Segment 3

Dr. D heads back to Virginia to meet Kali and help her build a bat house, which is one of the requirements for her Girl Scout wildlife badge. While constructing the bat house, Dr. D also explains differences in the various species populations. To learn more about how to count animals in a population, the tree house detectives dial up Carol City Elementary School, a NASA Explorer School in Miami, Florida. The class has just finished learning how to use random sampling, and they explain why and how to use sampling to estimate a population. Next, they dial up Dr. Dave Breininger, a wildlife ecologist studying and monitoring the endangered scrub jays at NASA Kennedy Space Center. Mr. Breininger helps the detectives understand habitats and how both nature and man can affect them.

Objectives

Students will

- learn about populations and factors that limit populations.
- identify the biotic potential and carrying capacity of various populations.
- use random sampling to collect and analyze data.
- identify the needs supplied by a habitat.
- learn about limiting factors, both natural and man-made, which affect populations within a habitat.

Vocabulary

biotic potential—the rate a population will grow under ideal conditions

carrying capacity—the maximum number of living things a habitat can support

equilibrium—a state of balance between opposing forces; when talking about populations, a time when the number of births equals the number of deaths

estimate—to determine roughly the size or amount

extinction—when a species no longer exists

habitat—an area that supplies food, shelter, water, and space for living things

high density—many items packed into a small space; when talking about populations, many living things in a small area

population—a group of organisms of the same species that live in a particular area

random sampling—to select a small portion to help estimate the entire amount

territorial—a specific place living things claim as their own; an area living things will defend and protect

Video Component

Implementation Strategy

The NASA SCI Files™ is designed to enhance and enrich existing curriculum. Two to three days of class time are suggested for each segment to fully use video, resources, activities, and web site.

Before Viewing

1. Before viewing Segment 3 of *The Case of the Zany Animal Antics*, read the segment overview to the students. List and discuss questions and preconceptions that students may have about animals, their basic needs, habitats, reproduction, and how they are classified.

2. Record a list of issues and questions that the students want answered in the program. Determine why it is important to define the problem before beginning. From this list, guide students to create a class or team list of three issues and four questions that will help them better understand the problem. To locate the following tools on the NASA SCI Files™ web site, select **Educators** from the menu bar, click on **Tools**, and then select I**nstructional Tools**. You will find them listed under the **Problem-Based Learning** tab.

   Problem Board—Printable form to create student or class K-W-L chart

   Guiding Questions for Problem Solving—Questions for students to use while conducting research

   Problem Log and Rubric—Students' printable log with the stages of the problem-solving process

   Brainstorming Map—Graphic representation of key concepts and their relationships

   The Scientific Method and Flowchart—Chart that describes the scientific method process

3. **Focus Questions**—These questions at the beginning of each segment help students focus on a reason for viewing. They can be printed ahead of time from the **Educators** area of the web site in the **Activities/Worksheet** section under **Worksheets** for the current episode. Students should copy these questions into their science journals prior to viewing the program. Encourage students to take notes while viewing the program to help them answer the questions. An icon will appear when the answer is near.

4. **"What's Up?" Questions**—These questions at the end of the segment help students predict what actions the tree house detectives should take next in the investigation process and how the information learned will affect the case. You can print them by selecting **Educators** on the web site in the **Activities/Worksheet** section under **Worksheets** for the current episode.

Careers

education director
marine science
   instructor
veterinarian

View Segment 3 of the Video

For optimal educational benefit, view *The Case of the Zany Animal Antics* in 15-minute segments and not in its entirety. If you are viewing a taped copy of the program, you may want to stop the video when the Focus Question icon appears to allow students time to answer the question.

After Viewing

1. Have students reflect on the "What's Up?" Questions asked at the end of the segment.

2. Discuss the Focus Questions.

3. Students should work in groups or as a class to discuss and list what they know about animal populations, estimating populations, and habitats. Have the students conduct research on animal populations, including biotic potential, high density, carrying capacity, random sampling, and habitats. Brainstorm any new ideas on what it will take to create a good habitat for animals in Jacob's backyard. As a class, reach a consensus on what additional information is needed. Have the students conduct independent research or provide them with the necessary information.

