Earth Day Resources
•Elementary Grades•

Reading: **How Many is Enough?**

Lesson Plans:

Comparing Needs and Wants (K-2; social studies, language arts) - *Students identify items presented to them as needs or wants and create a collage of images.*

Green Spaces (3-5; science, social studies, math) - *Students estimate and verify the amount of green space necessary to meet the oxygen needs of the entire class and then design an imaginary city that meets both the oxygen needs and daily living needs of the city's residents.*

Panther Hunt (3-5; science, social studies, math) - *Students gain an understanding of carrying capacity when they act as predatory animals in a finite area and attempt to accumulate enough food to stay alive.*

Web of Life (K-5; science, language arts, social studies) - *Through an interactive story and hands-on involvement, students explore how everything in the natural community is interconnected.*

Who Polluted the River? (K-2; science, social studies, language arts) - *By creating their own "polluted river," students learn how our growing population and use of resources have affected local waterways.*

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POPULATION EDUCATION

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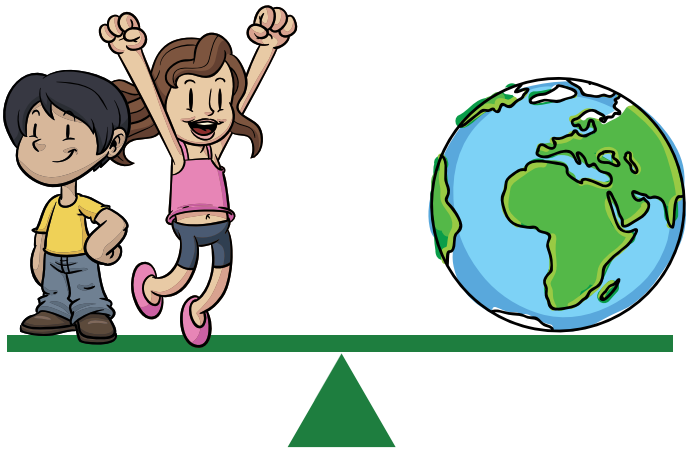
HOW MANY IS ENOUGH?

Unit 2 examined how populations grow. It is important for students to understand that populations cannot continue to grow indefinitely. Every ecosystem has a **carrying capacity**, the maximum number of members of a species that can be supported by the finite resources of that area. In this unit, students will learn that finite resources create a carrying capacity for animals and people.



Before beginning these activities, go over the following information with your students:

What would happen if the population of your class continued to grow but remained in the same classroom? Do you think there is a limit to the number of students your classroom could hold comfortably? If your class grew even by just a few students, there may not be enough desks, chairs, and school supplies to go around. Your class has a carrying capacity, the largest number of students that your classroom could hold and still allow your teacher to conduct class with everyone having desks, chairs, and supplies.

Think of a wooded area which is home to deer, rabbits, and squirrels. There is only enough food to be found for so many animals. If the populations of these animals grow too much, some may have to leave to find other food and shelter. The wooded area has a carrying capacity. It can only support so many animals.

The world also has a carrying capacity for humans. People need all sorts of things to live: food, water, shelter, and energy. For these things, we need to use land to grow crops, manage forests, and mine for fuel and minerals. There is a limit to how much food and how many trees can be grown and how much we can mine from the ground. If the population of people continues to grow, there will not be enough of these things, or **resources**, to go around.

Think about your classroom again. You may be happiest if the class size does not grow. That way, you have more space around your desk, get to ask and answer more questions in class, and get to know your classmates and teacher better. You may not want the population of your class to grow to the carrying capacity. It is the same in your town, country, and in the world. The best population size may not be the biggest, but one in which everyone has plenty to eat, open space to enjoy, a nice, safe place to live, and many friends.

UNIT 4 | MEETING PEOPLE'S BASIC NEEDS

COMPARING NEEDS AND WANTS

COUNTING ON PEOPLE
K-5 Activities for Global Citizenship

METHOD

Students identify items presented to them as needs or wants and create a collage of images.

MATERIALS

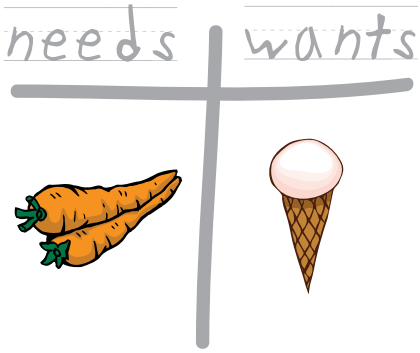
Part 1:

- Large paper bag
- Assorted common household items
- Item cards (provided, 1 set per student)

Part 2:

- Old magazines
- Scissors
- Glue sticks

INTRODUCTION



We live in a society of abundance. Students are constantly bombarded with messages and advertisements telling them to want and seek more material goods. Even TV shows and movies emphasize the idea that "more is better" and having a lot of material goods should be our goal. At times, it can be hard to appreciate what we already have and to determine what is actually necessary and what we can do without. In this activity, students clarify the things they need versus the things they want.

PART 1: IN THE BAG

PROCEDURE

1. Before class, fill a large paper bag with assorted household items such as a newspaper, pencil, fork, aspirin, potato, light bulb, CD, deck of cards, canned soup, a baseball, bottle of water, gum, cell phone, etc.

CONCEPT

Some resources are necessary for human's survival. Other resources, while they might make us happy, we can do without.

GRADE LEVEL

Lower elementary

SUBJECTS

Social Studies, Language Arts, Art

OBJECTIVES

Students will be able to:

- Define a need and a want.
- Differentiate between a need and a want.
- Describe where our human needs come from.

SKILLS

Critical thinking, decision making, categorizing, sorting, writing

2. In class, explain that you will be discussing needs and wants. Ask the students to share what they think defines a **need** and then provide the definition – a need is something you must have in order to survive. Now ask the students to share what they think defines a **want** and then provide the definition – a want is something that you would like to have but you are able to do without. Write both definitions on the board.

3. Take one item out of the bag at a time and ask the students if it is a need or a want. If there are disagreements over an item, ask the students to clarify why they made their choice. You may want to refer back to the definitions on the board. Create two piles of the items in the front of the classroom, one of needs and the other of wants, until you've gone through all of the items in the bag.

4. Focusing specifically on the pile of needs, go through each of the items and have the students brainstorm where the different items came from. (Water might be from a well underground, rain, a river or local lake; an ear of corn grew from a stalk growing in the soil; etc.)

5. Have each student take out two pieces of paper and label one piece "Needs" and the other piece "Wants."

6. Distribute a sheet of Item Cards to each student. You can start by having the students identify the picture on each card and write what it is on the line. (If you'd rather have the students just use the pictures and not label them, that's okay too.) Then students should cut out each image, including their written description.

7. Remind the students that a need is something necessary for them to live; a want is something they'd like to have but could live without. Instruct the students to separate the Item Cards into needs and wants. The cards that picture a need should be placed on the "Needs" piece of paper and wants should be placed on the "Wants" piece. Finally, the students will paste the images onto the paper. (You may want to check that students have separated the cards correctly before they begin pasting.)

PART 2: CREATE A COLLAGE

PROCEDURE

1. Have students create a collage by cutting pictures out of magazines. Give each student a piece of paper that has been divided in half with the left side section labeled 'Things I Need' and the right side section labeled 'Things I Want.' Provide a variety of magazines for the class.

2. Students should look through magazines and/or newspapers to find pictures of items that fit into these categories, cut out the images, and paste them into the appropriate section. (If students have a specific item in mind that they'd like to include but can't find in a magazine provided, you may want to let them look up an image online and print it.)

DISCUSSION QUESTIONS

1. How can we tell the difference between a need and a want?

   A need is something we cannot live without; we must have it to survive. A want is something that would make us happy but we can live without; it's something we wish we had.

