



# Deforestation

By Pam Blanchard.

### Focus on Inquiry

The student will collect data through a simulation game on deforestation and be able to describe how humans have impacted a simulated forest.

### Lesson Content Overview

Students will learn about subsistence farming and its role in rain forest (primary) forest deforestation.

<b>Duration</b> 60 minutes	<b>Setting</b> classroom	<b>Grouping</b> 2 to 4 students	<b>PTI Inquiry Subskills</b>
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Lesson Components	Estimated Time	Inquiry Subskills Used	Technology Used	Level of Student Engagement	Brief Description
<i>Engage</i>	15 min	3.6	Internet	3	Students quiz each other on facts about deforestation to generate curiosity and interest. Students then view a NASA visualization of rainforest deforestation and make observations. Another Internet mapping tool is used to zoom into the area.
<i>Explore</i>	30 min	3.7, 4.2	None	3	Students perform a simulation of deforestation due to subsistence farming. They record data for analysis.
<i>Explain</i>	15 min	5.7, 5.9, 7.3	None	2	Students share graphed data in a gallery walk. They discuss how their forest plots changed due to human activity. They also discuss how this simulation has both strengths and weaknesses in representing reality.
<i>Expand (optional)</i>	15 min	3.6	Internet	2	Students use the Global Forest Watch mapping tool to investigate an area of the Earth they are personally interested in. They describe in writing how this area has changed over the last 10-20 years.
<i>Evaluate</i>	5 min		None	1	

#### Level of Student Engagement

1	Low	Listen to lecture, observe the teacher, individual reading, teacher demonstration, teacher-centered instruction
2	Moderate	Raise questions, lecture with discussion, record data, make predictions, technology interaction with assistance
3	High	Hands-on activity or inquiry; critique others, draw conclusions, make connections, problem-solve, student-centered

**Next Generation Science Standards – Inquiry**

NGSS Practice 2: Developing and Using Models  
 NGSS Practice 4: Analyzing and Interpreting Data  
 NGSS Practice 8: Obtaining, Evaluating and Communicating Information

**Next Generation Science Standards – Earth Science (Disciplinary Core Idea)**

ESS3.A: Natural Resources. Humans depend on Earth’s land, ocean, atmosphere, and biosphere for many different resources. Minerals, fresh water, and biosphere resources are limited, and many are not renewable or replaceable over human lifetimes. These resources are distributed unevenly around the planet as a result of past geologic processes.

**Florida Science Standards - Inquiry**

SC.7.N.3.2 Identify the benefits and limitations of the use of a scientific model.

**Florida Science Standards – Earth Science**

SC.7.E.6.6 Identify the impact that humans have had on Earth, such as deforestation, urbanization, desertification, erosion, air and water quality, changing the flow of water.

## Materials and Advance Preparation

### Materials List

#### Class set:

- Internet
- SmartBoard or other projector

#### Student materials (groups of 2 or 4):

- 1 deforestation simulation board
- 112 dried beans (NOTE: 1 2-lb bag of dried beans is sufficient for a set of 16 sets)
- 16 forest plot cards
- 16 subsistence farming squares
- 16 secondary forest growth squares
- 3 small envelopes
- 1 plastic baggie or larger envelope (for the beans)

### Blackline Masters

1. **Blackline Master #1:** Deforestation Quiz Quiz Trade Cards (eight pages) – one set per class... you need one card for each student
2. **Blackline Master #2:** Deforestation Simulation Directions and Student Lab Sheets (6 pages) – one per student
3. **Blackline Master #3:** Deforestation Simulation Board – one per group
4. **Blackline Master #4:** Chips: Forest Plot, Secondary Forest, Subsistence Farming (2 pages) – one set per group
5. **Blackline Master #5:** Checking for Understanding: Deforestation (one page) – one per student

### Advance Preparation

1. Run off Blackline Masters (see Blackline Master list above)
2. Cut out Quiz Quiz Trade cards (Blackline Master 1) on the dotted lines. Fold cards over on the solid line in the middle so that the question is on one side and the answer is on the other side. Secure the two sides of the card together with a staple or tape.
3. Cut chips (three sets) and place in envelopes (Blackline Master 4)
4. Count out beans (~120/baggie)
5. Make sure the two Internet sites work: <http://svs.gsfc.nasa.gov/cgi-bin/details.cgi?aid=2116> and <http://www.globalforestwatch.org>
6. Consider laminating Simulation Board (Blackline Master #3).

## Lesson Information

### Learning Objectives

1. The student will be able to use the data collected in this lesson (*condition*) to correctly (*standard*) describe how their forest changed over 7 years (*task*).
2. The student will be able to correctly (*standard*) describe in detail, based on their data (*condition*), how humans impacted the forest (*task*).
3. The student will be able to correctly (*standard*) describe in detail, based on their experience with this simulation (*condition*), at least one benefit and weakness with the simulation (*task*).

### Prior Knowledge Needed by the Students

- Need to know how to record and graph data (bar and line graphs).

### Background Information

**Deforestation** occurs when trees are removed from a forest. This initially occurred in primary (virgin) forests when local groups cleared land for subsistence farming. Tree roots help hold soil in place so, as trees were removed, erosion often occurred. Flooding from rainwater collected in the lowest part of the topography. Animals that once considered this portion of the forest to be their homes, sought refuge

elsewhere. Subsistence farmers did not understand that the soil that supported these old forests was not rich in nutrients. The lack of nutrients in the soil decreased crop size in many places and the farmland began to provide smaller crops in as little as three years. When this occurred, farmers moved to a nearby strip of forest and began the process all over.

