heat and build our homes. Wood is one of these resources. However, indiscriminate extraction will affect the ecosystem in many ways. Soil erosion is one of them. In hilly forests, such as the ones in BC, the trees prevent the soil from being blown away by wind and rain. When the trees are cut, rain and wind can hit the soil directly and cause soil erosion. When erosion occurs it becomes difficult to replant the area, as the soil simply is not there.

Our need of wood products is never going to cease, so we need to find way to extract wood in a sustainable way. Clear cutting is a practice that has short term economic benefits, as it requires low manpower, but it has a high ecological impact. It removes many trees from the same area, increasing soil erosion and reducing habitat space for the animals of that ecosystem. Selective cutting, or sustainable extraction, removes trees from a large area but only a few from per square kilometer. This practice opens the forest canopy, which simulates the natural falling of trees. It also preserves animal habitat and prevents soil erosion. Sustainable logging also ensures the forest remains, which also ensures the jobs of the loggers in the future.

## Vocabulary

| Word: | Brief definition. |
| --- | --- |
| Erosion | Wearing away the land surface by removing topsoil faster than the process of soil formation |
| Landslide | The downward sliding of soil from a steep slope |
| Clear-cutting | The practice of removing all the trees from a given area |
| Sustainable cutting | The practice of logging an area removing only adult trees and allowing the forest to replenish those trees that were logged, so there are always trees to be cut. |

**Materials: (per group)**

- Tarp to cover tables
- Toothpicks (100s per student)
- Flat surface (styrofoam lids/ tiles/ cardboard)
- Light sand and soil
- Spray bottle
- Water

- Blocks (to tilt the flat surface containing the soil and sand)
- Pretzel sticks (one large bag)
- 2 containers per student (to keep the pretzels)

## In the Classroom

**Introductory Discussion**

1. What is the importance of wood for animals?

    - Discuss the forest dioramas and the importance of trees in those ecosystems

2. Look around you. How many objects can you find that are made of wood?

3. Where does the wood come from?

4. What are the effects of our extraction of wood? (make a list)

5. What do you think would happen to the soil if we took all the trees away?

    - Define clear cutting and sustainable cutting

    - Discuss the concept of erosion

    - Introduce the experiment

**Science Activity: Soil Erosion by deforestation**

Discovering the effect of wood extraction from the hillside

Experiment setup

1. Use the tarp to cover the work area

2. Take one flat surface and divide it into 3 equal sections

    a. Sections A, B and C

3. Apply treatments

    a. Section A: add 100 toothpicks in a random way (natural forest - control)

    b. Section B: add no toothpicks in the second section (clear cutting – treatment 1)

    c. Section C: add 50 toothpicks in a random way (sustainable cutting – treatment 2)

4. Add a thin layer of sand to the entire lid

5. Cover the sand with a thin layer of soil

6. Use the block to carefully tilt your forest

7. Fill spray bottle with water

Experiment

1. Obtain a deforestation and soil erosion worksheet

   a. Fill in the Experiment setup and Methods sections of the sheet

2. Spray water (start with 50 sprays) on Section A (control) and take notes in results section of the worksheet

3. Spray the same amount of water on sections B (treatment 1) and C (treatment 2)

4. Repeat steps 1 and 2 if necessary

Discuss the outcome (Clear cutting causes more erosion than random cutting)

NOTE: The number of sprays it takes to cause any sand/ soil to slide depends on the lightness of the sand. If after 150 sprays nothing happens. Simply pour water on the top (20 ml is enough for a small setup)

**Science Activity#2:** Sustainable reforestation

Play reforestation game

Rationale:

The game has rounds and turns. Each turn represents an 'operation' and round represents a year. At each operation you can get a maximum of 5 trees and you can have 2 operations per year; so each round will have 2 turns. At the end of the round, you can add to your forest half the number of trees you currently have (rounding it up). If you have 0 trees left, you must wait 2 rounds for the forest to grow back to harvesting size.

Rules:

1. Before the beginning of the game you will be given 2 minutes to think about a sustainable strategy

2. Everyone will start with 10 trees

3. Each turn will last 30 seconds and each round will have 2 turns

4. We will play for 20 rounds = 20 years

5. You can harvest a maximum of 5 trees each turn = max. 5 trees per operation

6. Mark on your sheet the number of trees harvested at the end of each year.

7. Count the trees left in you forest cup, divide that number by 2 (round it up) and add that many trees to your forest cup.

8. If at the end of any year you have no trees, you must wait 2 years to get 5 trees in your forest

9. You should keep all your pretzel trees you 'harvest' in your timber cup (DO NOT EAT only eat them at the end of the activity)

Playing the game:

1. Set the scenario

You are a logger in British Columbia. You have a family of 6: wife/ husband and 4 children. The government of Canada granted you a permit to log a hillside in Squamish for 20 years. This area has never been logged before. You have enough equipment and workers to go logging twice a

year. This is what in the industry they call an "operation". You need to get enough timber to pay your workers and feed you family, so coming back from the forest without any wood isn't an option. However, you received the ability to extract wood from this lot one year earlier that you expected. So for the first year, if you wish, you can go extract or not. It is your choice.

You are also a very environmentally conscious logger, and you want to make sure to leave some trees for the organisms that live there and you also want to make sure to have plenty of trees to log for 20 years!

Now here comes the hard part: how to get enough timber to make money but also leave a healthy forest behind every time you leave the hillside?