2. Looking at the lists you made, which side has more items?

The list of wants has more items.

3. Where do the things we need (food, air, water, shelter) come from?

The things we need come from nature/the environment.

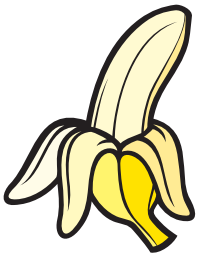
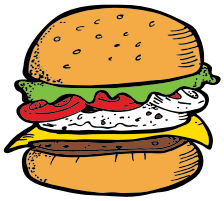
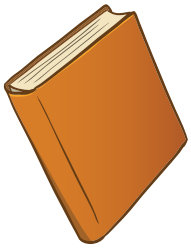
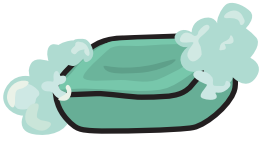
MEASURING LEARNING

Look over the individual students' lists and their collages to ensure understanding of needs versus wants. Have each student share their collage with the class by holding it up and pointing out the following three things: one item that is a want, one item that is a need, and telling the class where the need comes from. If the student doesn't know where the need comes from, open it up to the class to brainstorm.

FOLLOW-UP ACTIVITY

From the book *A Life Like Mine: How children live around the world*, select a couple of the children profiled. Lead a discussion with your class on how the needs and wants of these children might be similar or different from their own needs and wants. You might also compare and contrast how the profiled children's needs and wants are met when compared to how your students' needs and wants are met.

ITEM CARDS

UNIT 5 | CROWDING

GREEN SPACES

COUNTING ON PEOPLE
K-5 Activities for Global Citizenship

METHOD

Students estimate and verify the amount of green space necessary to meet the oxygen needs of the entire class and then design an imaginary city that meets both the oxygen needs and daily living needs of the city's residents.

MATERIALS

Part 1:

- Rulers or meter sticks
- String (20 ft piece for each student)
- Popsicle sticks (per student)
- Additional Popsicle sticks (optional)
- Geranium leaves (optional)
- Microscope or magnifying glass (optional)
- Calculator (optional)

Part 2:

- Student Worksheet

CONCEPT

It is important for communities to have green spaces so they avoid the dangers of overdevelopment.

GRADE LEVEL

Upper elementary

SUBJECTS

Science, Social Studies, Math

OBJECTIVES

Students will be able to:

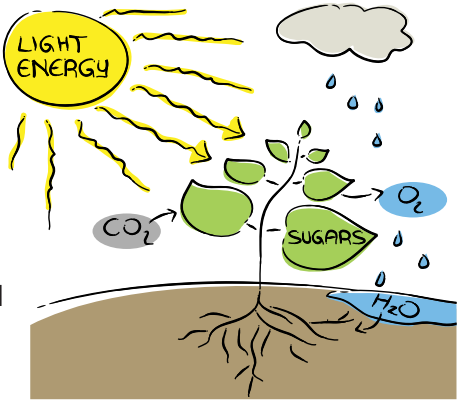
- Identify the amount of green space needed to supply oxygen for their entire class.
- Describe why green space is important and see how a growing population can impact the availability of green space.
- Develop ways to establish more green space in an urban setting.
- Assess the consequences of living with more people and less green space.

SKILLS

Collecting and analyzing data, estimating, adding, problem solving, measuring area, calculating percentages

INTRODUCTION

Green space can be defined as community space, such as parks, where plant life grows. In this activity, the focus is on green space consisting of grass. The more people there are, the less green space we have. For example, if our population doubles, we will need more houses, schools, hospitals, libraries, grocery stores, and roads. All of this construction decreases our green space. We need green space for many reasons, one of which is the production of oxygen.



During the process of photosynthesis, plants absorb carbon dioxide from the air and release oxygen. In doing this, plants help to filter pollutants out of the air (CO_2), while also producing oxygen for people and animals to breathe. (Note: Algae is also a large producer of oxygen, however is not

considered a plant.) In cities where many people live, it can be hard to maintain and/or preserve green space. Green spaces are important not only for oxygen production, but also to maintain biodiversity and create places for people to play and enjoy nature. Urban planners strive to design cities that will meet both the need for green space and city development.

PART 1: HOW MUCH GREEN DO WE NEED?

PROCEDURE

1. Before class, gather enough Popsicle sticks so that there is one for every student. Tie a 20 ft piece of string to each Popsicle stick.

2. Show students the stomata of geranium or other leaves, using a magnifier. Explain that, "Through the process of photosynthesis, plants absorb carbon dioxide from the air and make oxygen. It comes out of tiny openings like this one, called the 'stomata.' Some of the oxygen we breathe is made by plants." (A large portion of our oxygen comes from phytoplankton, or algae, which is not classified as a plant.)

3. While all plants make oxygen, today, we are going to think about the oxygen created by grass. Ask the class, "How large an area of grass do you think is needed to make a day's worth of oxygen for the entire class?" Have students write down their guesses on a piece of paper and give them to you. Tell students you will be working together as a class to figure this out.

4. Then ask the class, "How much grass do you think it takes to provide the oxygen needed by one person for one day?" After a few guesses tell them the answer, "A square of grass about 5 ft x 5 ft."

5. Give each student a Popsicle stick with a 20 ft piece of string tied to it and a ruler or meter stick. Go outside and have each student place their Popsicle stick with the string tied to it in the ground – this will be the first corner of their square. Next, students should use the ruler or meter stick to lay out a 5 ft x 5 ft square of string. If it is windy, students can anchor the string in place by placing additional Popsicle sticks in the ground at each corner and then wrapping the string around.

6. Make sure students' spaces are adjacent to each other, not overlapping. To save on time, you could have small groups of four work together to make adjacent squares, instead of coordinating the entire class together. Or, you may want to conduct this portion with the help of parent volunteers.

7. Find the area of each student's square (25 square feet), and then add (or multiply) to find out the total number of grass covered square feet needed to meet the oxygen needs of your class. Return the students' earlier estimates and discuss whether their guesses were larger, smaller, or close to the actual number of square feet needed to supply oxygen for the entire class.

8. Help students estimate how much green space is needed to supply all the students in the school with oxygen.

PART 2: CITY PLANNING

Our air, and the oxygen in it, is shared around the world. So we all benefit from the oxygen produced in other parts of the world. This part of the activity simulates the amount of oxygen needed by a population living in a city, without accounting for oxygen created in other parts of the world.

PROCEDURE

1. Give each student a copy of the Student Worksheet. Explain that the City Planning Grid represents a whole city and each block on the grid represents 25 square feet of space, enough to meet the oxygen needs of one person for one day, if it were covered in grass. Tell them there are 900 blocks.

2. Ask students, "If the entire city was green space planted with grass, how many people could be supported by the oxygen in this city?" (*900)*

3. Explain that the city cannot be all green space because there needs to be a place for the houses, roads, stores, and factories that will support the daily lives of the population.

4. Have students work through Part 1 of the Student Worksheet to determine if the city has enough green space to support a population of 400 people, once space for housing, roads, stores, and factories has been developed.

5. As a class, brainstorm ways that more green space could be produced in the city so that the population of 400 people can live with sufficient green space. Ideas could include: combining some of the residential areas into skyscrapers so that more ground level room is left open, ripping out unused parking lots to develop green space, requiring some "blocks" to have rooftop gardens, etc.

6. Challenge students to complete Part 2 and Part 3 of the Student Worksheet to design a city that can meet both the oxygen needs and living needs for a population of 400 people.

Note: You may want to assign these tasks for homework or as a project to be completed over several days.

STUDENT WORKSHEET ANSWERS

No, the developed space uses 594 blocks, leaving only 306 blocks, or 34% of the land area, open as green space. There would need to be 94 additional "green" blocks in order to support the oxygen needs of 400 people.