Over time, **urbanization** and **globalization** have greatly accelerated the loss of primary forests as wood from these forests are prized as building and furniture materials. **Urbanization** happens when cities are expanded, often-involving people moving into previously unsettled areas adjacent to the city.

**Globalization** is the interconnection of countries and industries around the world, driven by international trade and investment and encourages consumption while opening new markets for hard to find forest products: increases trade, and leads to more logging worldwide. Roads into primary forests made access easier. Large earth moving equipment pushed off these initial roads into areas never accessed before, leaving a large fish-bone shaped scar in the forest as the large trees are harvested and bare ground left in their wake. These barren areas are left to their own devices in terms of healing. A secondary forest will eventually grow, but will take 50 or more years to reach maturity. The types of tree and other plant species will often be very different from the native primary forest that once grew here. This means that very likely a different suite of animals will take up residence here based on the new composition of the forest ecosystem.

#### References

Kukreja, R. (no date). Deforestation facts. Accessed at <http://www.conserve-energy-future.com/various-deforestation-facts.php>

\_\_\_\_\_. (no date). Deforestation facts for kids. Accessed at <http://www.theworldcounts.com/stories/Deforestation-Facts-for-Kids>

## Lesson Procedure

### Engage

1. Today's lesson is going to be on the topic of deforestation. Ask students, "what do you know about deforestation?" Strategy: Think-Pair-Share. Link to strategy directions: <http://www.readingrockets.org/strategies/think-pair-share>  
Report out from the groups. Make a list on the board.
2. To allow students to explore some facts about deforestation, students will each receive one of the cards from **Deforestation Quiz Quiz Trade Cards (Blackline Master 1)**. They will use the Kagan Quiz, Quiz, Trade strategy to quiz one another. Link to strategy directions: <http://www.theteachertoolkit.com/index.php/tool/quiz-quiz-trade>  
(NOTE: There are 32 cards in the Blackline Master. Make extra copies if you have more than 32 students.)
3. So students can get an idea of the scale of deforestation, review a NASA visualization made with four Landsat images of the area of Rondonia, Brazil, from 1975 to 2001: <http://svs.gsfc.nasa.gov/cgi-bin/details.cgi?aid=2116>
4. Take a look at the Rondonia area using the Global Forest Watch mapping application at <http://www.globalforestwatch.org>

### Explore

#### Part 1.

1. Everyone should have the following materials: plastic baggie with beans, deforestation simulation board, and 3 envelopes (plot cards, sustenance farming cards, secondary farming cards), and a lab packet (Blackline Master 2).
2. Set up your forest by placing 7 dried beans on each of the 16 squares on Blackline Master 3: Deforestation Simulation Board. Each square represents a plot of healthy primary forest. Each bean represents a portion of the healthy forest that lives on that plot of land.

#### Part 2.

1. You will begin by simulating what might happen if there is a group of four subsistence farmers living in your forest for 7 years. Follow steps 2 through 6 to do this.

2. Mix the forest plot cards around in the envelope. Select a plot card and remove two beans from the corresponding numbered forest plot on Blackline Master 3. Record the plot number on your data sheet. Your Subsistence Farmer Co-Op has just begun to cut and clear land for their farms. You will pull a total of 8 forest plot cards to simulate the amount of trees they have removed from your forest during one year's time.
3. Return the plot card to the envelope. Repeat Step 2 seven more times to show how the Farmer's Co-Op expands their operation over time. Remember to remove two beans each time you select a plot card. If there is only one bean in the plot of land corresponding to the card you draw, remove that bean and randomly remove a bean from a nearby plot of land. This represents the fact that your farmer co-op group has moved to a neighboring plot to expand their farm. If no beans remain in the plot of land corresponding to the card you draw, randomly remove two beans from another adjoining plot of land. Make sure you put the plot card back in the envelope after each draw. (*NOTE: If you have laminated the simulation board, you can have students keep track of how many years each of your subsistence farming plots have been farmed. This will make it easier to know when to replace this label with secondary forest growth*).
4. At the end of 8 draws, observe the condition of your forest. Are there any areas that are completely clear of forest? *For plots that have zero beans remaining*, place a Subsistence Farming square on each of these plots. These plots represent cleared land under subsistence cultivation by the Farmer's Co-Op.
5. In a data table, record the number of beans in each of the 16 forest plots. Count and record the number of plots that are:
  - **healthy old-growth primary forest** (plots with seven beans),
  - **impacted primary forest** (plots with four, five or six beans),
  - **endangered primary forest** (plots with one, two or three beans),
  - **subsistence farming plots** (plots that have zero beans after Step 3; since this is the first year a plot is in subsistence farming, mark a 0-x), and
  - **barren soil/secondary forest begins to grow plot** (subsistence farming fails after three years, plot converts to barren soil)
6. Repeat steps 2 through 5 a total of 6 more times to simulate a seven years of data on your forest plot. Make sure you record the remaining trees (beans) left at the end of the year and condition of your forest in the data table. On the data chart, mark a 0-x,x for subsistence plots that are now in their second year, and 0-x,x,x for those in their last year of subsistence farming. These plots will convert to secondary forest growth the next year – and so they will be marked 0-2nd forest until the end of the simulation.
7. Use the data you have collected to make a line graph that shows how the number of plots in all five categories has changed over the course of the seven years that you ran this simulation. Label the scale on the x-axis with the number of years that have gone by. Label the y-axis from 1 to 16 for the number of plots. Create a key to show what category of forest health each line represents.

