

Lesson Plan: Human's Impact

By: Lauri Dahlin & Nichole Hughes

Target Grade: 4th Grade

Teacher Prep Time: 30 minutes

Lesson Time: 2 hours (We recommend doing this lesson over two days. Parts 2 and 3 can be done on the same day.)

- Part 1
 - 15 min - Introduction
 - 30 min - Forest Ecosystem Model
 - 15 min - Analysis
- Part 2
 - 40 min - Observing Human Impact
- Part 3:
 - 20 min - Predicting Human Impact

Lesson Overview: Students will investigate the question, “How has human activity impacted different ecosystems?” Students will complete a simulation in which they will be deer and will need to forage for a year’s worth of food. If students gather the correct amount of food they will live and have one offspring, otherwise they will die. They will run the simulation 4 times representing 4 years. The first two years will be typical years and then the last two years will show what happens when a housing development moves into the deer’s ecosystem. After the simulation, the students discuss the results and why they are significant to the scientific community. Students will build on the concepts that they learned in the simulation by looking at images (maps) of one area at two different times. From the maps they will identify what changes occurred to the land because of humans. Students will then apply that knowledge to a new ecosystem and draw what they think will happen in an ecosystem based on the projected increase in human population.

Learning Objective(s):

- Students will understand that humans can have a positive or negative impact on the land.
- Students will be able to construct explanations for how human activities have impacted the land.
- Students will be able to predict what impact humans will have on the land if current trends continue.

NGSS: 4-ESS2-2 Analyze and interpret data from maps to describe patterns of Earth’s features.

- **Science and Engineering Practice**
 - #4 Analyzing and Interpreting Data
 - Analyzing data in 3-5 builds on K-2 experiences and progresses to introducing quantitative approaches to collecting data and conducting multiple trials of qualitative observations. When possible and feasible, digital tools should be used.
 - Analyze and interpret data to make sense of phenomena, using logical reasoning, mathematics, and/or computation.
 - Compare and contrast data collected by different groups in order to discuss similarities and differences in their findings.
 - #6 Constructing Explanations and Designing Solutions for science

- Constructing explanations and designing solutions in 3-5 builds on K-2 experiences and progresses to the use of evidence in constructing explanations that specify variables that describe and predict phenomena and in designing multiple solutions to design problems.
 - Constructing an explanation of observed relationships (e.g., the distribution of plants in the backyard)
 - Identifying the evidence that supports particular points in an explanation.
- **Disciplinary Core Idea**
 - ESS2.E Biogeology
 - Living things affect the physical characteristics of their region.
- **Cross Cutting Concept**
 - #4 Systems and Systems Models
 - In grades 3-5, students understand that a system is a group of related parts that make up a whole and can carry out functions its individual parts cannot. They can also describe a system in terms of its components and their interactions.
- **Environmental Principle and Concept**
 - #2 People Influence Natural Systems
 - The long-term functioning and health of terrestrial, freshwater, coastal, and marine ecosystems are influenced by their relationships with human society.
 - Concept A: Direct and indirect changes to the natural systems due to the growth of human populations and the consumption rates influence the geographic extent, composition, biological diversity, and viability of natural systems.
 - Concept B: Methods used to extract, harvest, transport, and consume natural resources influence the geographic extent, composition, biological diversity, and viability of natural systems.
 - Concept C: The expansion and operation of human communities influences the geographic extent, composition, biological diversity, and viability of natural systems.

Where this lesson fits in: Students should have already learned about ecosystems and known the definition and function of producers and consumers. This lesson should come at the beginning of covering 4-ESS2-4 (analyze and interpret data from maps to describe patterns of Earth's features). Students will still need to spend more time looking at maps and identifying patterns of topographic features to fully cover this performance expectation.

Materials Needed: (It is recommended that you have students work in groups of 2-3 for)

- 3 one quart Ziploc bags per student
- 16 pieces of food markers per student, about 3 cm to 5 cm long (pasta works well)
- 1 "Human Impact" notebook per student
- 4 Cones (if you don't have cones you can use rope as well)
- 1 Large bin (to hold all of the deceased deer and expired food) for the class
- 1 timer
- 1 Whistle
- 1 "Impact Pictures" packet per group
- World Map (there is a world map you can project in the Google Drive folder if you do not have one in your classroom)

Teacher Prep:

- Part 1 (Forest Ecosystem Model)
 - Use cones to designate the home range (10 m X 10 m). For round 1 have ½ of of the students in your class be deer (ex: class of 30, 15 will be deer), and spread out 20 pieces of food markers for each deer (ex: 15 deer x 20 food markers = 300 food markers).
 - Have “Human Impact” notebooks for students
- Part 2: (Observing Human Impact)
 - Have “Impact Pictures” ready for students
 - Have a world map ready.