4. Have the students complete **Action Plans**, which can be printed from the **Educators** area or the tree house **Problem Board** area in the **Problem-Solving Tools** section of the web site for the current online investigation. Students should then conduct independent or group research by using books and Internet sites noted in the **Research Rack** section of the **Problem Board** in the Tree House. Educators can also search for resources by topic, episode, and media type under the **Educators** main menu option **Resources**.

5. Choose activities from the **Educator Guide** and web site to reinforce concepts discussed in the segment. Pinpoint areas in your curriculum that may need to be reinforced and use activities to aid student understanding in those areas.

6. For related activities from previous programs, download the **Educator Guide**. On the NASA SCI Files™ home page, select **Educators**. Click on **Episodes** in the menu bar at the top. Scroll down to the 2003–2004 Season and click on *The Case of the Prize-Winning Plants*. In the green box, click on **Download the Educator Guide**.

a. In the **Educator Guide** you will find

   a. **Segment 2** – *Adapting for the Future*

Close the PDF window to return to the **Educator Guide** page. Click on **Episodes** in the menu bar at the top. Scroll down to the 2001–2002 Season and click on *The The Case of the Inhabitable Habitat*. In the green box, click on **Activities/Worksheets**.

   a. **Segment 1** – *Biomes, Welcome to My Habitat, and Don't Burst My Bubble*

7. Have the students work individually, in pairs, or in small groups on the problem-based learning (PBL) activity on the NASA SCI Files™ web site. To locate the PBL activity, click on Tree House and then the Problem Board. Choose the 2004–2005 Season and click on *Mystery Animals of KSC*.

- To begin the PBL activity, read the scenario *(Here's the Situation)* to the students.

- Read and discuss the various roles involved in the investigation.

- Print the criteria for the investigation and distribute.

- Have students begin their investigation by using the **Research Rack** and the **Problem-Solving Tools** located on the bottom menu bar for the PBL activity. The **Research Rack** is also located in the **Tree House**.

8. Have students write in their journals what they have learned from this segment and from their own experimentation and research. If needed, give students specific questions to reflect upon, as suggested on the **PBL Facilitator Prompting Questions** instructional tool found by selecting **Educators** on the web site.

9. Continue to assess the students' learning, as appropriate, by using their journal writings, problem logs, scientific investigation logs, and other tools found on the web site. Visit the **Research Rack** in the **Tree House** and find the online PBL investigation main menu section, **Problem-Solving Tools**, and the **Tools** section of the **Educators** area for more assessment ideas and tools.

Resources *(additional resources located on web site)*

Books

Bruchac, Joseph: *Keepers of the Animals: Native American Stories and Wildlife Activities for Children.* Fulcrum Publishing, 1997, ISBN: 1555913865.

Hines, James Gary: *Friendships in Nature.* Creative Publishing, 2002, ISBN: 1559717912.

Kalman, Bobbie: *What Is a Biome?* Crabtree Publishing Company, 1998, ISBN: 0865058873.

Sachidhanandam, Uma: *Threatened Habitats.* Raintree Publishers, 2004, ISBN: 0739870157.

Smith, Sue: *Exploring Saltwater Habitats.* Mondo Publishing, 1995, ISBN: 1879531461.

Snowball, Diane: *Exploring Freshwater Habitats.* Mondo Publishing, 1995, ISBN: 1879531453.

Video

Disney Channel: *Populations (Bill Nye the Science Guy)*
Grades 3–8

Web Sites

National Geographic Kids
National Geographic Kids web site is full of games, stories, news, and pictures about animals.
http://www.nationalgeographic.com/kids/

Yahooligans! Animals
Visit this web site to learn about the different types of animals, to play games, to learn animal jokes, and to learn cool facts about animals.
http://yahooligans.yahoo.com/content/animals/

World Almanac for Kids
Visit this web site to learn amazing animal facts.
http://www.worldalmanacforkids.com/explore/animals.html

National Wildlife Federation Kidzone
National Wildlife Federation Kidzone lets the user pick the appropriate age group to learn all about animals. There are games, activities, resources, recipes, and many other fun things for kids to do.
http://www.nwf.org/kids/