DISCUSSION QUESTIONS

1. We need green space for air. Why else do we need green space?

Answers will vary but may include: being outdoors, going for walks, having picnics, playing sports, reading a book, a place for dogs to run, preserving the habitat of plants and animals, visual appeal, a place to be alone, increase tourism to an area, etc.

2. How do you think green spaces are impacted when the population of a city, state, or country grows?

As a population grows, green space may be developed in order to support the housing, education, and lifestyle needs of a larger population. As a result, the amount of green space gets smaller. Ecosystems may suffer as habitats are destroyed for development.

3. Can you think of ways to maintain green space, even when the population of a city is increasing?

Answers will vary but may include: tearing up unused or under-used paved places and turning them into parks or gardens, "building up" so that less space is needed for housing and businesses, passing laws to preserve the green space that is currently available, creating gardens and parks on rooftops of buildings, etc.

4. What are the possible consequences of living with more people and less green space?

Less green space would mean that there is less oxygen being produced and not as much pollution being filtered out of the air. This could cause air quality to decrease leading to a number of health problems. Less green space would also mean less room for people to enjoy the outdoors and fewer habitats to support plants and animals.

5. Grass is not the only oxygen producing plant. A plant's ability to produce oxygen is based on the amount of surface area that is green. What other plants could help filter air and create oxygen? How can this help create more green space in a city?

All trees, bushes, and flowers are also oxygen producers. These plants can be planted in areas where there isn't space to plant large plots of grass (sidewalks, courtyards, medians of roads, small yards, etc.). Areas with a combination of grass and other plants have even more oxygen producing potential!

MEASURING LEARNING

Rather than going over the Discussion Questions as a whole class, play the game "Corners." Write each question on a different piece of chart paper and tape the pieces of paper around the room. Divide the class into five small groups. Instruct the groups to rotate through each question, discussing the answers together and then responding in writing on the paper. Review responses to check for student understanding.

FOLLOW-UP ACTIVITIES

1. Using maps of your community, have students estimate the total area of land devoted to public parks and green space. Discuss whether this amount is sufficient, insufficient, or more than sufficient for community needs, considering things such as housing, transportation, filtering pollutants, recreation, etc. Then have students use current population totals to calculate the amount of green space (planted with grass) that would be needed to provide oxygen for city, county, state and/or national needs.

2. Using maps of New York City and current population estimates for Manhattan, have students determine whether Central Park is adequate to meet the oxygen needs of all Manhattan residents. Central Park is approximately 2.5 miles long and .5 miles wide (843 acres, which equals 1.47 million square feet). To give students a visual, you can "visit" Central Park on Google Earth. (Note: In 2012, Manhattan's residential population was approximately 1.6 million.)

3. Research and discuss how cities and communities are working to develop more green spaces. Project EverGreen is a group working to enhance green spaces in cities across the United States. A good place to start your research would be in the “Our Work” section of their website, **http://projectevergreen.com/our-work/**. Additional information can be easily found on-line.

4. Facilitate the activity, *Timber!*, to explore the effects of growing demand for trees on a forest.

GREEN SPACES
STUDENT WORKSHEET

Name: _____ Date: _____

Part 1: Each of the 900 blocks in your city planning grid is equal to 25 square feet, enough to support the oxygen needs of one person when planted with grass. However, not all this land can be left open – people need somewhere to live and work, and a way to get from place to place! Use the chart below to determine whether your city can currently support the daily living needs AND the oxygen needs of its 400 residents.

Type of land use	% of total land area used	Number of blocks on Grid
Housing	41%	369
Commercial (restaurants, stores, doctors, etc.)	6%	54
Industrial (factories)	4%	36
Transportation (roads, parking lots, airport, railroad)	8%	72
Public Facilities (schools, hospitals, museums, churches)	7%	63
Green Space, Vacant Land	_____ %	_____ blocks

*percentages are based on land use distribution in New York City.

Is the number of blocks available for green space enough to support 400 people? _____

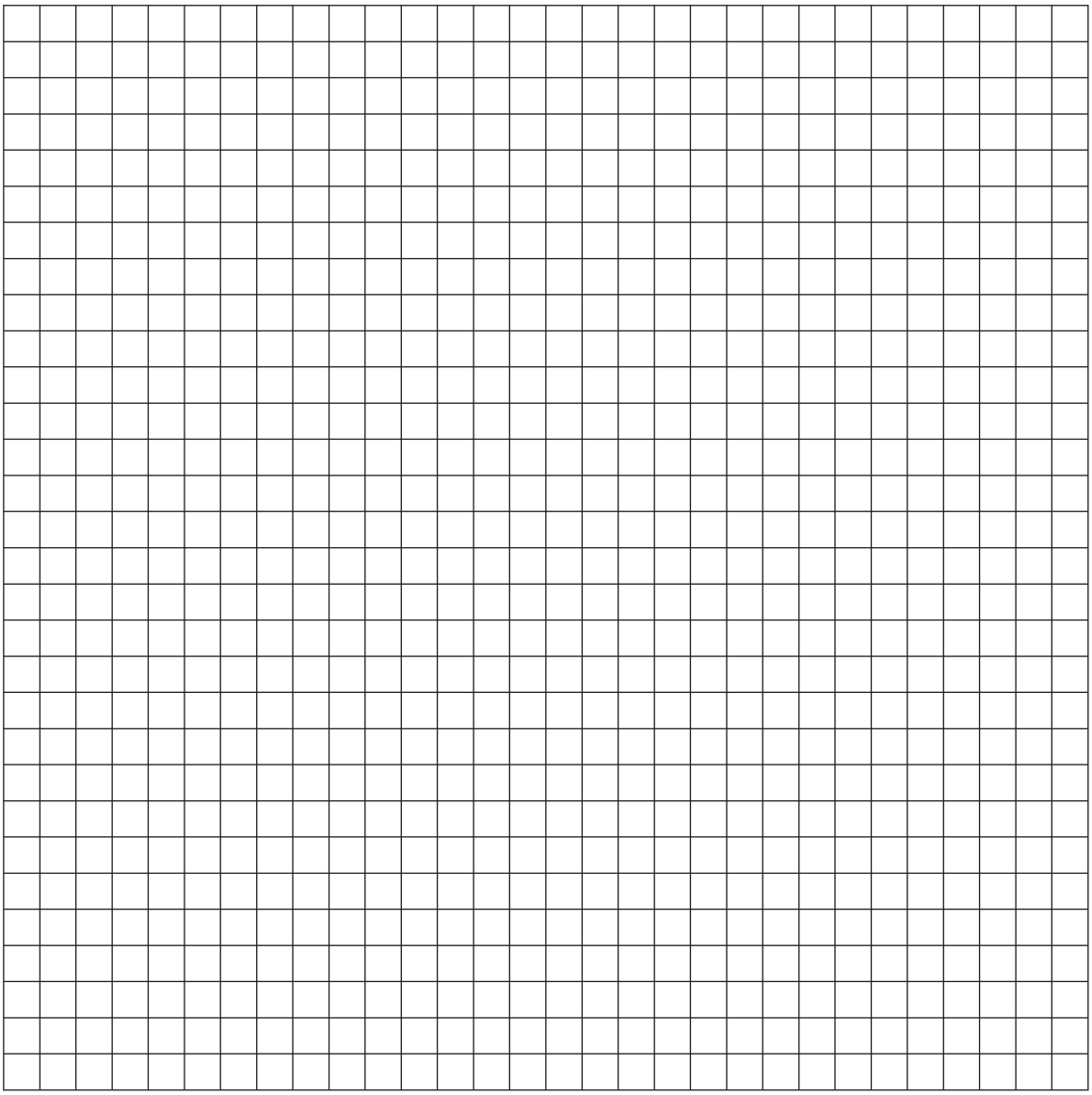
How many more "green" blocks would you need? _____

Part 2: Can you figure out ways to have more green space available? Make changes to your city and record your decisions below. Try to make your changes realistic and remember that you can make changes to multiple categories of land use. Don't forget, you need a total of 400 green squares!

