TIMBER!

METHOD

In a simulation, students model what happens to a forest when trees are cut faster than they are planted, and graph their results.

MATERIALS

For each group of four students:

- 120 craft sticks in a sealable plastic bag
- 32 craft sticks in a sealable plastic bag
- Timer
- Forest Chart (provided)
- Graph paper

INTRODUCTION

People rely on wood from trees to heat their homes, to cook their food, and to provide building materials and paper for homes, schools, and businesses. The more people there are, the greater the demand for wood. While it takes only seconds to cut down a tree, it takes years to grow a new one. We also depend on forests to regulate climate, clean the air, filter water, conserve soil, and provide homes for many birds and animals. In almost every part of the world, trees are being cut down at a faster rate than they are being replaced.

COUNTING ON PEOPLE

K-5 Activities for Global Citizenship

CONCEPT

Renewable resources, such as trees, are often used faster than they can be replaced.

GRADE LEVEL

Upper elementary

SUBJECTS

Science, Math, Social Studies

OBJECTIVES

Students will be able to:

- Discuss what happens when trees are cut down faster than they are replaced.
- Create line graphs to show the outcome in a model forest when more trees are cut than planted.
- Explain at least two reasons forests are important and two ways to help protect forests.

SKILLS

Adding whole numbers, doubling whole numbers, collaborating in small groups, analyzing data, setting up and drawing a line graph

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PROCEDURE

1. Divide the class into groups of four students. Ask students to think of ways that people use wood, both here in the U.S. and around the world. Write answers on the board. *(For building materials, paper, and furniture, for fuel to heat homes and cook food, etc.)*

2. In their groups, ask students to write down a list of reasons forests are important and a list of reasons forests are being cut down. *(Forests are important because they clean the air, provide shelter for wildlife, grow things we use like fruits, hold the soil in place, etc. Forests are being cut to provide wood for things like houses, furniture and paper, and to make space for farms, housing, roads, etc.)* Ask a few groups to share.

   Explain to students that while **deforestation** – cutting down the trees in a forest – happens for many reasons, today you're going to thinking about trees that get cut down so their wood can be used for things like building materials, heating homes, paper, etc.

3. Within their group, each student should take on one of the following roles: lumberjack, forest, forest manager, and timer.

4. Distribute the two bags of craft sticks, the timer, and a Forest Chart to each group.

   The student representing the forest should take the Forest Chart and the bag with 120 sticks. These sticks represent the trees in the forest – the trees available to the lumberjack for cutting.

   The student representing the forest manager should take the bag with 32 sticks. These sticks represent trees that will grow during the game.

5. Complete the first minute of the simulation simultaneously, explaining instructions and directing students.

   a. The timer indicates when 15 seconds have passed. Every 15 seconds for the rest of the simulation, the forest manager adds one tree to the forest (i.e. four trees every minute). In doing so, the forest manager simulates the average rate at which trees grow to maturity and become timber reserves in the real world.

   b. Stop at the end of the first minute and instruct the lumberjack to remove one tree from the forest. The tree represents the amount of wood the world needs at its present population.

   c. The forest records the transfer of trees, both those added to the forest and those cut down, on the Forest Chart. The information for the first minute is already filled in.

   d. At the end of each succeeding minute, the world's demand for wood doubles as a result of a growing population and increasing demand. At the end of the second minute, the lumberjack cuts two trees from the forest. At the end of the third minute, the lumberjack cuts four trees from the forest; then 8, 16, 32, 64, and 128.

6. Groups continue the simulation independently. It ends when all of the trees in the forest have been removed.

7. Ask students to sort the trees back into their original bags. They can simply separate out 32 sticks for the “forest manager” bag and put the remainder in the “forest” bag.

Minute	Number of Trees at Start of Minute	Number of Trees Planted	Number of Trees Cut	Number of Trees at End of Minute
1	120	+4	-1	123
2	123	+4	-2	125
3	125	+4	-4	125
4	125	+4	-8	121
5	121	+4	-16	109
6	109	+4	-32	81
7	81	+4	-64	21
8	21	+4	-128	

8. Discuss the following questions:

   a. How many minutes did it take for the lumberjack to cut all the trees in the forest?

   Just over seven minutes. At the end of seven minutes there were only 21 trees left. In the eighth minute, there would not be enough trees to meet the demand.

   b. Was the forest always shrinking? Explain.