2. Explain the game rules –instructions are also on the reverse side of the tally worksheet

3. Hand each student a Tally worksheet

4. Hand each student 2 cups:

   a. Label cup #1 "Timber Cup"

   b. Label cup #2 "Forest Cup"

5. Give each student 10 pretzels that will go in their "forest cup"

6. Ask students to write "10" under "number of trees" in year 1 of the worksheet

7. Draw on the board a table to keep track of the years and operations

| Operation \ Year | 1 | 2 | 3 | 4 | … |
|---|---|---|---|---|---|
| Start | 10 | 8 (5 + 3) | | | |
| 1 | 3 | | | | |
| 2 | 2 | | | | |
| Net total | 5 | | | | |

Before starting:

   a. Make sure everyone understand the rules

   b. Ask them to think of a sustainable way to log their forest

Results:

How much timber did you get after 20 rounds? How many trees are left in your forest?

What strategy did you employ? Why?

If we were playing the game again, how would you change your strategy?

**Closure Discussion**

Display the Biome dioramas that contain forests and ask:

1. What would happen if we cut all the trees?

2. What would be the consequences to the ecosystem?

3. What are the strategies we could use to minimize our impact?

**References**

1. < http://www.cnie.org/NLE/CRSreports/Forests/for-21.cfm#The%20Clearcutting%20Controversy> CRS Report for Congress. Gorte, R.W., "Clearcutting in the National Forests: Backgroung and

Overview". National Library for the Environment. Web site hosted by National Council for Science and the Environment (NCSE). Accessed Jan. 19, 2009.

2. Trees and Erosion, Lesson 6 from the Temperate Forest science unit, Life Science curriculum area, available from the Scientist in Residence Program website http://www.scientistinresidence.ca.

**Extension of Lesson Plan**

1. Students should investigate the effect of harvesting trees on the ecosystem balance and present their results theatrically – the play should have producers, consumers and humans, and it must show the interaction between the actions of humans on the other organisms and the climate.

2. Investigate ways to reduce wood consumption

# Sustainable Extraction Game

## General Rules:
1. Do not eat anything during the game
2. Make sure to take only what you need
3. At the end you are welcome to keep and eat all your 'trees'

## Game Rules:
1. You were given a concession to extract wood from this land for 20 years
2. Each year you can have 2 harvesting operations
3. You may decide to take between 0 and 5 trees in each operation
4. You can harvest a **MAXIMUM of 5 trees per operation**
5. If at any time you have 'zero' trees in your land you have to wait 2 years for the natural forest to re-grow to harvesting size
6. We will play 1 minute for each year – so you have 30 seconds to decide how many trees to harvest in each operation
7. Harvest your trees carefully. Think about a strategy to maximize the number of trees you can extract without hurting the forest too much.

## Playing:
1. Think about a wood extraction strategy that you think might be sustainable
   a. You have 2 minutes for this
2. Take 10 pretzel sticks and put it in your 'forest' plate
   a. Each pretzel represents one tree
3. In 'Year 1' of your tally sheet write the number of tree you have when you start (10 trees)
4. Each year you can have up to 2 operations:
   a. Decide how many trees you would like to extract in operation 1 of year 1
   b. Take that number of pretzels from your forest plate and put it in your 'timber' cup
   c. Write down the number of trees you took in operation 1 in your tally sheet
   d. Decide how many trees you would like to extract in operation 2 of year 1
   e. Take those trees and write the number down on your tally sheet
5. In 'Year 2" of your tally sheet write down the number of trees left on your forest plate
6. Proceed with extracting your trees for the next 19 years.

7. At the end of the game you will access whether your strategy worked and what was the impact for the logger's pocket and his/her family and the forest ecosystem.

**Extraction Tally sheet**     Name: _____

| Strategy: | | | |
|---|---|---|---|
| | Number of Trees | | Number of trees |
| **Year 1** | | **Year 11** | |
| Operation 1 | | Operation 1 | |
| Operation 2 | | Operation 2 | |
| **Year 2** | | **Year 12** | |
| Operation 1 | | Operation 1 | |
| Operation 2 | | Operation 2 | |
| **Year 3** | | **Year 13** | |
| Operation 1 | | Operation 1 | |
| Operation 2 | | Operation 2 | |
| **Year 4** | | **Year 14** | |
| Operation 1 | | Operation 1 | |
| Operation 2 | | Operation 2 | |
| **Year 5** | | **Year 15** | |
| Operation 1 | | Operation 1 | |
| Operation 2 | | Operation 2 | |
| **Year 6** | | **Year 16** | |
| Operation 1 | | Operation 1 | |
| Operation 2 | | Operation 2 | |
| **Year 7** | | **Year 17** | |
| Operation 1 | | Operation 1 | |
| Operation 2 | | Operation 2 | |
| **Year 8** | | **Year 18** | |
| Operation 1 | | Operation 1 | |
| Operation 2 | | Operation 2 | |
| **Year 9** | | **Year 19** | |
| Operation 1 | | Operation 1 | |
| Operation 2 | | Operation 2 | |
| **Year 10** | | **Year 20** | |
| Operation 1 | | Operation 1 | |
| Operation 2 | | Operation 2 | |

Name: _____

**Deforestation and Soil Erosion Worksheet**

Experiment setup:

| Natural Forest (Control) | Clear-cutting (treatment #1) | Sustainable cutting (treatment #2) |
|---|---|---|
| Number of toothpicks: _____ <br> Amount of water: _____ sprays | Number of toothpicks: _____ <br> Amount of water: _____ sprays | Number of toothpicks: _____ <br> Amount of water: _____ sprays |
| **Methods:** (describe what you did) <br><br><br><br><br> | **Methods:** (describe what you did) <br><br><br><br><br> | **Methods:** (describe what you did) <br><br><br><br><br> |
| **Results:** (What happened?) <br><br><br><br> | **Results:** (What happened?) <br><br><br><br> | **Results:** (What happened?) <br><br><br><br> |

**Conclusion:** (Which method of wood extraction causes less soil and sand to slide off the tile?)

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