Smithsonian National Zoological Park
The National Zoo is home to thousands of animals from all over the world. Learn about the exhibits, the wonderful species in the collection, science and conservation efforts in the wild and at the Zoo, and education resources. You can also take a virtual tour by watching many of the animals on web cams and viewing the photo galleries.
http://nationalzoo.si.edu/Animals/

Girl Scouts of the USA
Girl Scouts of the USA is the world's largest organization dedicated to helping all girls everywhere build character and gain skills for success in the real world.
http://www.girlscouts.org/

NASA Kennedy Space Center
The web site for NASA Kennedy Space Center in Florida can tell you all about the current space launches and landings as well as new space technologies.
http://www.ksc.nasa.gov/

Bats
Visit this site to learn about a bat's environment, how bats fly, echolocation, and much more. This site is a great thematic resource for teachers and students.
http://intergate.cccoe.k12.ca.us/bats/welcome.html

The Bug Club
Join the Bug Club and become a junior entomologist. Learn how to identify bugs by using a dichotomous key and care for bug pets. Visit the "Ask an Expert" corner to get answers to all your bug questions.
http://www.ex.ac.uk/bugclub/welcome.html

Activities and Worksheets

The Bumper Corn Crop*

Purpose

To determine the germination rate of corn to help predict its biotic potential

Teacher Note: You'll need both ears of corn and seed corn for this experiment. Decorative ears of corn may be used. You will need seed corn from a seed store or garden center for the planting part of this activity.

Divide the class into five or six groups prior to starting this activity.

Background

This activity looks at the germination rate of corn. Using this knowledge, you'll be able to predict the biotic potential for corn. The biotic potential is how much corn could be produced if nothing hindered its growth. It is rare to reach the biotic potential in nature. Competition from other plants and animals, weather conditions, disease, and changes in habitat are just a few things that limit growth.

Materials
Per group
1 ear of corn
100 corn seeds
a paper box, like a shoebox
    lined with plastic (garbage
    bag)
soil or dirt for the boxes
Data Sheet (p. 61)
science journal
balance
calculator (optional)

Procedure

1. Husk the ears of corn, if necessary, to expose all the kernels. Without counting, estimate the number of rows and kernels in your ear of corn. In your science journal record the total.

2. Count the number of kernels in a sample row and multiply this number by the number of rows. This process is called a random sampling. Record the total in your science journal.

3. Plant your seeds according to the package directions. A regular pattern will make it easier to observe the results.

4. Be sure to water the soil with the same amount of water as the other groups and put the planted seeds in an area where they'll receive maximum sunlight.

5. Observe and record any observations each day. It will probably take five or more days for seeds to sprout.

6. At the end of a week, count how many seeds have sprouted and record on the Data Sheet.

7. Using the assumptions listed on the data sheet, calculate the number of ears produced for each generation.

8. Based on the results in step 2 (random sampling of the ear of corn), calculate how many kernels will be produced for each generation. Hint: Multiply the number of ears by the total kernels in the sampling.

9. Shuck at least 50 kernels from the ear of corn.

10. Using a balance, find the mass of the 50 kernels.

11. Use the total mass of the 50 kernels to find the mass of kernels produced for each generation. Hint: Divide the total kernels by 50 and multiply that number by the mass found in step 10.

Conclusion

1. How many seeds sprouted by the end of the week?

2. What percentage of seeds sprouted?

3. What factors influenced the time required for seeds to germinate?

4. What factors keep corn from reaching its biotic potential?

5. Complete the "Bumper Corn Crop" worksheet to compute the biotic potential of the corn seeds.

6. How many ears of corn would be produced in the fourth generation?

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The Bumper Corn Crop*

Data Sheet

Extension

1. Vary the soil composition among the seedbeds to see the effect of soil quality on the rate of germination. Control all other variables.

2. Vary the amount of water you use with the seedbeds to see the effect of water on the rate of germination. Control all other variables.