### Explain

1. Share your group results with your class and compare your graphs with other student groups' graphs. You can use a gallery walk strategy to accomplish this sharing.
2. Summarize what happened to your forest plot over a span of seven years. Did everyone have the same result?
3. In addition to the loss of the primary growth forest, what effect do you think this activity had on the soil? Animals? Humans?
4. This simulation showed the effects on a primary growth forest by subsistence farmers. These farmers generally do not have bulldozers or other heavy equipment. How would a forest production company that had money to spend on heavy equipment change the scenario? How might you change this simulation to show the effects of a different type of production?
5. What are the strengths and weaknesses of this simulation (model)?

**Expand**

1. Ask students to use the Global Forest Watch mapping application (<http://www.globalforestwatch.org>) to investigate an area of the Earth that they are personally interested in. Have them identify the area, and using the time-lapse tool at the bottom of the interactive map, describe in detail how the area's forest has changed.

**Evaluate****FORMAL EVALUTION**

See *Blackline Master 5*.

**INFORMAL or OPTIONAL EVALUTIONS**

1. The students' data sheets from the simulation can be picked up and assessed for completeness and accuracy.

**Supplementary Resources****Teachers**

Global Forest Watch. (no date). *GFW Interactive Map*. Accessed at <http://www.globalforestwatch.org/>.  
An interactive map that allows the user to zoom in to a point on Earth to see the gain/loss in forests, changes in land use, conservation and many more attributes.

Riebeek, H. (February 1, 2008). Ancient forest to modern city: Mapping landscape change in the United States. NASA Earth Observatory website. Accessed at [http://earthobservatory.nasa.gov/Features/AncientForest/ancient\\_forest7.php](http://earthobservatory.nasa.gov/Features/AncientForest/ancient_forest7.php)  
A series of stories about how a specific site's landscape was mapped from the mid-1600's to today.

Thomson, J. (April 19, 2001). *Deforestation of Rondonia, Brazil, from 1975 to 2001*. NASA Scientific Visualization Studio. Accessed at <http://svs.gsfc.nasa.gov/cgi-bin/details.cgi?aid=2116>.  
NASA visualizations using four Landsat images of the Rondonia area in Brazil, taken in 1975, 1986, 1992, 2001.

Jones, T. (February 11, 2010). *Urbanization, Deforestation, Reforestation*. State of the Planet: Earth Institute, Columbia University Website. Accessed at <http://blogs.ei.columbia.edu/2010/02/11/urbanization-deforestation-reforestation/>  
Interesting article about the three areas, plus 'rewilding.' Additional links to related articles.

**CITATION OF SOURCES.**

\_\_\_\_ (no date). Deforestation facts for kids. Accessed at

<http://www.theworldcounts.com/stories/Deforestation-Facts-for-Kids>.

\_\_\_\_ (no date). *Jason Activity 2.3: How Many Nutria Are Too Many Nutria?* Jason Digital Learning Resources website. Accessed at [http://gated.jason.org/digital\\_library/26427.aspx](http://gated.jason.org/digital_library/26427.aspx)

EarthLabs. (no date). *Forests: Changes in the Land*. Accessed at

<http://serc.carleton.edu/eslabs/carbon/4a.html> and <http://serc.carleton.edu/eslabs/carbon/4b.html>.

Kukreja, R. (no date). Deforestation facts. Accessed at <http://www.conserve-energy-future.com/various-deforestation-facts.php>.

Tree clipart –royalty free use. Accessed at <http://www.clipartbest.com/clipart-jRcG7EeTL>

Urquhart, G., Chomentowski, W., Skole, D., & Barber, C. (no date). *Tropical deforestation*. Earth Observatory Website. Accessed at

[http://earthobservatory.nasa.gov/Features/Deforestation/tropical\\_deforestation\\_2001.pdf](http://earthobservatory.nasa.gov/Features/Deforestation/tropical_deforestation_2001.pdf).

Yes, I cited all materials and resources used in this lesson.

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Lesson author signature

Deforestation Quiz Quiz Trade

 <p>Card 1 Forests help reduce a warming climate by absorbing the greenhouse gas</p> <ul style="list-style-type: none"> <li>A. carbon dioxide</li> <li>B. water vapor</li> <li>C. ozone</li> <li>D. oxygen</li> </ul>	 <p>Answer: A</p>
 <p>Card 2 When deforestation occurs, land is converted from forests to</p> <ul style="list-style-type: none"> <li>A. green space or parks</li> <li>B. non-forest uses</li> <li>C. non-farm uses</li> <li>D. non-city uses</li> </ul>	 <p>Answer: B</p>
 <p>Card 3 Forests help cool the atmosphere through the process of</p> <ul style="list-style-type: none"> <li>A. photosynthesis</li> <li>B. water absorption</li> <li>C. evapotranspiration</li> <li>D. oxygen release</li> </ul>	 <p>Answer: C</p>
 <p>Card 4 One of the main causes of deforestation is</p> <ul style="list-style-type: none"> <li>A. agriculture</li> <li>B. growing cities</li> <li>C. firewood collection</li> <li>D. road building</li> </ul>	 <p>Answer: A</p>

 <p>Card 5 Which of the following is NOT a major rainforest? A. Madagascar B. Congo C. Amazon D. Smokey Mountains</p>	 <p>Answer: D</p>
 <p>Card 6 Every minute, forests the size of ____ football fields are cut down. A. 10 B. 20 C. 30 D. 60</p>	 <p>Answer: B</p>
 <p>Card 7 Forests cover ____ of the Earth's surface? A. 10% B. 20% C. 30% D. 60%</p>	 <p>Answer: C</p>
 <p>Card 8 One and a half acres of forest is cut down every _____. A. second B. minute C. hour D. day</p>	 <p>Answer: A</p>



Card 9

If the current rate of deforestation continues, rainforests will be gone from the Earth in

- A. 10 years
- B. 100 years
- C. 1000 years
- D. never, because we keep replanting the forests



Answer: B



Card 10

Scientists estimate that \_\_\_\_ of the world's oxygen is produced by the Amazon rainforest.

