UNIT 8 | PEOPLE AND WILDLIFE

# A WORLD OF DIFFERENCE: MADAGASCAR

COUNTING ON PEOPLE
K-5 Activities for Global Citizenship

## METHOD

In small group simulations, students compare the biodiversity of a temperate forest to that of a tropical rainforest and explore the role humans play in forests' diversity.

## MATERIALS

**Part 1:**

• Student Worksheet

**For each group of 2-3 students:**

• Counting Grid
• Graph paper
• 1 die
• 1 plastic baggie labeled "Temperate Forest," containing:
  20 dry black beans = Deer
  40 dry red beans = Oak trees
• 1 plastic baggie labeled "Tropical Rainforest," containing:
  20 dry black beans = Baobab trees
  8 small pieces of brown construction paper = Trap-Jaw Ant colonies
  5 small pieces of green construction paper = Malagasy Giant Chameleons
  2 small pieces of white construction paper = Ring-Tailed Lemurs
  1 small piece of black construction paper = Fossa (cat-like carnivore)

(Substitute beans and paper as necessary)

**Part 2:**

• Chest or large empty box
• Small empty cardboard boxes (cereal, detergent, etc.)
• Art supplies
• Holiday gift ribbons (optional)

## CONCEPT

Tropical rainforests have the greatest amount of biodiversity on the planet, but deforestation and other harmful practices by humans are threatening the existence of these extremely valuable habitats.

## GRADE LEVEL

Upper elementary

## SUBJECTS

Science, Social Studies, Math, Art

## OBJECTIVES

Students will be able to:

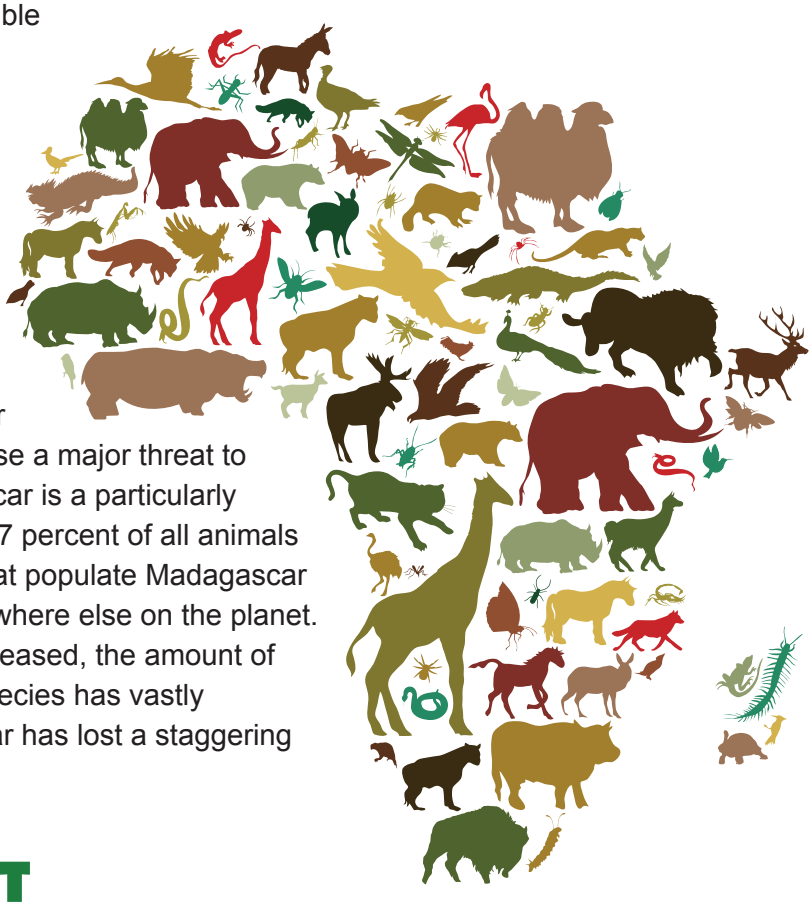
• Define biodiversity and explain why it is important.
• Compare and contrast the biodiversity of a temperate forest with a tropical rainforest.
• Use probability to demonstrate the impact of human population growth on these two different ecosystems.
• Hypothesize how people and ecosystems are affected by deforestation, and propose solutions to address the issues raised.