THE BUMPER CORN CROP

Make the following assumptions as the basis for calculations requested in the table below:

1. The plants will produce an average of two ears per plant, each ear identical to the parent ear.
2. All kernels from each crop will be planted.
3. The germination rate will be the same as in your investigation.
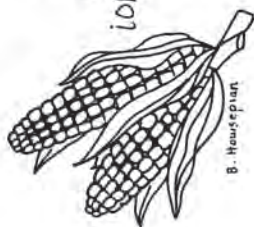
Biotic Potential Prediction Table

Description	First Generation	Second Generation	Third Generation
Number of seeds planted			
Number of seeds sprouting/ plants produced			
Number of ears produced			
Number of kernels produced			
Mass of kernels produced			
Volume of kernels produced			

How many ears of corn would be produced in the fourth generation?

B. Houstpian

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The Case of the Zany Animal Antics

Census Takers*

Purpose

To understand how scientists estimate the population of a large number of animals

Background

Knowing an organism population is important when studying it. Many times it is very difficult or impossible to count a large population of organisms. To estimate the total organism population, scientists determine the area the organism occupies and then count the number of organisms in random, small sections of the larger area. The numbers of organisms in the samples are then averaged to find the average number of organisms living in a unit area. This unit area varies with the size and range of the organism being studied. For large organisms with a big range, the unit might be square kilometers; for smaller organisms, the unit could be square meters; and for even smaller organisms, square centimeters or millimeters. When the average number of organisms per unit area is found, it is used to estimate the total population by multiplying the average number of organisms in the unit area by the total area an organism occupies. This method gives scientists a fairly accurate population estimate for a given organism.

Materials
Census Takers Worksheet
  (p. 64)
Critters Page (p. 65)
1-m yarn or string
scissors
highlighter
science journal
hand lens

Procedure: Pre-Activity

1. In your group, discuss the population of students in your school and brainstorm for ideas of how best to estimate the number of students without counting them.

2. Choose one method discussed and estimate the number of students in your school.

3. Share your results with the class and compare your answers with the actual count from the school's office.

4. Look at the Critters Page and predict the total number of critters on the page. Write your prediction on the *Census Takers Worksheet*.

5. Discuss how to sample the population of critters and brainstorm for some ideas of different ways to sample.

6. Using one of the methods discussed, take a sample of the critters population. Share and compare methods with other groups in class. Discuss what was difficult about sampling and what you would do differently.

Activity

7. One way to sample a population is a random sampling technique. To sample by using this technique, cut out the sampling square at the bottom of the *Census Takers Worksheet*.

8. Randomly drop the square onto the *Critters page*. Use a highlighter to trace around the outer edges of the square.

9. Count the number of critters within the square and record it on the *Census Takers Worksheet*.

10. Repeat steps 6–7 for four more trials.

11. Calculate the total number of critters and record.

12. Find the average number of critters per square unit by dividing the total number of critters by 5.

13. Look at the *Critters Page* and calculate the total number of square units. (Count the numbers of squares down and across and multiply.)

14. Multiply the average number of critters per square unit by the total number of squares and record.

15. This number is your population estimate. Record it on the *Census Takers Worksheet*.

16. On the *Census Takers Worksheet*, compare your estimate to the actual number and calculate the difference.

* **This activity is modified and used with the permission of the AIMS Education Foundation, http://AIMSedu.org**

Census Takers*

17. Brainstorm for ideas of how to best take an actual count of the critters on the page.

18. Choose one method and count the critters. Compare answers in your group and determine the actual number of critters.

19. Compare your prediction with the actual number of critters.

20. Using the group estimates, find the class average of the population estimates and compare it to the actual count.

Post Activity

21. To sample some real critters, go to a large, grassy area and mark off an area 20 meters by 20 meters.

22. Standing within the area, use a ball or small object to toss randomly in the air. Using string and golf tees, create a sampling square that is 1 square meter (1 m x 1 m) where the ball lands.

23. Repeat 4 more times, making sure that the sampling squares do not overlap.

24. Using graph paper, draw the sampling area and show the location of each square. Label each square on your graph paper A, B, C, D, and E.