- A. 10%
- B. 20%
- C. 30%
- D. 60%



Answer: B



Card 11

\_\_\_\_ of the world's tropical rainforests have already been cleared.

- A. one-fourth
- B. one-third
- C. one-half
- D. three-fourths



Answer: C



Card 12

Trees play an important role in our ecosystem by absorbing \_\_\_\_.

- A. carbon
- B. oxygen
- C. floods
- D. minerals



Answer: A

 <p>Card 13</p> <p>One reason deforestation occurs is to make room to enlarge farms. Another big reason, is to make room for</p> <ul style="list-style-type: none"> <li>A. public parks</li> <li>B. modern roads</li> <li>C. electrical lines</li> <li>D. cattle pastures &amp; ranches</li> </ul>	 <p>Answer: D</p>
 <p>Card 14</p> <p>Commercial _____ means the trees are being cut down for sale as timber and pulp.</p> <ul style="list-style-type: none"> <li>A. pasteurization</li> <li>B. climate change</li> <li>C. transpiration</li> <li>D. logging</li> </ul>	 <p>Answer: D</p>
 <p>Card 15</p> <p>A "secondary forest" means</p> <ul style="list-style-type: none"> <li>A. trees have started to regrow in a clear-cut area.</li> <li>B. a primary forest has transitioned into a newer, secondary forest.</li> <li>C. trees in this area have not yet been disturbed by deforestation.</li> <li>D. this forest is an exact duplicate of the primary forest.</li> </ul>	 <p>Answer: A</p>
 <p>Card 16</p> <p>A "primary" forest means</p> <ul style="list-style-type: none"> <li>A. this forest has not been disturbed by deforestation.</li> <li>B. this forest has only been disturbed once in its history.</li> <li>C. this forest contains the youngest trees in the region</li> <li>D. the same thing as "deforested."</li> </ul>	 <p>Answer: A</p>



Card 17

In the 1980's an area slightly smaller than \_\_\_ was estimated to have been deforested *annually* in South America.

- A. Florida
- B. Texas
- C. Alaska
- D. Connecticut



Answer: A



Card 18

When a forest is cut and burned, the carbon stored in the wood joins with oxygen and is released as

- A. water vapor gas
- B. carbon monoxide gas
- C. carbon dioxide gas
- D. sulfur dioxide gas



Answer: C



Card 19

Releasing CO<sub>2</sub> into the atmosphere enhances the

- A. ozone layer in the stratosphere.
- B. water absorption of clouds.
- C. greenhouse effect.
- D. probability of precipitation



Answer: C



Card 20

After the trees are cut down in a tropical rain forest they are burned to

- A. release nutrients back to the soil.
- B. decrease the richness of the soil.
- C. prevent firewood collection.
- D. take up nutrients from the soil.



Answer: A

 <p>Card 21</p> <p>Farmers planting on newly cleared rainforest soil found they can only grow crops for ___ years before the ground can no longer support crops</p> <p>A. 20 years B. 15 years C. 8 years D. 3 years</p>	 <p>Answer: D</p>
 <p>Card 22</p> <p>A secondary forest may take as long as ___ years to grow back..</p> <p>A. 10 B. 20 C. 30 D. 50</p>	 <p>Answer: D</p>
 <p>Card 23</p> <p>Shade farming, which leaves some of the original rain forest trees, is used for shade-loving crops like</p> <p>A. bananas B. pineapples C. coffee and chocolate D. palm and dates</p>	 <p>Answer: C</p>
 <p>Card 24</p> <p>In clear-cutting, all the trees are removed, including the ____.</p> <p>A. stumps B. natural water drainages C. roads D. electrical lines</p>	 <p>Answer: A</p>



Card 25

Forests help reduce a warming climate by absorbing the greenhouse gas

- A. carbon dioxide
- B. water vapor
- C. ozone
- D. oxygen



Answer: A



Card 26

When deforestation occurs, land is converted from forests to

- A. green space or parks
- B. non-forest uses
- C. non-farm uses
- D. non-city uses



Answer: B



Card 27

Forests help cool the atmosphere through the process of

- A. photosynthesis.
- B. water absorption.
- C. evapotranspiration.
- D. oxygen release.



Answer: C



Card 28

One of the main causes of deforestation is

- A. agriculture.
- B. growing cities.
- C. firewood collection.
- D. road building.



Answer: A

 <p>Card 29 Farmers working clear-cut areas in the rainforest found their crops A. prospered after 3-5 years. B. began to fail after 3-5 years. C. relocated to other areas. D. used more fertilizer.</p>	 <p>Answer: D</p>
 <p>Card 30 Every minute, forests the size of ____ football fields are cut down. A. 10 B. 20 C. 30 D. 60</p>	 <p>Answer: B</p>
 <p>Card 31 Forests cover ____ of the Earth's surface? A. 10% B. 20% C. 30% D. 60%</p>	 <p>Answer: C</p>
 <p>Card 32 One and a half acres of forest is cut down every _____. A. second B. minute C. hour D. day</p>	 <p>Answer: A</p>

Name \_\_\_\_\_ Date \_\_\_\_\_

## Deforestation Simulation Directions & Student Lab Sheets

### Directions:

#### Part 1: Prepare Your Forest

1. Set up your forest by placing 7 dried beans on each of the 16 squares of your **Deforestation Simulation Board**. Each square represents a plot of healthy primary forest. Each bean represents a portion of the healthy forest that lives on that plot of land.

