UNIT 3 | HOW MANY IS ENOUGH?

EARTH: THE APPLE OF OUR EYE

METHOD

An apple is sliced into pieces to model the amount of agricultural land being used on Earth while students track data on a pie chart.

MATERIALS

- Apple
- Knife
- Cutting board
- Pie Chart Tracking Sheet (provided)
- Markers
- Rulers
- Article: "Do we treat our soil like dirt?"

NOTE: If you would rather not use an apple and knife, use a ball of Play-Doh and dental floss.

INTRODUCTION

There are approximately 8 billion people living on the planet, and we all need food in order to survive. Whether fruit, beans, cheese, cereal or meat, the food we eat originates in the soil. As the global population grows, there will be more demand for food as well a greater need for healthy soil to grow that food. Already, half of all the **habitable land** on Earth is used for farming, and much of that **agricultural land**, about 75 percent, is used to raise livestock like cows, pigs, and sheep. Land used for livestock includes space for animal grazing and as well for growing crops like corn, oats, and barley that go into animal feed.

To feed our growing population in a sustainable way, we must keep the farmland we are currently using healthy and minimize the amount of land that will need to be converted from wild lands to farmland in the future. Protecting soil from erosion, reducing pollution of land, air and water, and reducing our consumption of meat and dairy can all help to preserve our current farmland while saving as much land as possible for other important uses, like wildlife habitat.

PROCEDURE

1. Before class, print copies of the National Geographic article "Do we treat our soil like dirt?" at the appropriate text level for your students (adjust using the "Selected text level" dropdown).

COUNTING ON PEOPLE
K-5 Activities for Global Citizenship

CONCEPT

Half of the habitable land on Earth is used for food production, and it is important to preserve agricultural land in order to feed a growing population.

GRADE LEVEL

Upper elementary

SUBJECTS

Science, Social Studies, Math

OBJECTIVES

Students will be able to:

- Describe Earth's geography in terms of relative amounts of water, inhospitable land, habitable land, and land being used for farming.
- Apply knowledge of fractions to create a pie chart showing how the features of Earth's surface are divided.
- Identify two reasons why protecting agricultural land and maintaining healthy soil is important for food production.
- Describe at least two ways people can help preserve agricultural land.

SKILLS

Using fractions, creating a pie chart, observing, problem solving, reading and comprehending informational text, understanding cause and effect

2. Ask students to share what they ate for breakfast that morning and write responses on the board.

3. Pick a few of the students' responses, and as a class, discuss where each food came from (a tree, grains from a farm, an animal, etc.).

4. Introduce the term "agricultural land" to students and ask them to determine whether or not their breakfast foods came from the Earth's agricultural land.

Agricultural land: Land used for growing food and raising livestock for human consumption.

5. Explain that you will use an apple to find how much of the Earth's surface is agricultural land that is used to grow the food that feeds our human population.

6. Distribute the Pie Chart Tracking Sheet, markers, and a ruler to each student. Explain that students will keep track of the different features of the Earth's surface by making a pie chart on their Tracking Sheet.

7. Slice the apple according to the instructions, narrating as you go. (For a non-food option, use a baseball-size ball of Play-Doh. The Play-Doh will need to be somewhat firm so it keeps shape while you cut it with the dental floss.) Use a globe or a map of the world to point out the different geographic features that are discussed during the demonstration.

8. Pause throughout the demonstration to allow students time to color and label their Pie Chart Tracking Sheet based on the divisions in the apple-cutting demo.

Apple	**Earth**	**Narrative**	**Pie Chart**
Whole Apple	Planet Earth	Hold the apple out so that the class can see it. "This apple represents our planet."	
3/4	Earth's water	Cut the apple into quarters. Hold out 3/4 in one hand. Ask the students, "What do you think these pieces represent?" They may want to look at the globe for help. "These pieces represent all of the water in the world." Ask, "What fraction of the Earth's surface is covered in water?" *(3/4)* Set the three "water" sections aside.	Students color 3/4 of the pie chart blue to represent Earth's water and label it.
1/4	Earth's land	Hold out the remaining quarter. Ask the class, "What fraction remains?" *(1/4)* "This 1/4 represents all of the land on our planet."	