## SKILLS

Observing, counting, analyzing data, critical thinking, calculating probabilities, researching

# INTRODUCTION

It is estimated that there may be as many as 30 million plant and animal species worldwide, although only 1.4 million have been discovered and named. Over half of all species can be found in the tropical rainforests of Asia, Africa, and Latin America. We refer to this incredible variety of life forms as **biodiversity**. This biodiversity not only adds to the beauty and richness of our planet, but it is also critical to human health and survival. Biodiversity can be an indicator of ecosystem health. People depend on other species for food, medicines, industrial products, and such "ecological services" as water purification, nutrient cycling, and pollination.



These diverse rainforests, however, are in trouble. Due to increased demand for timber as well as land for farming and grazing, deforestation and habitat loss pose a major threat to the long-term survival of tropical rainforests. Madagascar is a particularly troubling example. Roughly 90 percent of plants and 87 percent of all animals including birds, reptiles, mammals, and amphibians that populate Madagascar are **endemic species**, meaning they can be found nowhere else on the planet. However, as Madagascar's human population has increased, the amount of tropical rainforest habitat available for these unique species has vastly decreased. It is estimated that since 1950, Madagascar has lost a staggering 93 percent of its original forest cover.

# PART 1: VANISHING ACT

## PROCEDURE

**1.** Go over the definition of biodiversity, and tell your students that today they'll be comparing the biodiversity of a U.S. temperate forest to a rainforest in Madagascar. Ask students if they can point out Madagascar on a map, and if they cannot, find it as a class. Explain that Madagascar is the world's fourth-largest island and contains an extremely unique ecosystem. If you think students have sufficient background knowledge, you can ask what some differences are between temperate forests and tropical rainforests. Have them list some plants and animals that can be found in the respective forests, and explain how the two habitats are different. You may also choose to provide background information and images of the species featured in the activity.

**2.** Students should have a basic understanding of probability in order to do this activity. Provide a refresher explanation of probability, especially in how it relates to rolling a die, if the students are not aware. (Because there are six sides to a die, each number has a one in six, or 1/6, chance of being rolled.)

**3.** Divide the class into groups of two or three and provide each group with one die, one Temperate Forest baggie, one Tropical Rainforest baggie, a Counting Grid, and a Student Worksheet for each student. Egg cartons may also be used in place of Counting Grids. Students should work on a flat surface. Be

sure to inform the students that one grid is used for the Temperate Forest and the other is used for the Tropical Rainforest.

**4.** Have students distribute the "species" on their Counting Grid according to the directions at the top of the Student Worksheet and complete the activity, following the directions on pages 1 and 2 of the worksheet.

**5.** Have students from each group share at least one observation from the activity, and then go over the Discussion Questions as a class.

## ANSWERS TO STUDENT WORKSHEET

(P = Probability)

**2.** *Answers will vary.*

**3.** *In the U.S. forest, there are many of each kind of species. Every acre has at least one of each species. In the tropical rainforest, each acre is very different in species composition - no two acres are alike.*

**4.** a. *P = 6/6 or 1. All outcomes will impact the deer because they are in every acre.*
b. *P= 6/6 or 1. All outcomes will impact the oak trees.*

**5.** *Species Probability*
*Black beans = Baobab trees (6/6 = 1)*
*Brown paper = Trap-Jaw Ants (4/6 = 2/3)*
*Green Paper = Malagasy Giant Chameleons (4/6 = 2/3)*
*White Paper = Ring-Tailed Lemurs (1/6)*
*Black Paper = Fossa (1/6)*

**6.** a. *P = 0/6 or 0. No species is unique to one acre.*
b. *2/6 or 1/3. Clearing an acre with the Fossa or the Ring-Tailed Lemurs will cause extinction because each species is only found in one acre. (If students have placed the Fossa and Ring-Tailed Lemurs in the same acre, then P = 1/6.)*

**7.** a. *P = 5/6*
b. *P = 5/6*
c. *No; The probabilities stay the same because each roll is an independent event.*

**8-9.** *Answers will vary.*

## DISCUSSION QUESTIONS

**1.** What basic observations can be drawn by comparing the biodiversity of a U.S. temperate forest and the biodiversity of a tropical rainforest?