#### Part 2: Run the Simulation

1. You will begin by simulating what might happen if there is a group of four subsistence farmers living in your forest for 7 years. Follow steps 2 through 6 to do this.
2. Mix the forest plot cards around in the envelope. Select a plot card and remove two beans from the corresponding numbered forest plot on your **Deforestation Simulation Board**. Record the plot number on your data sheet. Your Subsistence Farmer Co-Op has just begun to cut and clear land for their farms. You will pull a total of 8 forest plot cards to simulate the amount of trees they have removed from your forest during one year's time.
3. Return the plot card to the envelope. Repeat Step 2 seven more times to show how the Farmer's Co-Op expands their operation over time. Remember to remove two beans each time you select a plot card. If there is only one bean in the plot of land corresponding to the card you draw, remove that bean and randomly remove a bean from a nearby plot of land. This represents the fact that your farmer group has moved to a neighboring plot to expand their farm. If no beans remain in the plot of land corresponding to the card you draw, randomly remove two beans from another adjoining plot of land. Make sure you put the plot card back in the envelope after each draw.
4. At the end of 8 draws, observe the condition of your forest. Are there any areas that are completely clear of forest? *For plots that have zero beans remaining*, place a **Subsistence Farming** square on each of these plots and remove their plot cards from your envelope. These plots represent cleared land under subsistence cultivation by the Farmer's Co-Op.
5. In the data table, record the number of beans in each of the 16 forest plots. Count and record the number of plots that are:
  - **healthy old-growth primary forest** (plots with seven beans),
  - **impacted primary forest** (plots with four, five or six beans),
  - **endangered primary forest** (plots with one, two or three beans), and
  - **subsistence farming plots** (plots that have zero beans after Step 3).
  - **barren soil/secondary forest begins to grow plot** (subsistence farming fails after three years, plot converts to barren soil)
6. Repeat steps 2 through 5 a total of 6 more times to simulate a seven years of data on your forest plot. Make sure you record the remaining trees (beans) left at the end of the year and condition of your forest in the data table.
7. On the data chart, **mark a 0-x,x for subsistence plots that are now in their second year, and 0-x,x,x for those in their last year of subsistence farming**. These plots will convert to **secondary forest growth** the next year – and so they will be marked 0-2nd forest until the end of the simulation.

#### Part 3: Analyze Your Data

1. Use the data you have collected to make a line graph that shows how the number of plots in all five categories has changed over the course of the seven years that you ran this simulation. Label the scale on the x-axis with the number of years that have gone by. Label the y-axis from 1 to 16 for the number of plots. Create a key to show what category of forest health each line represents.

### Forest End Year 1

Record each plot card pull below.

\_\_\_\_\_

Healthy primary forest = \_\_\_\_\_ plots  
(seven beans remain in each plot)

Impacted primary forest = \_\_\_\_\_ plots  
(four, five or six beans remain in each plot)

Endangered primary forest = \_\_\_\_\_ plots  
(one, two or three beans remain in each plot)

Subsistence farming = \_\_\_\_\_ plots  
(zero beans remain in each plot)

Barren, beginning of secondary forest growth = \_\_\_\_\_ plots  
(After a plot has been in subsistence farming for three years, the soil becomes barren and the plot is abandoned. A secondary forest begins to grow.)

Record the number of trees (beans) that remain in each forest plot at the end of this year.			

### Forest End Year 2

Record each plot card pull below.

\_\_\_\_\_

Healthy primary forest = \_\_\_\_\_ plots  
(seven beans remain in each plot)

Impacted primary forest = \_\_\_\_\_ plots  
(four, five or six beans remain in each plot)

Endangered primary forest = \_\_\_\_\_ plots  
(one, two or three beans remain in each plot)

Subsistence farming = \_\_\_\_\_ plots  
(zero beans remain in each plot)

Barren, beginning of secondary forest growth = \_\_\_\_\_ plots  
(After a plot has been in subsistence farming for three years, the soil becomes barren and the plot is abandoned. A secondary forest begins to grow.)

Record the number of trees (beans) that remain in each forest plot at the end of this year.			

### Forest End Year 3

Record each plot card pull below.

\_\_\_\_\_

Healthy primary forest = \_\_\_\_\_ plots  
(seven beans remain in each plot)

Impacted primary forest = \_\_\_\_\_ plots  
(four, five or six beans remain in each plot)

Endangered primary forest = \_\_\_\_\_ plots  
(one, two or three beans remain in each plot)

Subsistence farming = \_\_\_\_\_ plots  
(zero beans remain in each plot)

Barren, beginning of secondary forest growth = \_\_\_\_\_ plots  
(After a plot has been in subsistence farming for three years, the soil becomes barren and the plot is abandoned. A secondary forest begins to grow.)

Record the number of trees (beans) that remain in each forest plot at the end of this year.			

### Forest End Year 4

Record each plot card pull below.