25. Carefully observe one of the sampling squares and choose a critter to count.

26. Count the number of that kind of critter in the circle and record for that square.

27. Continue to sample the other circles.

28. Continue to find the average number of critters and an estimate of their population.

29. Compare and contrast this activity to the previous activity.

Conclusion

1. Why is it important to select a random sample?

2. How did the population estimates and the actual population differ?

3. Do you think this method is an accurate way to determine the population of a large area?

4. How does the class average compare to the actual population?

5. How was sampling real critters more or less difficult than for paper critters?

6. In a real sampling, would you be able to count every critter for an actual count? Explain.

Extension

Sprinkle sand on a sheet of graph paper and take several samples to find the approximate number of grains on the whole sheet.

Census Takers*

Census Takers

Procedure:

- Carefully cut out the square *Critter Counter* at the bottom of this page. Be as exact as you can.
- Look at the page of critters. Estimate the total number of critters on the page. Record your estimate in the table below.
- Randomly drop your cut-out square on the page of critters, trace around it, and count the number you see within the square. Record the number in the table below. Do this five times. Add your five samples together to get a sample total.

	Population samples					
Estimate	**A**	**B**	**C**	**D**	**E**	**Sample total**

- Divide your sample total by five to get the average. Multiply the average by the number of square units on the page of critters to determine the population estimate.

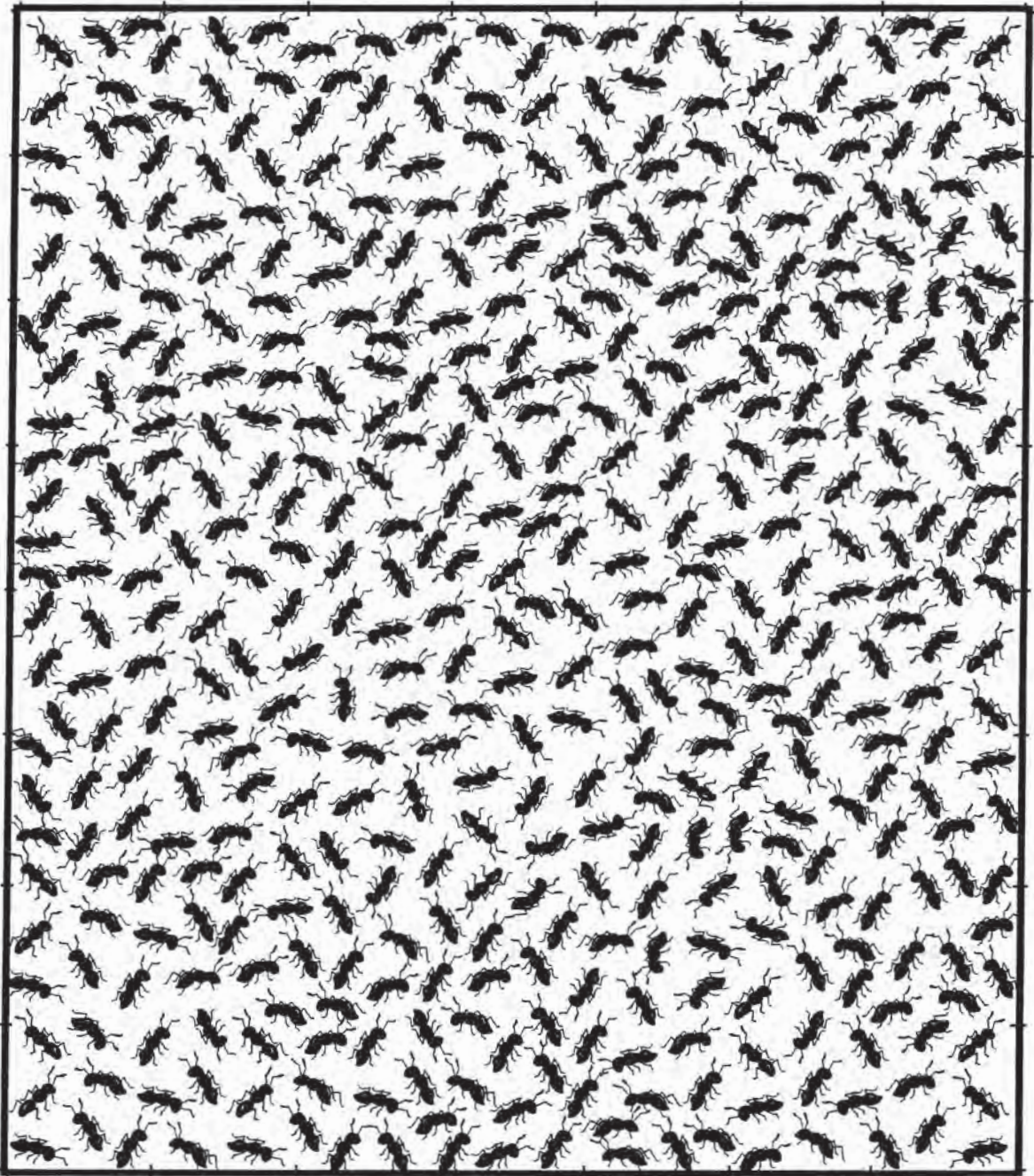| Sample total	÷ 5 =	Average	x	Number of square units	=	Population sample estimate
	÷ 5 =		x		=	