Apple	Earth	Narrative	Pie Chart
1/12	Inhospitable land	Slice the land (the remaining 1/4) in thirds, lengthwise. Hold out one of the pieces. Ask the class, "What fraction of the Earth's surface is this?" *(1/12)* "This 1/12 represents the areas where people can't live, and we also can't grow food." Ask students, "What types of land might fall into this category?" *(polar areas, deserts, swamps, very high or rocky mountains)*. "We call this land **inhospitable**." Set this "inhospitable land" slice aside.	Students divide the remaining 1/4 of their pie chart into thirds, lengthwise. Students decorate 1/12 of their pie chart to represent inhospitable areas and label it.
2/12 or 1/6	Habitable land	Hold up the remaining 2/12. Ask the class, "What fraction of the Earth's surface is this?" *(2/12 or 1/6)* "This is land that is "habitable" – land where people can live, and we could grow crops. But we don't use all of this land for agriculture.	
1/12	Habitable land that is not used for agriculture	Hold up one of the two "habitable" 1/12 pieces from the last step. "This land includes everything that isn't growing crops to feed us." Ask, "What types of things would be included on this land?" *(forests, wild shrub lands, developed areas like roads, schools, houses, etc.)* You may want to share that most of this land is forests and shrub lands that are home to rich and diverse wildlife. Some of it, but only a small fraction (1%), is developed by humans. Set this slice aside.	Students decorate and label another 1/12 of their pie chart to represent habitable land that is being used for things other than growing crops. They may color trees, buildings, roads, etc.
1/12	Agricultural land	Hold up the second of the two "habitable" 1/12 pieces and ask students, "What fraction of the Earth's surface is this?" *(1/12)* "This represents the Earth's agricultural land, all the land on Earth that is currently being used to grow food." You may want to remind them that this is half of all the habitable land on Earth.	

Apple	Earth	Narrative	Pie Chart
1/12 peel	Topsoil of agricultural land	Carefully remove the peel from the 1/12 slice of 'agricultural land' from the last step. Hold out the peel. "This peel represents **topsoil** – the soil right on the surface of the Earth in which plants grow."	
1/48 peel	Land used to grow crops directly for humans (doesn't include livestock)	Say, "But not all of the crops grown in this soil are being used in the same way." Cut the peel crosswise into 4 equal pieces and hold up one piece (1/48 of the whole apple's peel). "This is the amount of our farmland that is being used to grow crops like beans, fruits, vegetables and grains that get harvested for humans to eat. What fraction of our farmland is this?" *(1/4)*	Students divide the remaining 1/12 of the pie chart crosswise into 4 equal sections. Students label 1 of those 4 sections as cropland for humans.
3/48 peel		Ask, "What do you think the remaining agricultural land is used for?" "The remaining 3/4 of agricultural land is used for livestock like cows, pigs, and sheep. This land is used for grazing, where livestock eat grasses and other plants, and also to grow crops like corn, soybeans, oats, and barley that go into livestock feed."	Students label the remaining 3 sections (3/48 of the pie chart) as cropland for livestock.

If you want to reinforce the math concepts from the apple-cutting demo, have students work on one or more of the questions from the "Math Extension Bank" below. The extension questions can be worked on individually or in small groups.

Math Extension Bank

- Write a formula to express how the Earth's land is divided. *(Option 1: 1/3 inhospitable + 1/3 habitable but not used for crops + 1/3 agricultural; Option 2: 2/3 habitable +1/3 inhospitable; Option 3: 1/48 crops for people + 3/48 farming land for livestock +1/12 habitable but not used for farming + 1/12 inhospitable)*

- Write an equation using < or > to show how two different features of the Earth surface compare in size.

- Write a math story using at least five fractions or percentages to explain how the Earth's surface is divided. Teacher note: If necessary, provide a 'Fraction Bank' that includes the following fractions: 1/4, 3/4, 1/2, 1/12, 1/6, 1/48, 3/48

  Sample story 1: 1/4 of the Earth's surface is land. 1/3 of all the land on Earth is inhospitable and can't grow crops. Also people can't live there. Of the land where people can live, 1/2 is used for crops. The other 1/2 is forest and land that people are using for things like roads and houses. When you look closely at our cropland, you see that only 1/4 of it is used for food that humans eat straight from the farm. The other 3/4 of cropland goes to grazing and feeding livestock that eventually get eaten by humans.

  Sample story 2: 1/4 of the Earth's surface is land and 3/4 is water. 1/12 of Earth's surface is too harsh for people to live and for people to grow crops. Another 1/12 is covered in forests and things like roads, schools, and houses. The last 1/12 is land that is used to grow crops.

- We used an apple as a 3D model of the Earth. Can you think of a way to show the divisions we made using a different method?

9. Distribute a copy of the article "Do we treat our soil like dirt?" to each student. While they read the article, they should use their markers to highlight threats to the world's soil and underline things that can be done to protect the world's soil.