\_\_\_\_\_

Healthy primary forest = \_\_\_\_\_ plots  
(seven beans remain in each plot)

Impacted primary forest = \_\_\_\_\_ plots  
(four, five or six beans remain in each plot)

Endangered primary forest = \_\_\_\_\_ plots  
(one, two or three beans remain in each plot)

Subsistence farming = \_\_\_\_\_ plots  
(zero beans remain in each plot)

Barren, beginning of secondary forest growth = \_\_\_\_\_ plots  
(After a plot has been in subsistence farming for three years, the soil becomes barren and the plot is abandoned. A secondary forest begins to grow.)

Record the number of trees (beans) that remain in each forest plot at the end of this year.			

### Forest End Year 5

Record each plot card pull below.

\_\_\_\_\_

Healthy primary forest = \_\_\_\_\_ plots  
(seven beans remain in each plot)

Impacted primary forest = \_\_\_\_\_ plots  
(four, five or six beans remain in each plot)

Endangered primary forest = \_\_\_\_\_ plots  
(one, two or three beans remain in each plot)

Subsistence farming = \_\_\_\_\_ plots  
(zero beans remain in each plot)

Barren, beginning of secondary forest growth = \_\_\_\_\_ plots  
(After a plot has been in subsistence farming for three years, the soil becomes barren and the plot is abandoned. A secondary forest begins to grow.)

Record the number of trees (beans) that remain in each forest plot at the end of this year.			

### Forest End Year 6

Record each plot card pull below.

\_\_\_\_\_

Healthy primary forest = \_\_\_\_\_ plots  
(seven beans remain in each plot)

Impacted primary forest = \_\_\_\_\_ plots  
(four, five or six beans remain in each plot)

Endangered primary forest = \_\_\_\_\_ plots  
(one, two or three beans remain in each plot)

Subsistence farming = \_\_\_\_\_ plots  
(zero beans remain in each plot)

Barren, beginning of secondary forest growth = \_\_\_\_\_ plots  
(After a plot has been in subsistence farming for three years, the soil becomes barren and the plot is abandoned. A secondary forest begins to grow.)

Record the number of trees (beans) that remain in each forest plot at the end of this year.			

### Forest End Year 7

Record each plot card pull below.

\_\_\_\_\_

Healthy primary forest = \_\_\_\_\_ plots  
(seven beans remain in each plot)

Impacted primary forest = \_\_\_\_\_ plots  
(four, five or six beans remain in each plot)

Endangered primary forest = \_\_\_\_\_ plots  
(one, two or three beans remain in each plot)

Subsistence farming = \_\_\_\_\_ plots  
(zero beans remain in each plot)

Barren, beginning of secondary forest growth = \_\_\_\_\_ plots  
(After a plot has been in subsistence farming for three years, the soil becomes barren and the plot is abandoned. A secondary forest begins to grow.)

Record the number of trees (beans) that remain in each forest plot at the end of this year.			

### Forest End Year 8

Record each plot card pull below.

\_\_\_\_\_

Healthy primary forest = \_\_\_\_\_ plots  
(seven beans remain in each plot)

Impacted primary forest = \_\_\_\_\_ plots  
(four, five or six beans remain in each plot)

Endangered primary forest = \_\_\_\_\_ plots  
(one, two or three beans remain in each plot)

Subsistence farming = \_\_\_\_\_ plots  
(zero beans remain in each plot)

Barren, beginning of secondary forest growth = \_\_\_\_\_ plots  
(After a plot has been in subsistence farming for three years, the soil becomes barren and the plot is abandoned. A secondary forest begins to grow.)

Record the number of trees (beans) that remain in each forest plot at the end of this year.			

### Conclusions & Analysis

1. In what year did your subsistence Farmer's Co-op first clear a forest plot?

\_\_\_\_\_

\_\_\_\_\_

2. Summarize what happened to your forest plot over a span of seven years. Did everyone in the class have the same result?

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

3. In addition to the loss of the primary growth forest, what effect do you think this activity had on the soil? Animals? Humans?

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4. This simulation showed the effects on a **primary growth forest** by subsistence farmers. Subsistence farmers generally do not have bulldozers or other heavy equipment. How would a forest production company that has money to spend on heavy equipment change the scenario? How might you change this simulation to show the effects of a different type of production?

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5. **Urbanization** happens when cities are expanded, often-involving people moving into previously unsettled areas adjacent to the city. Where would urbanization potentially fit into this simulation?

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6. **Globalization** is the interconnection of countries and industries around the world, driven by international trade and investment and encourages consumption while opening new markets for hard to find forest products. Where would **globalization** potentially fit into this simulation?

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7. What are the strengths and weaknesses of this simulation (model)?