Lesson Sequence:

Part 1(a): 15 minutes	Introduction <ol style="list-style-type: none">1. Ask students to define and name some examples of producers and consumers, and what their role is in the food chain.<ul style="list-style-type: none">○ What are some examples of producers?<ul style="list-style-type: none">▪ Grass, seaweed, trees○ Where do producers get their energy?<ul style="list-style-type: none">▪ Plants get their energy from the Sun.○ What are some examples of consumers?<ul style="list-style-type: none">▪ deer, lions, bears, herbivores, omnivores2. Pass out a student notebook to each student and have them write their name on it.3. Introduce the focus question (How has human activity affected different ecosystems?) to the class by projecting it on the board as you say it aloud and students point to it in their notebooks.4. Tell students that they will be performing a simulation in which they will look at how deer are affected by different changes to their ecosystem. The first two times they run the simulation it will be with no changes to the ecosystem. Then they will see what happens when the area that the deer live in is reduced.5. Ask students, “What do you think will happen to the deer population when their home range is reduced?”6. Have students discuss their answers with their partners and then share out.
Part 1(b): 30 minutes	Forest Ecosystem Model <ol style="list-style-type: none">1. Define the following terms for students that will be used in the simulation<ol style="list-style-type: none">a. <i>Home Range</i>: Roped off section of the yardb. <i>Deer Population</i>: Amount of Ziploc bags held by studentsc. <i>Deer Casualties</i>: Amount of Ziploc bags on the ground2. Go over the ecosystem model components with students:<ol style="list-style-type: none">a. One year equals one minuteb. Deer food is represented by pasta.c. Deer that eat 5-10 pieces of pasta, in one year, live and have an offspring.d. Deer that do not eat 5-10 pieces of pasta in one year, either overeat or starve and therefore, die and must drop their Ziploc bag on the ground.3. Go outside to the simulation area.4. <i>Start Year 1 Simulation</i>5. Give ½ of the class one Ziploc bag each.6. Set the timer for one minute, and let the year 1 foraging begin.

7. After the timer goes off, have students gather at the end of the home range and count their food markers.
8. If they have 5-10 food markers they continue to hold onto the bag, and if they have more than 10 or less than 5 they put their bag on the ground.
9. Count how many deer survived and have them record the results. All deer should survive this round.
10. Have students return the food markers to the home range.
11. Remind the students that every deer that survives will have one offspring. Ask the students how many offspring were born the next year, and then ask them how many total deer there will be at the beginning of year 2. Have students record this information in their notebooks.
12. Hand out the appropriate number of offspring bags to students. Now all students should have at least one bag. If needed, students can hold multiple bags.
13. *Start Year 2 Simulation*
14. Set the timer for 1 minute, and let the year 2 foraging begin.
15. After the timer goes off, have students gather at the end of the home range and count their food markers.
16. If they have 5-10 food markers they continue to hold onto the bag, and if they have more than 10 or less than 5 they put their bag on the ground.
17. Count how many deer survived and record the results.
18. Ask students how many offspring the deer had and get students to record total number (deer that survived and offsprings) for the number of deer that will be present at the start of year 3.
19. Hand out the appropriate number of offspring bags to students. Now students will have multiple bags.
20. Explain that a housing development is being put up in the area and $\frac{1}{4}$ of the deer's food resources will be removed (take $\frac{1}{4}$ of the bags and dump the pasta into the large bin and then return the bags to the students-- also remove $\frac{1}{4}$ of the home range).
21. Have students return the remaining pasta to the home range.
22. *Start Year 3 Simulation*
23. Set the timer for 1 minute, and let the year 3 foraging begin.
24. After the timer goes off, have students gather at the end of the home range and count their food markers.
25. If they have 5-10 food markers they continue to hold onto the bag, and if they have more than 10 or less than 5 they put their bag on the ground.
26. Count how many deer survived and record the results.
27. Ask students how many offspring the deer had and get students to record that total number (deer that survived and offsprings) for the number of deer that will be present at the start of year 4.
28. Hand out the appropriate number of offspring bags to students.
29. Have students return the remaining pasta to the home range.
30. *Start Year 4 Simulation*
31. Start the timer for 1 minute and let year 4 foraging begin.
32. After the timer goes off, have students gather at the end of the home range and count their food markers.
33. If they have 5-10 food markers they continue to hold onto the bag, and if they have more than 10 or less than 5 they put their bag on the ground.
34. Count how many deer survived and record the results.