- Record the actual population and find the difference between your estimate and the actual. If your estimate is higher than the actual population, subtract the actual from the estimate.

Actual population	–	Population estimate	=	Difference
	–		=	

Critter Counter
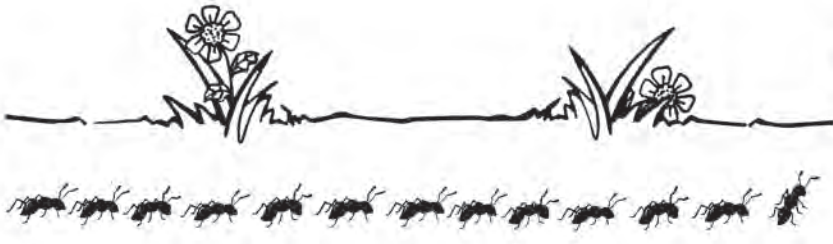
Census Takers*

Hungry Cougars

Segment 3

Purpose

To define and analyze factors which affect carrying capacity

Teacher Prep

1. Before the activity, mark 200 poker chips to represent animals (prey) that follow these numbers:

   - 100 chips with "S" (squirrel) on one side and 1 kg on the other
   - 50 chips with "R" (rabbit) on one side and 2 kg on the other
   - 30 chips with "P" (porcupine) on one side and 7.5 kg on the other
   - 19 chips with "B" (beaver) on one side and 20 kg on the other
   - 1 chip with "D" (deer) on one side and 75 kg on the other

   (Use paper labels.)

2. Hide the chips around a large, open area. If possible, camouflage the chips.

Background

Cougars are hunters. They are predators and need a large area of undisturbed forest to support the needs of their prey. In this simulation, each cougar must gather 50 kg of food, enough to live for one month.

Procedure

1. You are about to become a cougar. You are a solitary carnivore, eating deer, opossums, rabbits, mice, and other forest creatures. You usually hunt at night and have excellent eyesight and wonderful hearing. You run swiftly and can climb and jump 20 feet or more. If necessary, you can also swim. You usually use the element of surprise to help you stalk your prey.

2. You will be taken to your "habitat" and given time to hunt. To survive, you must gather at least 50 kg of food.

3. Your hunt will be timed. You'll have only 3–5 minutes to stalk and capture your food.

4. As you collect your food, put it into your "stomach" bag.

Materials

Per Student
a paper or plastic bag "stomach"

Per Class
stopwatch or timer

Hungry Cougars

Segment 3

Conclusion

1. How many of your classmates survived?

2. Two hundred chips were hidden. Were all the prey found?

3. What would happen if more cougars were added to the habitat?

4. Did anyone find the deer? The deer was worth 75 kg of meat, which is more than any cougar needs to survive. Would a real cougar have continued to hunt after getting that much food?

Extension

1. Play the game again, but add some "limiting factors." Ask students to pull one scenario from a bag. They MUST follow the scenario drawn. Some possible scenarios might be these:

   a. You were injured while hunting. You are lame and unable to move quickly. You must hop while you look for food.

   b. You were blinded by a porcupine while hunting. It is hard for you to find food. You must wear a pair of sunglasses with one lens blocked by construction paper while you look for food.

   c. Extra rain has fallen in your habitat and the stream is at its peak. The beavers have been affected by this change. If you find a beaver "chip" you cannot pick it up. If you pick it up, you will lose five chips when you tally at the end of the hunt.

   d. The walnut trees in the area are NOT producing walnuts. The squirrels are hungry and sick. If you find a squirrel "chip" you cannot pick it up. If you pick it up, you will lose two chips when we tally at the end of the hunt.