*For the U.S. forest, there are a lot of each kind of species. Almost every acre has at least one of each. In the tropical rainforest, each acre is very different in composition — no two acres are exactly (or even closely) alike.*

**2.** Why do you think a greater variety of beans and paper were found in the tropical rainforest grid?

*Tropical rainforests may only occupy less than 7 percent of the earth's surface, but over half of all species*

*in the world are found there. Even though biodiversity is typically higher in tropical environments, temperate forests are extremely important to the health of the planet and also have a relatively high level of biodiversity. However, the level of biodiversity in a temperate forest pales in comparison to that found in tropical rainforests. In fact, a 2:5 ratio does not even reflect the overwhelming percentage of rainforest species. Take trees for example: There are, on average, about four tree species per acre in a temperate zone forest in North America compared to 20-86 tree species in an average acre of a tropical rainforest. Another interesting fact: Costa Rica, though only the size of West Virginia, has more species of trees and birds than are found in all of North America!*

**3.** How is the biodiversity of the U.S. forest affected by human activity? How about in the tropical rainforest? Make sure to draw parallels from the activity.

*In the U.S. forest, there was a decline in the number of individuals of both species, but they still existed in the other acres that were not destroyed. In the Madagascan rainforest, there was significant loss of biodiversity. Some species were rare to begin with and their numbers were further reduced. Some species may have only existed in the acres that were cut and therefore no longer exist anywhere (they've become extinct).*

**4.** Can you think of ways that people could benefit from the richness of the rainforest without cutting it down? (Hint: What are some things we value that are grown in the rainforest?)

*Biodiversity is immensely valuable, but this value is often not recognized. For example, along with providing subsistence food for the people who live in the area, a healthy rainforest provides many valuable goods such as fruits, nuts, resins, oils, medicinal plants, and tree bark. These goods are often ignored in an economic assessment of forest use but studies show their value may far exceed that of timber or crops that will only grow for a few seasons in the poor rainforest soil. People who live near rainforests can also profit from ecotourism (visitors coming to see a specific ecosystem), which depends on preserving the rainforest. Biodiversity is also important because it makes an ecosystem more resilient to potential threats, and more able to heal or rebound after a disaster.*

**5.** Name as many objects in your home as you can think of that come from a plant or an animal. Name five jobs that depend on plants.

*Many things in the home come from a plant or an animal. Various foods and spices in the kitchen come from either a plant or animal. Any type of wood surface or chair is another obvious choice, as are many clothes. Also, paper products such as toilet paper, paper towels, newspaper, etc. come from plants.*

**6.** How would you feel if all the lions, tigers, and bears in the world went extinct? How do you think this would affect your life? How would this affect the health of other animals and plants? Do these animals have dollar values that we can calculate and compare?

*Every species of plant, animal, fungi, etc. on the planet plays a vital role to the health of their ecosystem. If you take one piece of the habitat out, the entire ecosystem may be affected. For example, lions are the top predators in their respective habitats, but their population numbers are currently declining. Scientists have linked the decline in the population of lions as well as leopards, another top predator, to the rise in numbers of desert baboons. The increase in numbers of baboons led to increased human interaction as the baboons*

*expanded their search for food, which in turn led to an increase in the transmission of intestinal parasites to humans from the baboons.*

# PART 2: BIODIVERSITY: THE TREASURE CHEST OF LIFE

Now that your students have begun to understand the importance of maintaining the planet's biodiversity, they can have a hand in educating others. Ask students to think of biodiversity as the "treasure chest of life" where each and every living thing glitters like a precious genetic gem. They can now put this thought into a 3-D display.

## PROCEDURE

**1.** Borrow a trunk, like the kind you or one of your students might have in an attic, or have students decorate a big box to look like an old trunk.