Type of land that will change	What change will be made?	How many blocks will be turned into green space?

Part 3: Use the City Planning Grid to design your new city. Choose a color (not green!) to represent each type of developed land by coloring in the boxes in the key. Then color the appropriate number of squares on the grid to represent each. After you're done "building" your developed areas, color all your open spaces green. Are you left with enough green space to support all your people? Don't forget to name your new "green" city!

City Name: _____



Key:
Fill in each square with the color you will use to represent the five different land uses.

- ☐ Housing
- ☐ Industrial
- ☐ Public Facilities
- ☐ Commercial
- ☐ Transportation

PANTHER HUNT

COUNTING ON PEOPLE
K-5 Activities for Global Citizenship

METHOD

Students gain an understanding of carrying capacity when they act as predatory animals in a finite area and attempt to accumulate enough food to stay alive.

MATERIALS

- 200 paper cups (3 oz)
- Blindfold

INTRODUCTION

It's been said that every person on the planet, all seven billion of us, could fit into the state of Texas. But being able to fit a certain number of people into a space doesn't mean they'd be able to live there for any length of time. We need more than just a certain amount of space to survive; we need things like food and water. There isn't enough farmland or drinking water in Texas to support seven billion people. Texas, the United States, and the planet all have limits to how much they can give to support people. Every habitat has a limit – that is its **carrying capacity**. This simulation helps students understand the concept of carrying capacity in nature by having them act out the survival attempts of panthers living in an area with limited food resources.

PROCEDURE

1. Prior to class, label the bottom of each cup to represent a prey animal as follows:

80 cups marked S (squirrel = 1 kg)
60 cups marked R (rabbit = 2 kg)
36 cups marked P (porcupine = 7.5 kg)
22 cups marked B (beaver = 20 kg)
2 cups marked D (deer = 75 kg)

Set the cups out around the classroom so that the bottom is facing up, showing students the letters indicating what type of prey the cup represents. This activity could also be done in an outdoor space.

CONCEPT

Every piece of land has a limited carrying capacity for the number of animals and/or humans it can support.

GRADE LEVEL

Upper elementary

SUBJECTS

Science, Social Studies, Math

OBJECTIVES

Students will be able to:

- Define carrying capacity and explain how it relates to animals and people.
- Calculate the carrying capacity of a determined area.
- Determine the similarities and differences between animal and human population growth patterns and carrying capacities.

SKILLS

Observing, understanding cause and effect, adding, role playing, using metric weights, finding averages, multiplying, dividing

Note: For classes of roughly 25 students, 200 cups works best. To adjust for class size, decide how many panthers will survive and determine the carrying capacity by multiplying that number by 50, and subtracting from 1,060 (total amount of kg in a 200-cup set). There shouldn't be enough prey available for all the panthers to survive – the simulation works best when only 50-70 percent of the panthers survive the season to show how finite resources affect carrying capacity.

2. Write what each cup represents, the animal and the weight, on the board so the students will know what they're hunting.

3. When ready to begin the simulation, indicate the area where you have set out the cups, and say, "This is the habitat of a population of panthers and each of you represents one panther. Right now you will each try to find enough food in this habitat to survive for about a month, 50 kg." Explain to students that 1 kg = 2.2 lbs, so 50 kg = 110 lbs. It may be helpful to show a picture of a panther to the class.

4. Select one student from the class and explain, "This panther has been injured by tackling a big buck and now has a broken leg so he/she will have to hunt on one leg." Tell the student to hop on one foot.

5. Select another student and say, "This panther is blind due to an injury caused by a porcupine." Give the student a scarf or bandana to use as a blindfold.

6. Select a third student and explain, "This panther is a female with two cubs and each cub needs 25 kg of food to live, so if they are all going to survive, she needs to find 100 kg of food."

7. Indicate the chart on the board and read it aloud to be sure the students understand what they're looking for. Ask each student to set up a panther den by selecting a small area where they will bring their prey. This could be their desks or areas along the wall.

8. Give students the following instructions: "Each panther must walk into the habitat to hunt. (Panthers don't run down prey, they stalk it.) When a panther finds a prey animal, he or she picks it up and carries it to his or her den. Each panther can only carry one prey animal at a time. Remember that in the wild, panthers don't fight over prey, as a resulting injury may kill them. Once the prey is in a panther's den, it is safe from other panthers (panthers don't steal)." Students continue to repeat the process until all the prey has been collected.

9. When all the paper cups have been gathered, the hunting is over. Each student should return to his or her den to calculate the quantity of food he or she gathered. Then, discuss with the class the following questions.

DISCUSSION QUESTIONS

1. How many kilograms did each panther gather? How many panthers survived in this habitat? Is that the carrying capacity of this habitat for panthers? (*No*) How can we calculate the carrying capacity for this habitat?

   Answers will vary. To calculate the amount of panthers that could have survived in the simulation, add up all of the prey (1060 kg) and divide by the amount each panther needs to survive (50 kg). The habitat could have supported 21 panthers.

2. If more panthers played the game, would this habitat support them? How many kilograms of prey would be needed for the whole class of panthers to survive?

No, the habitat would not support more panthers playing. The amount needed for the entire class to survive could be found by taking the total number of students and multiplying by 50.

3. How many kilograms did the blind panther gather? The injured panther? Can a blind or injured panther survive in the wild? What about the mother panther? What are the chances of her cubs surviving in this habitat? Who is the mother going to feed first?

Answers will vary. In regards to the mother panther, explain that she will probably feed herself first to keep healthy so that she can tend to her cubs. If she stays healthy, perhaps the habitat will support healthy cubs in the future.

4. What would happen to the panther population if all the rabbits died of a disease? What would happen to the prey animals if all the panthers were captured and removed from the habitat?

If all the rabbits died of a disease, the carrying capacity of the panthers would drop. The panthers' food supply would be cut; therefore, fewer panthers would survive. If all the panthers were captured and removed from the habitat, the prey animals would have no predators and the balance of the ecosystem would shift – population levels of the prey animals may significantly increase; over-grazing would affect the plant populations causing a food shortage; the changes in the ecosystem would increase competition for resources because the population levels are not sustainable.

5. What would happen to the panther population if the water became polluted? Why would the concentration of the pollutant be greatest in the panthers?

The panthers and all the other animals drinking the water would become sick and some may die. The panthers would have the highest concentrations of pollutants in their bodies because panthers are at the top of the food chain; they eat the other creatures that are also drinking the water. This is called ***bioaccumulation****. Not only are they consuming the polluted water themselves, they are taking in all of the pollution that is stored in the tissue of each animal they eat.*

6. Do you notice anything about where the surviving panthers are located? (You may want the surviving panthers to raise their hands so they're easy to see.) Where are they in relation to the food supply?

Often, the students seated closest to the paper cups will survive while those further away will not.

7. Though this game is about the carrying capacity of panthers in a region, do the same rules apply to humans? How are they similar and dissimilar?

Yes. Similarities include: humans are at the top of the food chain; just as the panthers compete for prey, humans compete for a number of limited resources within our own habitat, or society; in some cases, whether or not you get resources depends on how close you are to them (your access level and their availability). Dissimilarities include: humans generally don't stop "hunting" when we have enough of something (we continue competing for things that we don't really need while panthers stop when they are full).

MEASURING LEARNING

Have students write their thoughts and ideas about the following questions in their journals. “Think about our classroom. What is the carrying capacity of our classroom? What classroom resources determine the maximum number of students that can be in a class? Looking around the room at the resources we have, how many additional students do you think we could add before reaching our carrying capacity?” Younger students could work in groups to determine carrying capacity of one of the following: the classroom, the school, or a neighborhood.