<p>Part 1(c): 15 minutes</p>	<p>Analysis</p> <ol style="list-style-type: none"> 1. Go back into the classroom. 2. Have students discuss what happened with students in their table group then have a classroom discussion. 3. Go over questions 1-4 with the class.
<p>Part 2: 40 minutes</p>	<p>Observing Human Impact</p> <ol style="list-style-type: none"> 1. Have students get into groups of two or three students. 2. Read Part 2: directions aloud. 3. Use one of the Impact Pictures set to model answering questions 5-9 (we recommend the first image of New Mexico). 4. Give each group 1 “Impact Pictures” packet and assign 1 “Before” and “After” set to each group. 5. With your example of the “Impact Pictures” set, show students how to fill out a post-it note and put it on the map. Tell them that they will also need to complete and present on question 11 for their ecosystem. Go over the terms with them on the chart for question 11. <ol style="list-style-type: none"> a. Deforestation: Cutting down of trees b. Pollution: The presence or the introduction of a harmful man made substance to an area c. Pollution: The presence or the introduction of a substance that hurts the environment. d. Resource Extraction: The removal of a natural resource from the Earth for human use (ex: mining) e. Land Development: When land is cleared or changed by people to meet their needs. f. Climate Change: Change in the average temperature of an area over time (usually increases). g. Increased Human Population: When the number of people in an area increase, putting stress on local resources. 6. Tell students that they will also need to decide as a group if their impact is positive or negative. 7. Pass out post-it notes and have students fill them out (see example below) and put them on the map. Then discuss the impact that they saw so they are ready to talk with the class. <div data-bbox="391 1423 1417 1524" style="border: 1px solid black; padding: 10px; margin: 10px auto; width: fit-content;"> <p style="text-align: center;">Reason(s) for change + or - sign next to each reason for change</p> </div> 8. Call one group at a time to present about their ecosystem and what they think happened. As students are talking, have the rest of the students put the ecosystem they are discussing in front of them. 9. For each presentation, have students fill out a row on the table in question 11 and have them put a “+” if the impact is positive, and a “-” if the impact is negative. It is helpful if you do this with them on an example notebook under the document camera (as a teacher you can decide on how many ecosystems are studied and presented, so it is possible not all lines in the chart will be used).

	10. Once all presentations are finished, ask students if humans have had more positive or negative impacts.
--	---

Part 3: 20 minutes	<p>Predicting Human Impact</p> <ol style="list-style-type: none"> 1. Students will continue to refer to the “Impact Pictures” set for Part 3. 2. Have students look at the map of Maui (question 12) and point to the areas that are cities. 3. Tell students that based on what they have learned, they are going to predict what impacts people have already had on Maui. Tell students that they will need to use evidence from the Impact Pictures to back up their reasoning. 4. Have students fill in question 12. Then share out their responses with the class. 5. Tell students that the population on Maui has been increasing and they need to predict what the consequence of this will be <i>if the population doubles</i>. 6. Have students open their notebooks so that they can see both pages 4 and 5 at the same time. 7. Tell students that they are going to use a pencil to show areas they predict will become populated,, and they will use a green color to show the areas they predict will remain forested. Then under the picture they should explain what they did and why.. 8. Once students are finished, have a few of them share their maps under the document camera.
--------------------------	---

Example Student Work:

Name: Nichole

Human Impact

How has human activity affected different ecosystems?



Vocabulary:

System: A set of things working together in an interconnecting network.
Ecosystem: A community of organisms interacting with each other and with the nonliving environment.