A Habitat Sit-In

Purpose:

To visualize the importance of food, shelter, water, and space in any habitat

Teacher Note: Please caution students to be careful when they're asked to "sit" in this activity and do not have them hold the "sitting" position too long.

Background

Habitats supply the food, water, shelter, and space needed to support living things. If any one of the four elements is missing, the habitat will be affected.

Procedure

1. In your class, count off one, two, three, and four. All the ones will be food, twos will be water, threes will be shelter, and fours will be space.

2. Stand in a circle following this pattern. People representing food will stand beside someone representing water, who will be beside someone representing shelter and then beside someone representing space. Stand shoulder to shoulder. Repeat the pattern until all students are included in the circle.

3. Turn so that you face the back of the person to your right. Everyone should be facing in the same direction—their fronts facing the backs of the people beside them.

4. Pull the circle closer together. There should be no more than a few cm between each person.

5. Very carefully squat into a seated position. You will sit on the lap of the person behind you for just a few seconds.

6. Working together, the person behind you is acting as your support.

7. All together, carefully stand up.

8. All "spaces" should step out of the circle.

9. Why would it be unsafe for the remaining people to now sit in a circle?

Conclusion

1. How does this activity demonstrate the importance of ALL four habitat needs—food, water, shelter, and space?

2. In the "real world," what might have happened to pull "space" out of the habitat?

Extension

1. Food, water, shelter, and space are all essential for a healthy habitat. From this activity, you can see how interconnected they are. Draw a picture or diagram to show this interconnection.

I Need My Space*

Purpose:

To experience the need for space in a habitat

Teacher Prep

1. Before the activity, mark off boundaries based upon the size of your class. If your class size is

   • *20–24 students, you'll need a space 3.5 meters by 4.0 meters*

   • *25–29 students, you'll need a space 4.0 meters by 4.0 meters*

   • *30–34 students, you'll need a space 4.0 meters by 4.5 meters*

   • *35+   students, you'll need a space 4.0 meters by 5.0 meters*

Background

A habitat is a place where plants or animals live and can get everything they need. Every living thing must have food, water, shelter for protection, and enough space to grow, move, hunt, and play. In this activity, you'll see the need for space in every habitat.

Procedure

1. The sheet of newspaper represents the "minimum" amount of space you need to live, survive, and grow in a "special" habitat.

2. With your classmates, go to the habitat that's been created by your teacher. All your classmates will be living with you inside this habitat.

3. In a healthy habitat, none of the newspapers may overlap. If they overlap, you will be weakened and will not survive.

4. Two "animals" will begin by having both students place their newspapers inside the habitat. Once the newspapers are on the ground, they cannot be moved.

5. Look at the habitat and determine if it supplies lots of food, water, shelter, and space.

6. To double the population, add two more creatures. Be sure the newspapers don't overlap.

7. Evaluate the health of the habitat.

8. One at a time, the remaining animals will enter the habitat and place their newspapers on the ground.

9. Evaluate the "health" of the habitat after all animals have entered.

Conclusion

1. How many animals could live comfortably in this habitat?

2. What limited the number of creatures that could fit in this habitat?

3. How could you fit more creatures in the space?

4. What are some real-world limits to a habitat?

Extension

1. Look outside for an area densely populated with very young plants. If possible, protect that area from being weeded or mowed and watch what happens to the plants over a period of time.

2. Set up an experiment in which you plant radishes or other fast growing seeds in identical small flowerpots or paper cups. Plant one seed in the first cup, two in the second, four in the third, eight in the fourth, and so on, until you have seeds spaced 1 cm apart. Give each container the same amount of water and exposure to sunlight. Compare the plants as they sprout and mature.

3. Divide your classroom in half by running a string down the middle of the room. For an hour or two, carry out your normal schedule but keep everyone in only half the room. What happens?