FOLLOW-UP ACTIVITY

Now that students have completed a simulation of carrying capacity for wild animals in a finite habitat, follow up with *From Island to Island*, an activity that encourages students to consider the carrying capacity for people on an island with limited resources.

Adapted, with permission, from Joan Wagner, Science Education Consultant/Author, Focus on Learning, Albany, NY. Panther Hunt is based on “How Many Bears Can Live in the Forest?” an activity developed by Project WILD, www.projectwild.org ©2000.

UNIT 8 | PEOPLE AND WILDLIFE

WEB OF LIFE

COUNTING ON PEOPLE
K-5 Activities for Global Citizenship

METHOD

Through an interactive story, students explore how everything in the natural community is interconnected.

MATERIALS

- Ball of yarn or string
- Large index cards
- Character cards (provided)
- Markers or crayons
- Student Worksheet

INTRODUCTION

The earth is composed of both natural and human-built environments. All of these environments, or communities, are made up of a web of relationships between people, resources, and other living things. In this activity, students will see the connections between community members living in a forest and what can happen to the whole web when one part is altered. By taking on the role of one of the forest community members, students will discover cause and effect relationships between the actions of people and animals, and the balance of a specific environment.

PROCEDURE

1. To prepare for the activity, each student will need a name tag indicating which community member they will be in the story. You can distribute the images provided, giving one card to each student, and allow the students to color them. Then paste the image on an index card. Or, students can draw their assigned community members directly on the index card. Whatever your source of pictures, be sure to write the creature or item's name below the image.

CONCEPT

In an ecosystem, everything is connected to everything else and the well-being of one can affect the well-being of all.

GRADE LEVEL

Lower and upper elementary

SUBJECTS

Science, Language Arts, Social Studies

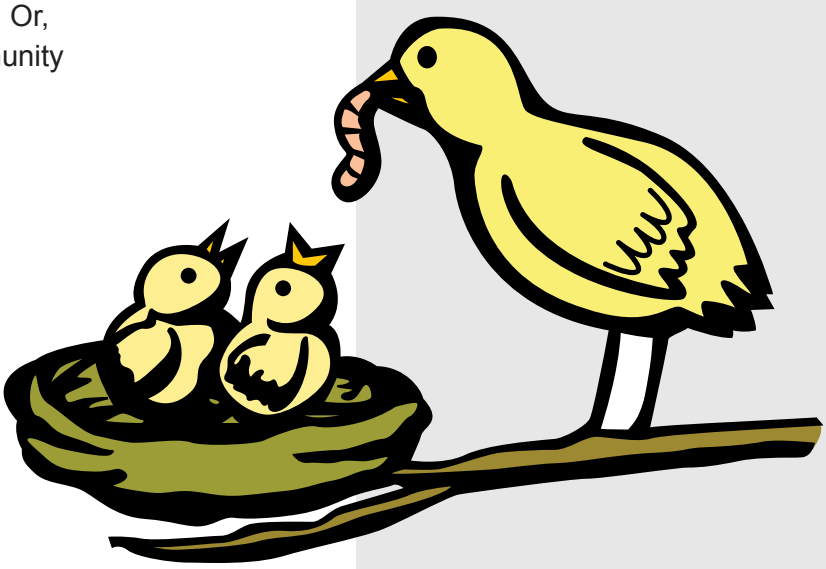
OBJECTIVES

Students will be able to:

- Name two relationships between living things in a forest.
- Explain the interconnectedness of all members of an ecosystem.
- Identify two things people can do to help keep forests and forest creatures healthy.

SKILLS

Drawing connections, explaining cause and effect, cooperating, listening, observing, role playing, imagining, conducting research, creative writing



Members of the Forest Community:

a. Sun
b. Water
c. Air
d. Ant*
e. Tree*
f. Bird*
g. Worm*
h. Soil
i. Flower
j. Bee*
k. Plant*
l. Rabbit*
m. Fox*
n. People*

* Characters that should be doubled up if the class size exceeds 14 students. When more than one student plays a given role, the two students should sit together in the circle.

Note: You may want to replace some of the generic characters with plants/animals that are common in your area in order to make connections to your specific location/environment. For example, if you're in Wisconsin, rather then just using "bird," use "robin," the state bird. Or instead of "tree," use a tree that is visible from your classroom window.

2. Each student assumes the role of one member of the forest community listed above. The corresponding pictures will serve as the nametag for characters in the story and should be hung around students' necks with yarn, or taped to their shirts.

3. Have the students sit in a circle on the floor, making sure they are not in the order of the character list above. The teacher will stand and narrate the story. A ball of yarn will be passed to each student when his/her character's name appears in bold capital letters in the script. The crisscrossing yarn inside the circle will gradually form a web.

4. The "sun" will be the first student with the yarn ball. Then, when you get to "tree," the "sun" should roll, rather than throw, the ball to the "tree" while holding onto the end of the yarn. Continue to have the students hold a piece of the yarn and the roll then ball with the mention of each new character. It's best if they keep their hands close to the floor so the yarn will lie flat inside the circle and the teacher can walk over the yarn. The yarn is only passed to each student once, when his/her character's name is first mentioned.

5. When the story is over and the web is complete, have the students stand, lifting their part of the yarn so the whole group can see the web at work. Go over the Discussion Questions.

FOR UPPER ELEMENTARY STUDENTS:

6. Now that the students have experienced the forest community's web, challenge them to look at the webs of other ecosystems. Divide the class into small groups and assign each a different ecosystem. These could include: prairie/grassland, fresh water lake, desert, arctic tundra, beach/coastal, mountain, or wetlands.

7. Each group should conduct research to discover what community members make up their assigned ecosystem. Have the students write a story about the interconnectedness of their ecosystem, using the community members as characters and their assigned ecosystem as a setting. Allow the groups enough class time to research and write the story, or, you may want to assign parts of the project as homework.

8. Select several of the student-written stories to read aloud in class and have the students create a yarn web. As a group, discuss potential threats and then ways to protect each of the ecosystems and the community members within them.

Forest Community Story

Instructions to the students:
"Imagine that you're no longer in the classroom but outside in the sunshine, surrounded by the smells and sounds of a forest. Imagine that you are becoming the part of the forest pictured on your nametag.

I'm going to read a story about this forest, which shows how important each member of the forest is to all the other members. As I tell about your part of the forest, a classmate will pass a ball of yarn to you. Take hold of the yarn, and when I read the next character, roll the ball to that new person.

Don't let go of your part of the yarn, but hold it down on the floor so I can walk around inside the circle and help pass the yarn to the next person."

Interactive Story:
Our forest community grows healthy and strong with the light of the **SUN**.
[Hand the ball to the child who is the sun.]

All of the creatures in the forest depend on the sun's energy. It keeps them all warm and helps them grow. Rain has just stopped falling in the forest and has given every thirsty thing a big drink of **WATER**. The day is cool from the afternoon rain. The cool **AIR** is what the forest breathes. Take a deep breath. We all need the sun, water, and air to live.