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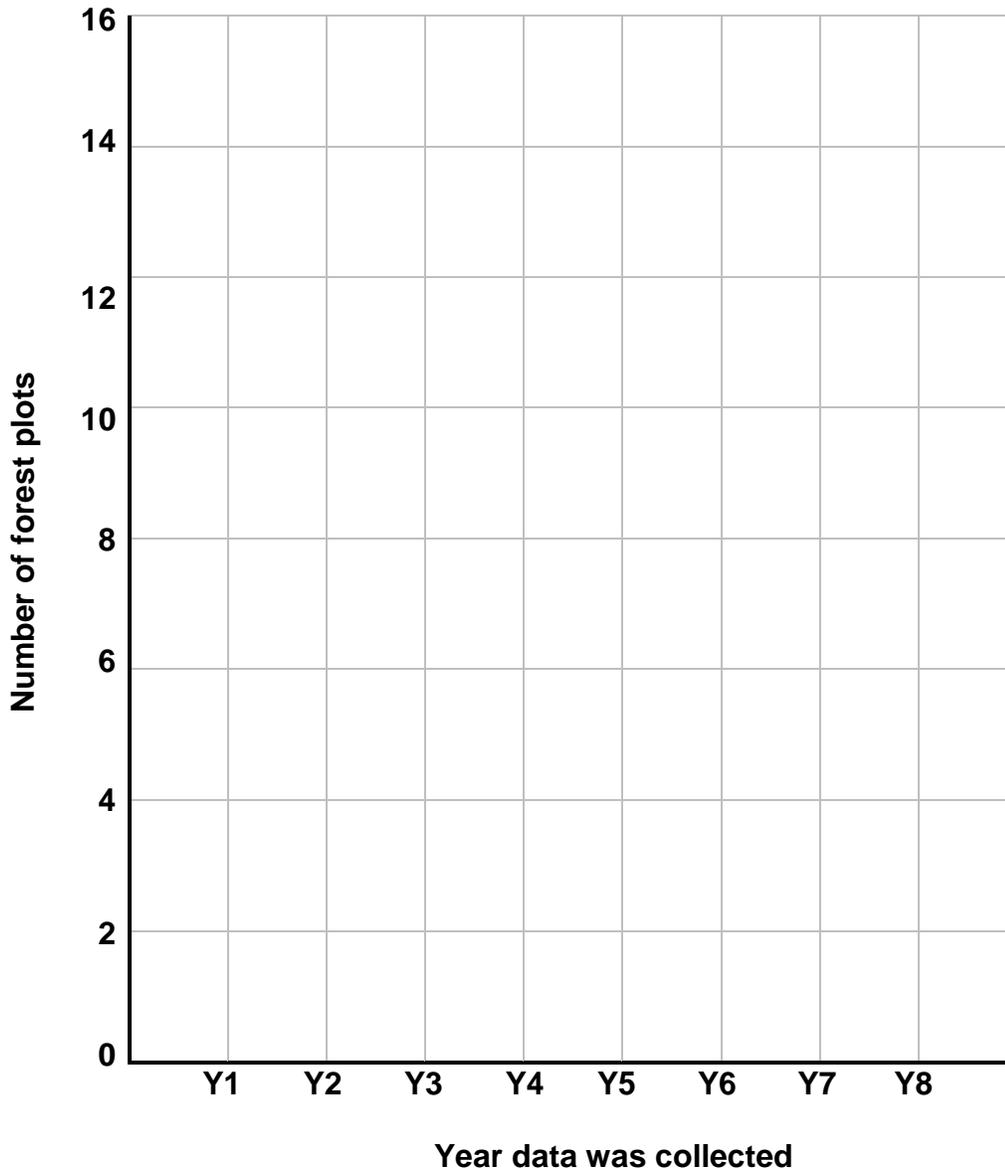
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6. Graph your data for forest changed over time. You will have five colored lines to represent each of the five categories.

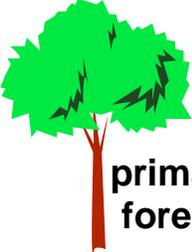
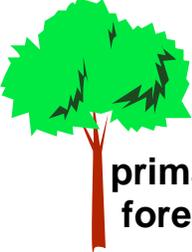
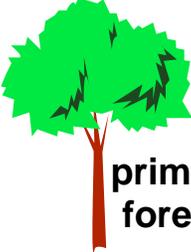
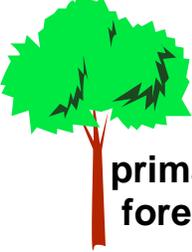
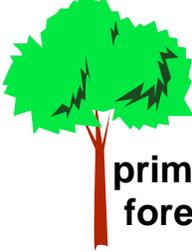
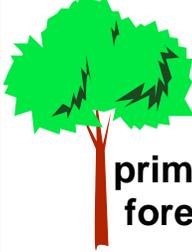
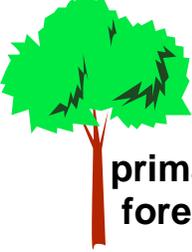
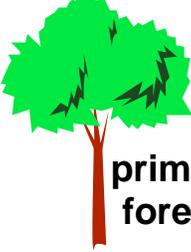
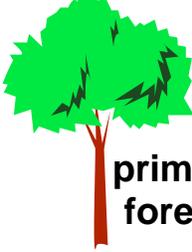
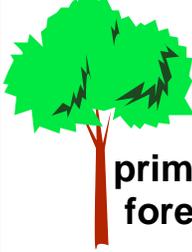
Title: \_\_\_\_\_



**KEY**

- healthy primary forest (7 beans)
- impacted primary forest (4, 5, or 6 beans)
- endangered primary forest (1, 2, or 3 beans)
- subsistence farming (yrs 1-3)
- barren, start of secondary forest (yrs 1-3)

# Deforestation Simulation Board

<p><b>Plot 1</b></p>  <p>primary forest</p>	<p><b>Plot 2</b></p>  <p>primary forest</p>	<p><b>Plot 3</b></p>  <p>primary forest</p>	<p><b>Plot 4</b></p>  <p>primary forest</p>
<p><b>Plot 5</b></p>  <p>primary forest</p>	<p><b>Plot 6</b></p>  <p>primary forest</p>	<p><b>Plot 7</b></p>  <p>primary forest</p>	<p><b>Plot 8</b></p>  <p>primary forest</p>
<p><b>Plot 9</b></p>  <p>primary forest</p>	<p><b>Plot 10</b></p>  <p>primary forest</p>	<p><b>Plot 11</b></p>  <p>primary forest</p>	<p><b>Plot 12</b></p>  <p>primary forest</p>
<p><b>Plot 13</b></p>  <p>primary forest</p>	<p><b>Plot 14</b></p>  <p>primary forest</p>	<p><b>Plot 15</b></p>  <p>primary forest</p>	<p><b>Plot 16</b></p>  <p>primary forest</p>