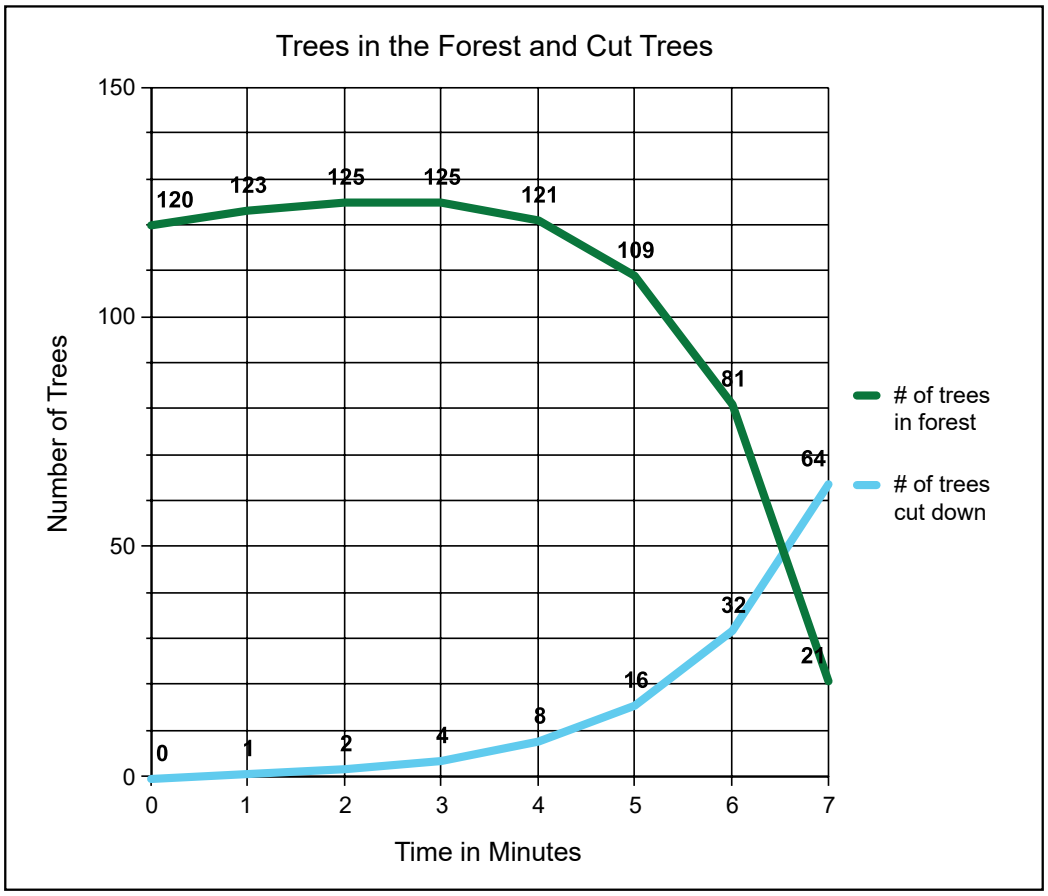
   No. By the end of the second minute, the forest increased by five trees (from 120 to 125) and stabilized for another minute. Starting with the fourth minute, the doubling of trees being cut made the forest start to shrink.

9. Distribute a piece of graph paper to each student. Explain that graphing situations like that of our forest can give us a clearer picture of the quantity of a resource over time.

10. Students should set up their graph with “Number of Trees” on the y-axis and “Time in Minutes” on the x-axis. Instruct students to use the numbers from their charts to make a line graph that plots both the number of trees that were cut and the number of trees left in the forest at the end of each minute.

    Alternatively, students can create an electronic graph. NCES’s Kids’ Zone has an easy **Create a Graph program**. Hint: When you create your data set on this site, there will be “seven items” (the minutes) and “two groups” (trees cut down and trees in the forest).

11. Optional: Challenge students to suggest possible modifications to the supply (how/why trees are being planted) and demand (how/why trees are being cut) of trees in the forest that would change its fate. Run the simulation several more times to try out the modifications. Students may be able to find a method for sustainable management. Ask students to consider what human behaviors would need to change in order to achieve their sustainable management strategy.



DISCUSSION QUESTIONS

1. What might happen when trees are cut down faster than they can be planted? Think of who/what depends on the forest and what the forest provides.

   Answers may include: loss of biodiversity in forest communities, loss of habitat for animals that live in forests, less shade, air quality suffers, etc.

2. If the forest manager could develop a tree that grows at a rate of one tree per second, would tree growth keep up with timber demand? Why not?

   No. The doubling of the use of wood due to increased population size would still lead to the demise of the forest. If the simulation was done with 60 sticks added to the forest each minute, it would only increase the life of the forest by two years.

3. What could be done to prevent the forest from being fully cut down?

   Changes to both the supply and demand are useful in preserving the forest. In general, the forest can only be maintained if we replace what we cut down. So, we would need to plant as many new trees as we remove. Less trees would need to be cut if people conserve the use of tree products such as paper, packaging, and lumber.

4. Does planting a new tree make up for cutting down a mature tree? Why or why not?

   Sometimes yes and sometimes no. A new tree does not immediately provide the same services as a mature tree.

   Optional: Discuss the different between old-growth and new-growth forests.

MEASURING LEARNING

Have students draw a tree (or provide them with a printed tree image) and write the services and resources that a mature tree can provide inside the image. Outside the tree have them write ways to preserve trees. After completing the activity, the trees can be hung up on a wall to create a classroom forest!

FOLLOW-UP ACTIVITIES

1. Read the book *Wangari's Trees of Peace: A True Story from Africa* by Jeanette Winter (2008). Wangari Maathai was awarded the Nobel Peace Prize in 2004 for her efforts in conservation. She is a prime example of how to think globally but act locally, as her devotion to planting trees in her home country, Kenya, has turned into a worldwide tree planting movement called the **Green Belt Movement**.

2. Poet Ogden Nash (1902-1971) wrote the following verse to describe his feelings about the beauty of trees and the danger they are in:

   "I think that I shall never see
   A billboard lovely as a tree.
   Indeed, unless the billboards fall,
   I'll never see a tree at all."

   As a class, discuss the meaning of the poem and how, with only a few words, the author has delivered a powerful and memorable message. Invite students to write their own short verse about trees. This could be in the form of a limerick, haiku, or other rhyming or non-rhyming verse.

3. Organize a tree planting event at your school or in your community. To organize a tree planting event and secure saplings, contact your local nursery. Alternatively, contact the Arbor Day Foundation for more information.

Timber! originally appeared in Two Cans and Toucans: Exploring Shrinking Habitat developed by Biological Sciences Curriculum Study (BSCS), Colorado Springs, CO for The National Science Foundation's National Science and Technology Week packet, (c)1990.

TIMBER! FOREST CHART

Minute	Number of Trees at Start of Minute	Number of Trees Planted	Number of Trees Cut	Number of Trees at End of Minute
1	120	+4	-1	123
2				
3				
4				
5				
6				
7				
8				

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