A hard-working **ANT** is making its way through the forest. He is looking for a place to make his home and spots a tall, beautiful **TREE**. The forest trees stretch from the ground to the sky and look to the sun to give them strength. *[With older students, explain the complementary relationship between people and trees. People inhale oxygen and exhale carbon dioxide while trees, and other plants, take in carbon dioxide and produce oxygen.]*

The forest is full of life today. A colorful **BIRD** sings from the branches of one of the trees and looks around on the ground below for food. It spots a **WORM** moving around on the forest floor that will make a perfect lunch. *[The web is beginning to take shape.]*

The worm wiggles on the ground and eats the leaves that have fallen from the trees. Thanks to this working worm, the **SOIL** of the forest is clean and is a good place for things to grow. *[For older students, explain how the worm, ants, and other insects are part of the process of decomposition. They might be small, but they are still very important parts of the forest community.]*

Nearby, a **FLOWER** has sprouted from its seed in the ground and waves its petals in the wind. Its roots find food in the soil. This flower has been waiting for the busy **BEE** to buzz by and leave the pollen that helps it make the seeds for next year's flowers. *[With older students, elaborate on the process of pollination and explain that the flowers depend on the bee for this process.]*

The roots of this flower dig deep into the soil of the earth. Next to the flower is a **PLANT** getting warm from the rays of sunlight coming through the trees. The raindrops have dried on its leaves. This healthy plant is food for the **RABBIT** who hops by, ready to take a bite of its green leaves. A **FOX** watches the fuzzy rabbit from behind a log, keeping an eye on its food for the day. *[For older students, explain that plants are producers because they create their own food by using energy from the sun. Rabbits and foxes are consumers because they cannot create their own food and must eat other organisms for energy.]*

But suddenly, the fox hears a loud sound and runs off to hide. Two **PEOPLE** are walking through the forest. They are picking plants and flowers as they walk. They are happy to be in the woods where the air is cool and the animals play. From way up in the branches of the tree, the bluebird sings its welcome song. They stop for a moment to enjoy this special place and then they walk on.

[Each child in the circle is now holding part of the yarn, ending with the two people who have entered into the forest community. Ask the class to stand up, being careful not to let go of their part of the yarn. They should continue to stand in the circle through Discussion Question 5, below.]

DISCUSSION QUESTIONS

1. Look how the web has grown and how many of the strings overlap. Think about the importance of the relationships within the forest. For example, what effect did the people walking through the woods have on the web?

They picked flowers and plants.

If the plants are taken from the forest, which other creatures will be affected? *[Instruct the student who represents the plant to give his/her string a gentle pull.]* Who feels this pull?

The rabbit and the bee.

2. If plants become scarce, where will the rabbit get its food?

If the rabbit cannot find enough food here then it might have to leave this forest to find food somewhere else.

And what other community member needs the rabbit? *[Instruct the student who represents the rabbit to give his/her string a gentle pull.]* Who feels this pull?

The plant and the fox.

3. If rabbits become scarce, where will the fox get its food?

The fox might need to leave the forest to hunt somewhere else.

[Emphasize the concept that everything is connected to and needs everything else. The students can continue to pull their strings as the questions are being asked. At times, the teacher may need to cue the students regarding what parts of the forest are affected.]

4. What happens if a tree falls or is cut down in the forest? Who will feel a pull? Is the tree anyone's home?

The ant and the bird feel the pull. Both make their homes in trees.

Other than the tree, who else is the bird connected to? *(The worm.)* And who is the worm connected to? *(The soil.)* Who needs healthy soil? *(Plants, flowers, trees, the ant, the rabbit, and the fox do.) [These students can all pull their strings.]*

5. What would happen if it didn't rain in the forest for many weeks? What creatures would this affect?

All of the animals, trees, and plants need water, just like we do. [The student who is "water" can pull on his or her string. All the other parts of the forest can pull their strings as well.]

6. What would happen if we drove cars or a school bus near the woods to go on a field trip? Would this be good or bad for the air that the entire forest breathes? *[The student who is "air" can pull his/her string. Point out that this affects all of the forest community and the people too!]*

[The students can return to their seats for discussion of the following questions.]

7. What would happen if our entire classroom took a field trip to this forest and decided to have a picnic?

Answers will vary but may include: we would create a lot of trash, our bus would create exhaust, etc.

If we left our garbage, how would this hurt the forest community?

Answers will vary but may include: animals might try to eat plastic or other things they shouldn't eat and get sick, the trash might get into a stream and pollute the water, etc. This question focuses on human impact on the forest. The greater number of people, the greater the impact.

8. What can we do to protect the forest in the story and all forests?

Answers will vary but may include: put garbage in trash cans, don't pick wildflowers and plants, plant trees, etc. Introduce the concept of stewardship – that people can be protectors of forest communities. The idea is not to discourage kids from visiting the forest, but rather to instill the importance of being respectful and understanding how our actions can affect other living things.

MEASURING LEARNING

For lower elementary, have the students complete the Student Worksheet. Some connections may differ from child to child and that's ok. Be more aware that each character is part of at least one connection and that the connection explanations are accurate.

For upper elementary, use the student-written stories to gauge students' understanding.

FOLLOW-UP ACTIVITIES

1. Students can recreate the web in the form of a collage by mounting their nametags on poster-board and showing connections by either drawing lines and arrows or gluing yarn between the items pictured.

2. Have students create shoebox dioramas of habitats that include all the members of an ecosystem. Students can present their 3-D representation of the ecosystem web and explain how each of the components is connected.

3. Students can make eco-accessories (such as bracelets or key rings) from yarn or string and beads, which symbolize the categories of elements from the story: Yellow = Sun, Green = Plants, Clear/White = Air, Brown = Soil, Blue = Water, Red = People & Animals.

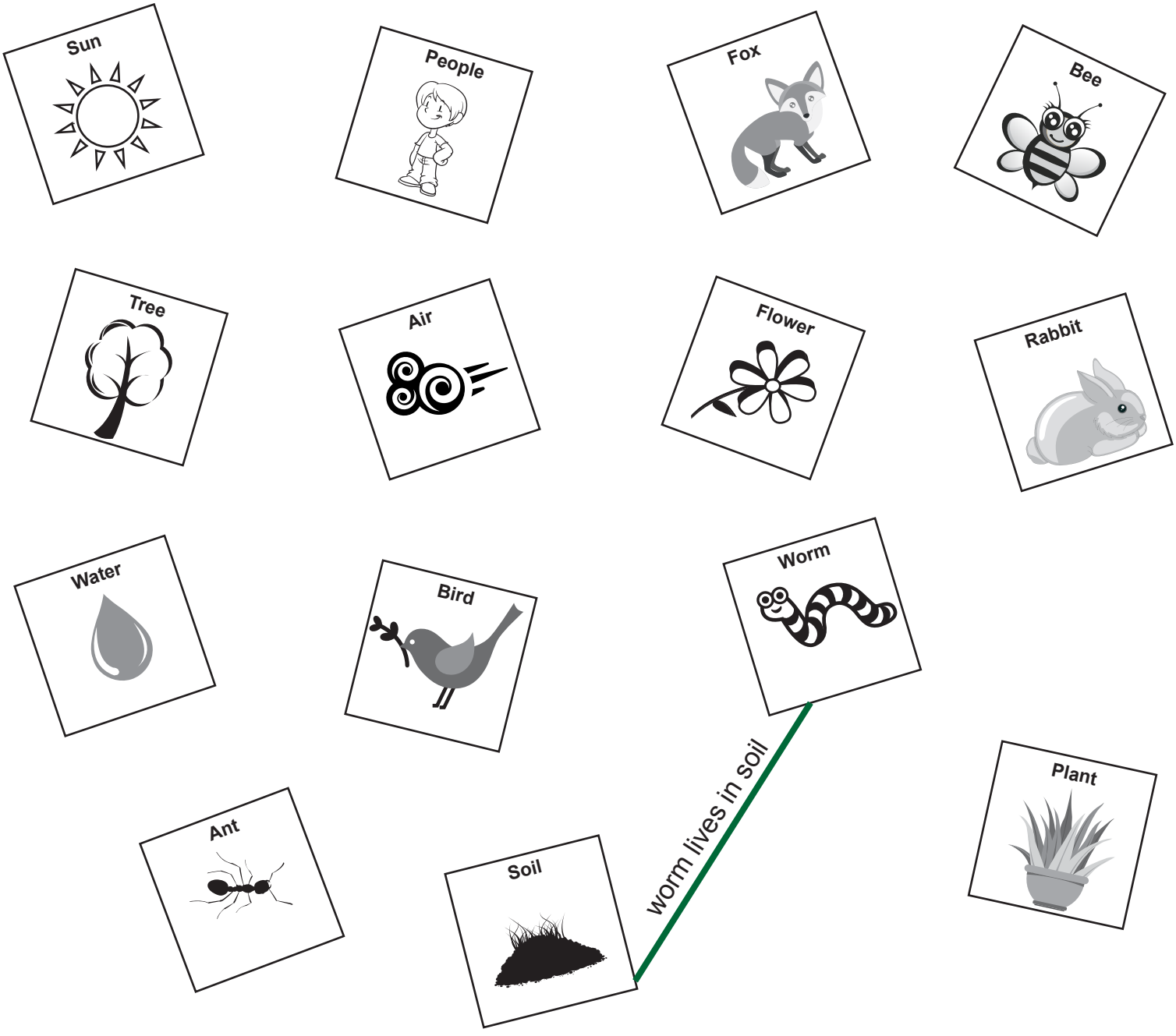
The web of life is a common theme in environmental education. Variations of this activity can be found in Sharing Nature With Children by Joseph Cornell, Dawn Publications, 1979.