**2.** Have each student research an obscure plant or animal found in a tropical rainforest, like the rosy periwinkle found in Madagascar. Lots of websites have information on rainforests, and books and magazines with rainforest information are available for background reading in libraries. Back issues of *National Geographic, Ranger Rick*, and other wildlife magazines are good sources as well.

**3.** Take empty boxes (cereal, detergent, etc.) of all different sizes and wrap them in recycled paper. Have students create colorful illustrations of the rare plant or animal on the wrapped box. They could collage, paint, draw, or stick colored clay onto the box to decorate it. They could also glue leaves, twigs, or grasses onto the box if representing a plant species.

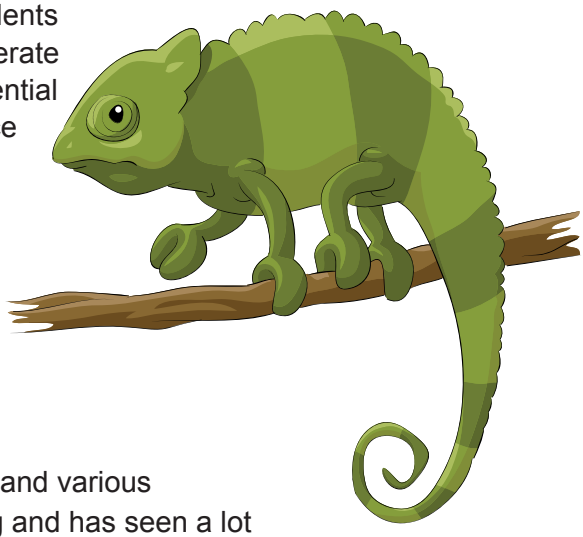
**4.** Tie a gift ribbon around the box, or place a bow on top to make it a "gift." Have students choose the most exciting "gift" their plant or animal offers the world and write it on a gift tag. How is it unique? Why is it truly precious? Is it okay for a life form to exist just because it does, not just for the benefits to other species?

**5.** Put all the "gifts" of biodiversity into the trunk. Place it in the school lobby and let people touch and read the gifts. You will be sharing the gift of knowledge about biodiversity!

Note: This activity may be repeated using a different ecosystem and different species in order to show the students that biodiversity everywhere is important.

# MEASURING LEARNING

Review the students' answers on their worksheets. Have the students complete an exit slip, writing three facts they learned about temperate forests and tropical rainforests from the activity and also one potential solution for the conservation of forests and successful coexistence with humans.



# FOLLOW-UP ACTIVITIES

**1.** Assign or have the students choose a side in a debate about economic expansion versus protecting the environment. A specific question could be, "You live in a small town near a mountain range, surrounded by open green spaces, forests, and various habitats with high biodiversity. The town, however, is struggling and has seen a lot of people lose their jobs. GloboCorp is a huge company and has proposed to build its new factory right in your area. The factory will bring a lot of new jobs to your community and also bring a lot of money in for the town. But the construction site is right in the middle of a forest with very high biodiversity, including the critically endangered red wolf. Your forest is one of the few in the world that the shrinking population of wolves calls home. In order to build the factory, a massive chunk of the forest will need to be cut down and destroyed. Should the people of your town approve the proposal that brings GloboCorp to your area, or should they not let GloboCorp build a factory in order to save the forest?" You can either have the students each write a short argument for their side and turn it in, or have them research and prepare for a debate.

**2.** You may be interested in following this activity with another from Counting on People, called *Timber!* It too deals with deforestation and examines more closely the effects that increasing population and increasing demand for wood have on a forest.

Adapted, with permission, from Sheila Jones, Wake Soil and Water Conservation District, Raleigh, NC, as printed in The Conservation Catalyst Newsletter, Winter 1993-1994.

# A WORLD OF DIFFERENCE
## STUDENT WORKSHEET

Name: _____ Date: _____

**1.** Place beans and colored paper on your Counting Grid according to the instructions below. Each type of bean or color of paper represents a species, and each is an individual of that species.