10. After reading, have students pair up to compare the threats and protections that they identified in the article.

DISCUSSION QUESTIONS

1. What are some foods you eat every day that are grown directly in the soil? What are some foods that come from livestock?

Answers may include: grains (like rice, wheat for bread, and corn for cereal), apples and other fruits that grow on trees, carrots and other vegetables, spinach and other green, leafy plants. All meat and dairy products come from livestock, including burgers, steak, ham, hotdogs, chicken, cheese, yogurt, milk, etc.

2. Are there examples of agricultural land in your community? Or examples of agricultural land you've seen somewhere else? What do these spaces look like?

Answers will vary.

3. Think about the article you just read. What are some human actions that are threatening the health of the world's soil?

Soil erosion, paving over farmland, loss of nutrients, and pollution.

4. **Erosion**, the removal of soil from the Earth's surface by wind and water, is the most serious threat to soil health. Although it is a natural process, erosion can be made worse by human actions. What human actions can cause soil erosion (look at the highlights in your article)?

Deforestation*: The roots and fallen leaves and branches of plants help to keep soil in place. When trees are cut down, the soil is no longer protected, and it easily washes away in the wind and rain. Planting trees can help prevent soil erosion.* '

Overgrazing*: When cattle eat grass, they pull it out of the ground by the roots, taking some soil with it. Each bite leaves a patch of ground uncovered, exposed to the wind and the rain. Also, these animals have sharp hooves that tear up the surface a little with each step.*

5. The article mentions that another threat to agricultural land is the loss of nutrients in the soil, which happens when the soil is not allowed to rest. What do you think it means to let soil "rest?"

It takes time for nutrients in the soil to replenish after growing a plant. To let soil rest, it can be left empty for a season so that the nutrients can be restored. Or, because different plants require different nutrients to grow, a different type of plant can be grown in the soil. This is known as ***crop rotation*** *– rotating the type of plants being grown in the soil so that nutrients can replenish. Most large industrial farms don't practice crop rotation because it is harder to maintain and more expensive. But many small, local farms rotate their crops and allow the soil to rest when needed.*

6. Why do you think so much more land is required for raising livestock than for other crops?

Answers will vary. Livestock not only need space and pastures to graze on, but also require feed. Animal feed is often made from corn, barley, wheat and other foods that require cropland to grow. It takes a lot of space to grow the grasses and grains that livestock will need to eat year after year in order to grow into big, healthy adults.

7. Can you think of reasons why we might need to increase the amount of land needed to grow crops?

We may need to increase the amount of land being used to grow crops if there is too much soil erosion, if the soil becomes polluted or losses its nutrients, or if more people eat meat and dairy so that there is more need for land dedicated to livestock grazing and feed. We may also need more farmland as the human population grows and there are more people to feed.

8. Earth's topsoil is generally 5-10 inches deep. It can take up to 1,000 years for about one inch of topsoil to form. Why is it important to preserve the topsoil on our agricultural land? Can't we just expand agricultural land into habitable land that's not currently being used for agriculture?

Because top soil takes so long to form, if the soil on agricultural land becomes damaged, polluted, or erodes away, we may need to expand into areas being used for other things. Most of the habitable land not being used for farming is covered in rich wild lands (forests and shrub land) that support a diversity of plant and animal wildlife. Converting this wild land to crops for humans or livestock would harm important ecosystems. Forests are also critical in filtering the air and helping to prevent climate change.

9. What are some ways we could help protect the agricultural land that we currently use (look at the underlines in your article)?

Answers may include: keeping the soil and water clear of pollution by disposing of chemicals properly, planting trees in areas that might be prone to erosion, eating less meat and dairy, conserving energy to help reduce pollution that becomes acid rain and pollutes the soil, buying food from farmers who practice crop rotation, teaching others about the importance of protecting our soil.

10. Where else does food come from beside agricultural land?

Waterways including oceans, rivers, lakes, and streams. It is important to take care of our waterways as well as our farmland.

MEASURING LEARNING

Students write an exit-ticket that lists one reason it is important to maintain healthy agricultural land and one action that can protect current farmland.

FOLLOW-UP ACTIVITIES

1. Arrange a class field trip to a local farm. At the farm, explore foods that come from the farm, discuss with the farmer how the farm may have changed over the years, and investigate how the farmer keeps the soil healthy.

2. Try the activity, *Scraps into Soil*, in the People and Waste Unit of this curriculum in order to further explore soil and introduce students to the concept of composting. You can use the soil from this activity to start a class or school garden.

EARTH: THE APPLE OF OUR EYE
PIE CHART TRACKING SHEET

Name: _____ Date: _____

THE EARTH'S SURFACE