WEB OF LIFE
STUDENT WORKSHEET

Name: _____ Date: _____

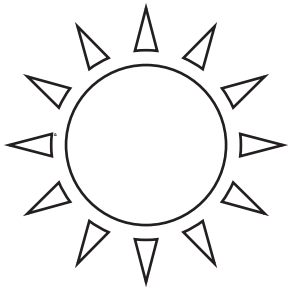
Below are the animals, plants, and other things from the forest. Draw lines between any two that are connected. Draw as many connections as you can but make sure everything has at least one line connecting it to something else.

On each line, write why the two are connected. The first line has been drawn.



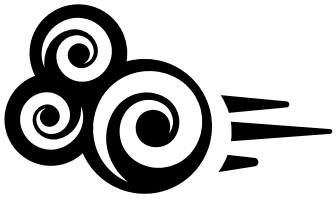
CHARACTER CARDS

Sun

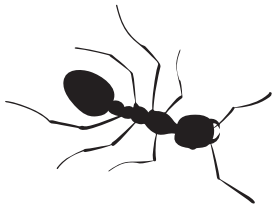


Water

Air

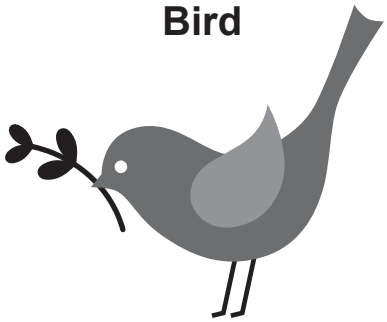


Ant



Tree

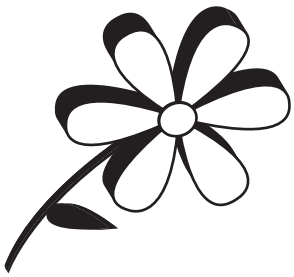
Bird



Worm

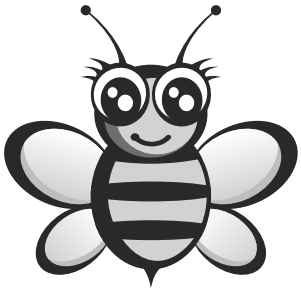
Soil

Flower



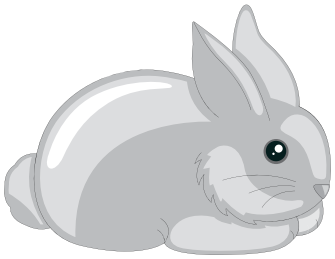
CHARACTER CARDS

Bee



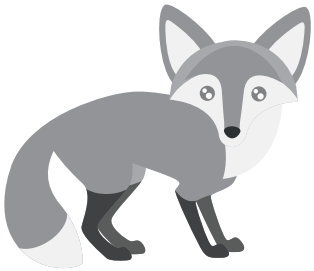
Plant

Rabbit



People

Fox



UNIT 7 | PEOPLE AND WASTE

WHO POLLUTED THE RIVER?

COUNTING ON PEOPLE
K-5 Activities for Global Citizenship

METHOD

Through an interactive story, K-2 students experience the pollution of a local river over time and propose methods to protect the river from current and future pollution.

MATERIALS

- 1 clear gallon jar or bowl of water
- 1 plastic film canister for each student (canisters are often available for free at film processing stores—if you can't find film canisters, any small condiment container with a lid will work)
- Canister labels (provided)
- Character nametags (provided)
- Story: *Who Polluted the River?* (provided)
- Canister ingredients
- Plastic fish toy (optional)

INTRODUCTION

Rivers have always been an important resource. They provide water for drinking, a means of transportation, a home for wildlife, and more. As human populations have increased, so has our impact on the water system and many rivers have changed as a result. In this activity, students participate in an interactive story about the changes humans have made to a river over time and learn how many of our rivers have become **polluted**. This example demonstrates that just as we each contribute to the problem, we can also each be part of the solution.

PROCEDURE

1. Prepare and label the film canisters using the provided Canister Labels and the items in the chart below. Prepare enough canisters for each student to have at least one. There are 10 canisters, so unless your class is very small, you will need to double some characters. (Some students will have identical canisters.)

   Note: Don't have more than one barnyard canister (coffee), as two doses of it will make the water too dark to notice the progression of pollution afterwards.

CONCEPT

Over time, individual actions have impacted our rivers in both negative and positive ways, causing many rivers to change.

GRADE LEVEL

Lower elementary

SUBJECTS

Science, Social Studies, Language Arts

OBJECTIVES

Students will be able to:

- Discuss ways people can pollute a water source.
- Propose methods for preventing and cleaning up water pollution.
- Explain why it is more effective to prevent pollution than to clean it up after the fact.

SKILLS

Critical thinking, listening and observing, role playing, understanding cause and effect, describing

CHARACTER	INGREDIENTS
Trees	Dry leaves
Building sites	Soil (dry)
Farmers	Baking soda
Family picnics	Litter, assorted (shreds of paper, pieces of plastic, etc.)
Person fishing	Tangle of fishing line or dental floss
Barnyards	Water + instant coffee
Factories	Water + one drop red food coloring
Drivers	Vegetable oil + one drop red and green food coloring
Washing the car	Soapy water
Motorboats	Vegetable oil + one drop red and green food coloring

2. Cut out the Character Nametags. Make sure that there is a Character Nametag for each canister you've made (ex. if there are two "Driver" canisters, there should be two "Driver" character cards).

3. Fill a clear jar or bowl with water. Place the container in a location that can be seen by all students. If using a fish toy, put it in the water now and when asking the questions within the story, point to the fish and include the question "How do you think the fish feels?"

4. Distribute one Character Nametag to each student. To activate background knowledge, ask students to share one thing they already know about the Character they are given (the sound it makes, what color it is, etc.).

5. Set up the labeled canisters within easy reach of where you'll be facilitating the activity, lined up in the order they are to go into the water.

6. Explain that you will tell a story about the river, (insert the name of a river in your area, if you wish) and that each of the students will play a part in the story. The jar of water represents the river. When they hear the name of the item pictured on the Character Nametag you've given them, they should come up to you and get the matching canister, open it, and empty its contents into the container.

Note: If you feel the students will have trouble opening the canisters without spilling the contents, remove the lids for them, or leave the lids off altogether.

7. Read the story *Who Polluted the River?* aloud. Add emphasis as you read each bolded character name and pause after each question to give the students time to think and respond.

DISCUSSION QUESTIONS

1. Who polluted the river?

Everyone played a role.