Blackline Master #4

Forest plot chips (cut one set per group; place in an envelope)

1	2	3	4
5	6	7	8
9	10	11	12
13	14	15	16

Secondary forest chips (cut one set per group; place in an envelope)

 secondary forest (years 4-50)	 secondary forest (years 4-50)	 secondary forest (years 4-50)	 secondary forest (years 4-50)
 secondary forest (years 4-50)	 secondary forest (years 4-50)	 secondary forest (years 4-50)	 secondary forest (years 4-50)
 secondary forest (years 4-50)	 secondary forest (years 4-50)	 secondary forest (years 4-50)	 secondary forest (years 4-50)
 secondary forest (years 4-50)	 secondary forest (years 4-50)	 secondary forest (years 4-50)	 secondary forest (years 4-50)

Subsistence Farming Chips (cut one set per group; place in an envelope)

 <p><b>subsistence farming</b> (years 1-3)</p>	 <p><b>subsistence farming</b> (years 1-3)</p>	 <p><b>subsistence farming</b> (years 1-3)</p>	 <p><b>subsistence farming</b> (years 1-3)</p>
 <p><b>subsistence farming</b> (years 1-3)</p>	 <p><b>subsistence farming</b> (years 1-3)</p>	 <p><b>subsistence farming</b> (years 1-3)</p>	 <p><b>subsistence farming</b> (years 1-3)</p>
 <p><b>subsistence farming</b> (years 1-3)</p>	 <p><b>subsistence farming</b> (years 1-3)</p>	 <p><b>subsistence farming</b> (years 1-3)</p>	 <p><b>subsistence farming</b> (years 1-3)</p>
 <p><b>subsistence farming</b> (years 1-3)</p>	 <p><b>subsistence farming</b> (years 1-3)</p>	 <p><b>subsistence farming</b> (years 1-3)</p>	 <p><b>subsistence farming</b> (years 1-3)</p>

Name \_\_\_\_\_ Date \_\_\_\_\_ Student No. \_\_\_\_\_

**Checking for Understanding: Deforestation**

- \_\_\_ 1. One of the main causes of deforestation is (SC.7.E.6.6)
- A. agriculture
  - B. diseased trees
  - C. firewood collection
  - D. road building
- \_\_\_ 2. A "secondary forest" means (SC.7.E.6.6)
- A. this forest is an exact duplicate of the primary forest.
  - B. a primary forest has transitioned into a newer, secondary forest.
  - C. trees in this area have not yet been disturbed by deforestation.
  - D. trees have started to regrow in a clear-cut area.
- \_\_\_ 2. When people move into new areas that were previously uninhabited, establishing cities and buildings in the areas, this is called: (SC.7.E.6.6)
- A. urbanization
  - B. globalization
  - C. deforestation
  - D. desertification
3. Briefly describe at least one strength of this simulation. (SC.7.N.3.2)
4. Briefly describe at least one limitation of this simulation. (SC.7.N.3.2)
5. How could you improve this simulation to better reflect what really happens with deforestation? (SC.7.N.3.2)
5. How could you modify this simulation to reflect the role that urbanization and globalization play in deforestation? (SC.7.N.3.2)

**Blackline Master #5 – Answer Key**

Name \_\_\_\_\_ Date \_\_\_\_\_ Student No. \_\_\_\_\_

**Checking for Understanding: Deforestation – ANSWER KEY**



- \_\_\_ 1. One of the main causes of deforestation is (SC.7.E.6.6)
  - A. agriculture
  - B. diseased trees
  - C. firewood collection
  - D. road building
  
- \_\_\_ 2. A “secondary forest” means (SC.7.E.6.6)
  - A. this forest is an exact duplicate of the primary forest.
  - B. a primary forest has transitioned into a newer, secondary forest.
  - C. trees in this area have not yet been disturbed by deforestation.
  - D. trees have started to regrow in a clear-cut area.
  
- \_\_\_ 2. When people move into new areas that were previously uninhabited, establishing cities and buildings in the areas, this is called: (SC.7.E.6.6)
  - A. deforestation
  - B. globalization
  - C. urbanization
  - D. desertification
  
- 3. Briefly describe at least one strength of this simulation. (SC.7.N.3.2)
 

Answers may vary but could include that the simulation shows the effects of clear cutting land for agriculture on deforestation.
  
- 4. Briefly describe at least one limitation of this simulation. (SC.7.N.3.2)
 

Answers may vary but could include that in this simulation we are not able to simulate any natural phenomenon with the forests like natural regrowth, natural die off, or the potential that the farmers would replant trees that they cut down in future generations.
  
- 5. How could you improve this simulation to better reflect what really happens with deforestation? (SC.7.N.3.2)
 

Answers may vary but could include that special cards could be drawn to represent timber companies that are harvesting the lumber that DO have machines and equipment to make the deforestation speed up. We could also add urbanization and globalization factors into the simulation to show other factors that impact deforestation.
  
- 5. How could you modify this simulation to reflect the role that urbanization and globalization play in deforestation? (SC.7.N.3.2)
 

Answers may vary buy could include that when a plot of land is cleared, a building is put in that plot to prevent secondary forest from growing (urbanization). We could have special cards that are drawn that identify that a special product or type of lumber is found in a plot of land and that the entire plot gets cleared out (globalization).