Part 1. Forest Ecosystem Model

Ecosystem Model Terms:

Home Range: Coned off section of the playground
Deer Population: Amount of Ziploc bags held by students
Deer Casualties: Amount of Ziploc bags on the ground



Ecosystem Model Rules:

- One year equals one minute.
- Deer food is represented by pasta.
- Deer that eat 5-10 pieces of pasta, in one year, live and have one offspring.
- Deer that do not eat 5-10 pieces of pasta, in one year, either overeat or starve and therefore, die and must drop their Ziploc bag on the ground.

Year	Number of Deer at Start of Year	Number of Deer that Survived	Explanation
1	10	10	Enough food
2	20	20	Enough food
3	40	32	Less food, ↑ pop.
4	32	27	Less food, ↑ pop.

1

- Year 2, started with 20 deer and 20 survived. The number of deer in that year increased stayed the same decreased because there was enough food to sustain population.
- Year 4, started with 32 deer and 27 survived. The number of deer in that year increased stayed the same decreased because there was 1/4 less food + an increase in pop.
- What were the parts of this ecosystem? deer, food, space, housing development
- Do the parts of the ecosystem affect each other? (Circle One) Yes No

Part 2: Observing Human Impact

Directions: Your group will be assigned an ecosystem to investigate. You will get two maps of the same location each showing a different time period.

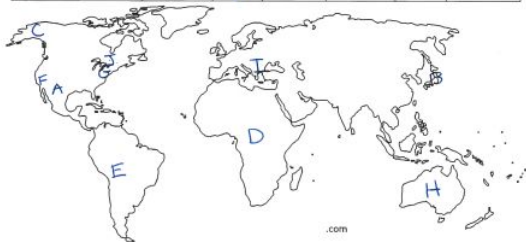


- What ecosystem was your group assigned?
U.S.A Alaska
- Look at the oldest map of your ecosystem and describe the different land, water, and plant features in the area. There are mountains and snow. There are no plants.
- What parts of your ecosystem changed (living and nonliving)? The snow melted into water and there are plants.
- The changes to the ecosystem during the given time period were: Positive Negative
- What human activity or activities caused these changes? People cause carbon dioxide levels to rise which raised the temperature.
As a class review human impact vocabulary.
- Get post-it note from your teacher. Write the following on your post-note:
 - Name of your ecosystem
 - Human activity(ies) that impacted the ecosystem
 - Indicate with a + or - if it was a positive or negative change
 Be prepared to share this information with the class and place the post-it note on the correct location on the world map.

2

11. For each location decide which of the following categories influenced the observable changes and/or the environment. Mark each box with a (+) for a positive change and a (-) for a negative change. Then put the letter next to the location name on the world map below.

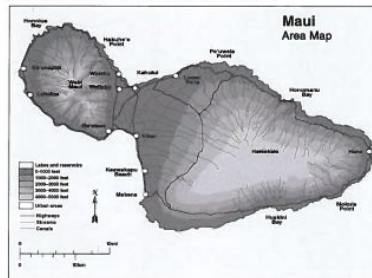
Location	Deforestation	Pollution	Resource Extraction (e.g. mining)	Land Development	Climate Change	Increasing Human Population
A. US: New Mexico					+	-
B. Japan		-				
C. US: Alaska					-	
D. Kenya	-			-		-
E. Brazil	-			-		
F. US: California		+			+	
G. US: Virginia	-		-	-		
H. Australia					-	
I. Romania		-	-	-		
J. US: New York		+				



3

Part 3: Predicting Human Impact:

- Look at the map of Maui. The white areas represent cities known as urban areas. Make a claim about how people have influenced the natural system in Maui.

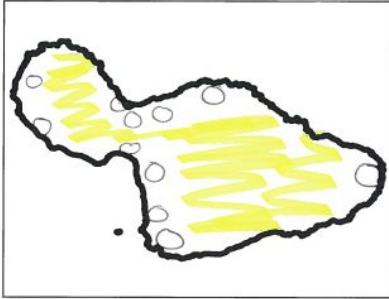


(Claim) We think people have caused deforestation

(Evidence) We reached this conclusion because in Kenya between 1973 and 2009 we saw deforestation occurred as people moved into likely happen in Maui.

4

13. Draw a model of Maui Island with the changes you predict will happen to the island's ecosystem if the population doubles. Shade the populated areas with pencil and color in the forested areas green.



14. Explain your drawing: I think the areas with large populations will grow.
There will also be new areas that did not have people in them before.