2. What effect did the increasing population have on the health of the river? What are some examples?

In this situation, population growth led to increases in pollution. Examples include: factories that make things for people leaking paint and chemicals, cars leaking oil, families leaving trash on the beach, etc.

3. Think about the pollution contained in your canister. What could each of us do to keep the river clean by making sure these kinds of pollution don't get into it in the first place?

Answers will vary but may include: biking or walking instead of driving, using water carefully, picking up litter so it doesn't end up in our fresh water supply, etc.

4. Challenge students to come up with ways to clean up the water in the bowl—after all, everything has to go somewhere. Can water be cleaned up in the real world?

Solids can be strained using a kitchen strainer or netting. Students may also find coffee filters or absorbent cotton helpful. In reality, people clean up rivers in many ways – using nets to pull out large items, treating the water with chemicals, etc.

5. Is it easier to prevent pollution, or to clean it up later? Have students explain their ideas.

Preventing pollution is known to be a more effective approach for ensuring clean waterways.

MEASURING LEARNING

Ask students to pick a pollutant from the story and illustrate:

1. an action that would cause that pollutant to go into the river.
2. an action that would prevent that pollutant from entering the river.

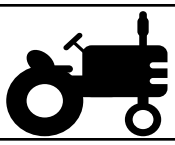
FOLLOW-UP ACTIVITY

Arrange a class field trip to your local waste water treatment plant. Prior to your visit, have each student write down one question they have about polluted water and/or the cleaning process. At the plant, ask that an employee provide a tour of the facility and provide information such as how the water is cleaned, how much water goes through the plant, and why the plant is an important part of the local community. Be sure to leave time for student questions!

WHO POLLUTED THE RIVER?
CANISTER LABELS

Trees

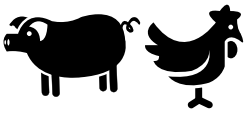
Building sites



Farmers

Person fishing

Family picnics



Barnyards

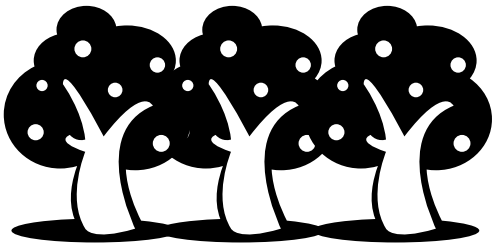
Factories

Drivers

Washing the Car

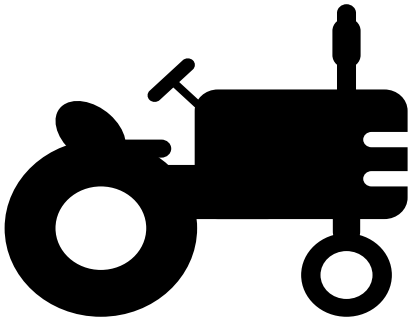
Motorboats

WHO POLLUTED THE RIVER?
CHARACTER NAMETAGS



Trees

Building sites

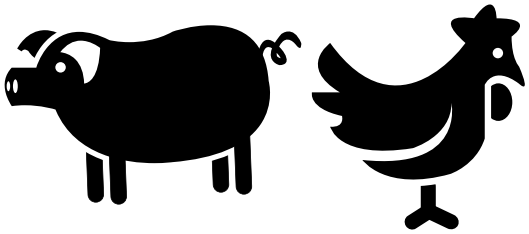


Farmers

Person fishing

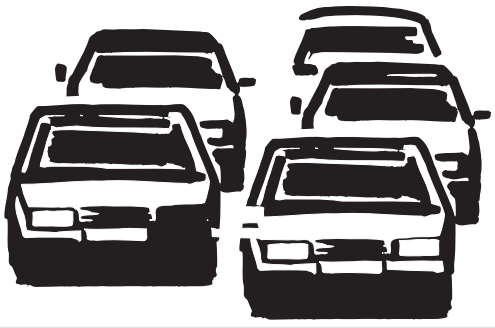
Family picnics

WHO POLLUTED THE RIVER?
CHARACTER NAMETAGS



Barnyards

Factories



Drivers

Washing the car

Motorboats

STORY: WHO POLLUTED THE RIVER

There was a time many years ago when our land was very wild. This was a time before roads and cars. Only a small number of people lived here then. These native people depended on nature for many of the things they needed to survive, but they lived simply and didn't change the natural surroundings too much. The people hunted in the forests, found food in the swamps, and caught fish in the river. *[Insert the name of a local river.]* The beautiful and sparkling river was home to fish and other wildlife. Imagine that the container of water in front of you was taken from the river a long, long time ago.

- Describe how the water looks to you. Would you drink this water? Eat fish that came from it? Swim in it?

Eventually, more people traveled to this land from across the ocean. They found rich soil for farming, forests full of wildlife, and a river that provided plenty of food and water. It was a perfect place to live.

- How do you think the new people used the river? *(Answers will vary but may include: for water to drink, cook with, bathe and wash clothes in; to catch fish from; to go boating on; to move supplies from place to place)*
- Do we use the river the same way today? *(Answers will vary.)*

The river has changed a lot since that time long ago. This is the story of those changes. Listen for the name of what's pictured on your Character Nametag. When you hear your picture named, walk up to the teacher, get the matching container, and dump what's inside into the river. Be sure to stand to the side, so the whole class can see the bowl.

Years went by, and once in a while there were big storms. Strong winds whipped through the **TREES** and blew leaves into the water. More and more people moved to the area. Gradually, a city grew up around the river. People drained swamps and cut down forests to build houses, schools, churches, stores, roads, hospitals and many other buildings. Rains washed loose soil from these **BUILDING SITES** into the river.

- Is this water safe to drink? *(If the response is "no," ask if the river had leaves or soil in it when people long ago drank from it.)*
- Would you swim in it? Is it safe for animals to drink and fish to swim in?

At first, the city was small. Upstream, **FARMERS** planted crops to feed all the people as the city grew. They used chemicals called fertilizers to make their crops grow faster. Some farmers kept pigs and other animals in **BARNYARDS**. As rainwater drained out of the fields and barnyard, it carried some of the fertilizers and manure into a little creek behind the farm. The creek flows into the river.

- Would you drink this water now? Would you swim in it? Go boating on it?
- Is it safe for fish and animals?

Now, the city along the river has grown to be one of the largest cities in the country. Many people live and work in and around the city. Many businesses provide services for the people. Several **FACTORIES** make things that people want, like cars and furniture, but the factories leak paint and other chemicals into the river. These pollutants cause the fish to become sick. As people move about their busy days, they often drive from place to place. Traffic jams are a big problem for **DRIVERS** who take their cars to and from work. If a car is not taken good care of, it might also leak oil or other fluids, which will be washed off the roads and into the river with the next rain.

A boy in the city is out **WASHING THE CAR**. The soapy water rushes down the driveway into the storm drain by the curb; the storm drain empties into the river. The grease and grime on a car contains tar from the roads, very tiny bits of rubber from the wearing of the tires, and rust. If the boy had gone to a local car wash instead, the water would have been cleaned before it went back into the river or was recycled.

On nice days, many people head down to the river. Some zoom up and down the river in **MOTORBOATS** and don't notice that a little engine oil leaks into the water. The oil will not mix with the river water, but will float on the surface. It will coat the feathers of ducks or other birds that paddle around on the water looking for food, making it harder for them to stay afloat or fly. Lots of people are having **FAMILY PICNICS** in the parks along the river, too. Some of these people have left trash on the shore. With the next storm, that trash will wash into the river. On the shore a **PERSON FISHING** snags a hook on a log. Instead of untangling it, the person fishing simply breaks off the snagged piece of the nylon fishing line and lets it fall into the river. The land is no longer wild, and the river has changed a lot over the years.