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The Endangered Hoppit*

Segment 3

Purpose

To gain an understanding of animal extinction

Teacher Prep

Before the activity, mark off the hoppit's habitat. Spread small objects throughout this area to represent food.

Background

When a living thing can no longer be found on Earth, it is "extinct." Some living things are "nearly extinct" or "endangered." "Threatened" living things are likely to become endangered if they are not protected. An "extirpated" living thing can no longer live in the wild but is protected in another environment, like a zoo.

It is sad that more than 20 kinds of living things become extinct every week. Human activity that changes animal habitats is responsible for these losses.

Materials

a large number of similar, small objects such as popcorn, playing cards, or poker chips
timer or clock

Procedure

1. You and your classmates are hoppits. A hoppit is an imaginary creature which hops continuously when it's awake. A healthy hoppit hops on two legs. Hoppits spend their lives hopping and looking for food, storing their food in a small pile in their nest. They may also stop to rest and sleep in their nest. The only time you may stop hopping is when you are at your nest.

2. Begin your life as a hoppit. You will hop on two legs, gather food, and take it to your nest. You may only pick up one piece of food at a time, returning to your nest to store each piece of food.

3. Five minutes later—Bad weather is making it harder to get food. You can only hop on ONE leg now. If you hop on two legs, you will "die" and be out of the game of life.

4. Five minutes later—Human beings are building homes and stores around your habitat. You can still leave your food piles in your nest, but you cannot rest by your nest any longer. To stay alive, you must continuously hop on one leg while you gather food.

5. Five minutes later—Stop hunting for food and survey which hoppits are alive and which are dead. You MUST HAVE at least two hoppits for the species to continue.

Conclusion

1. How many hoppits lived? Were there enough for the species to continue?

2. What factors affected the hoppit population?

3. Compare these factors to limiting factors found in the real world.

Extension

1. Research endangered animals and plants found in your area. What caused them to be endangered?

2. How might the hoppits have adapted to their habitats as the habitats changed? How would these adaptations increase the hoppit population? Design a "newly improved" hoppit that has adapted to changes in its environment.

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Answer Key

The Bumper Crop

1. Answers will vary.

2. Answers will vary.

3. The quality of the seeds affected seed germination. Other variables were kept constant during this experiment.

4. In the real world, corn doesn't reach its biotic potential for many reasons. Corn seeds are eaten, the soil may be infertile, there may not be rain, other plants compete for space, and so on.

5. Answers will vary.

6. Answers will vary.

Census Takers

1. A random sample is necessary so that the results are not skewed. If a person selected the location for each sample taken, he/she might be biased and then the sample may have more or less than "average."

2. Answers will vary.

3. Answers will vary.

4. Answers will vary.

5. Answers will vary.

6. In most instances you would not be able to count every critter. It would only be possible in a very small area.

Hungry Cougars

1. Answers will vary.

2. Answers will vary.

3. More cougars in the habitat will have to share the same amount of prey. It's likely that all prey will be eaten and some cougars will starve.

4. No, animals in the wild only hunt and eat when they are hungry. They only take as much as they need and do not "store" food.

A Habitat Sit-In

1. To be able to sit in this circle, all parts must be present. Every person is needed, just as every element (food, water, shelter, and space) is needed in a habitat.

2. If a habitat were crowded, animals and plants would have to compete for food, water, and shelter. They may become aggressive. Food and water may become scarce.

I Need My Space

1. Answers will vary.

2. Space limited the number of animals in this habitat.

3. Carefully arranging the newspapers would help more animals fit in the space. Careful planning would help.

4. In the real world, habitats are limited by the amount of food and water, people clearing the land, weather, disease, and so on.

The Endangered Hoppit

1. Answers will vary.

2. The hoppit population was affected by competition from other hoppits, weather, and people taking their space.

3. In addition to these factors, animals also have to deal with disease, pollution, a loss of food and water, and so on.

On the Web

Family Sense

1. Answers will vary.

2. Answers will vary but might include that, after time, the sense of smell seems to dull to scents. It may be difficult to tell the difference between two scents.

3. With 500 pups crammed into a very small space, it would be hard to tell where each scent is located. Some scents are very similar. It would also be very noisy. Adult bats use position as a third way to locate their pups.