Temperate Forest in the United States:
**Deer** (20 black beans): Place at least 1 in each acre, but no more than 5 in any acre.
**Oak tree** (40 red beans): Place at least 3 in each acre, but no more than 10 in any acre.

Tropical Rainforest in Madagascar:
**Baobab tree** (20 black beans): Place at least 3 in each acre, but no more than 4 in any acre.
**Trap-Jaw Ant colony** (8 pieces of brown paper): Place at least 1, but no more than 3, in any 4 acres. DO NOT place ant colonies in 2 acres.
**Malagasy Giant Chameleon** (5 pieces of green paper): Place at least 1, but no more than 2, in any 4 acres. DO NOT place chameleons in 2 acres.
**Ring-tailed lemur** (2 pieces of white paper): Place 2 in the same acre.
**Fossa** (1 black piece of paper): Place 1 in any acre.

**2.** Once you have placed the species, fill in the tables below to show the distribution of species in each forest. If at least one individual of a species lives in an acre, place an "X" in that space on the table. To find total species per acre, count the squares with an "X" in the column for that acre. (Remember, you're not recording the number of individuals in each acre, just marking if any of the species is there. So no matter how many individuals are in the acre, you still only place one "X.")

**TABLE 1**

| | Temperate Forest Table | | | | | |
|---|---|---|---|---|---|---|
| **Species** | **Acre A** | **Acre B** | **Acre C** | **Acre D** | **Acre E** | **Acre F** |
| **Deer** | | | | | | |
| **Oak Tree** | | | | | | |
| **Total Species per Acre** | | | | | | |

**TABLE 2**

| | Tropical Rainforest Table | | | | | |
|---|---|---|---|---|---|---|
| **Species** | **Acre A** | **Acre B** | **Acre C** | **Acre D** | **Acre E** | **Acre F** |
| **Baobab Tree** | | | | | | |
| **Trap-Jaw Ant Colony** | | | | | | |
| **Malagasy Giant Chameleon** | | | | | | |
| **Ring-Tailed Lemur** | | | | | | |
| **Fossa** | | | | | | |
| **Total Species per Acre** | | | | | | |

**3.** How would you contrast the temperate forest biodiversity and the tropical rainforest biodiversity?

_____

**4.** Look at your forests to find out what happens when an acre of forest is cleared:

**a.** What is the probability that the deer population will change if you clear one acre in the temperate forest?

_____

**b.** What is the probability that the oak tree population will change if you clear one acre in the temperate forest?

_____

**5.** What is the probability that the population of each species in the tropical rainforest will change if you clear one acre there? Provide your answers in Table 3.

**TABLE 3**

| Species | Probability |
|---|---|
| **Black Beans = Baobab Trees** | |
| **Brown Paper = Trap-Jaw Ants** | |
| **Green Paper = Malagasy Giant Chameleons** | |
| **White Paper = Ring-Tailed Lemurs** | |
| **Black Paper = Fossa** | |

**6. a.** What is the probability that any species will become extinct if you clear one acre in the temperate forest? _____

**b.** What is the probability that any species will become extinct if you clear one acre in the tropical rainforest?_____

The United States, which contains temperate forests, has a natural (not including immigration) human population growth rate of 0.6% annually. Madagascar, which features tropical rainforests, has a natural human population growth rate of nearly 3%, five times that of the U.S. When you roll the die, a roll of 1 will represent population growth in the U.S., and you should clear one acre of temperate forest to meet the needs of society for their houses, paper, etc. Rolls of 2, 3, 4, 5, or 6 will represent population growth in Madagascar and therefore one acre of tropical rainforest should be cleared.

**7. a.** What is the probability that you will clear an acre of tropical rainforest on your first roll?

_____

**b.** What is the probability that you will clear an acre of tropical rainforest on your second roll?

_____

**c.** Does the probability change from one roll to the next? _____
Why or why not? _____

_____

**8.** Now roll the die and clear an acre (remove all the beans and/or paper) in either the temperate forest or tropical rainforest (depending on your roll). Record your data in Table 4. Continue rolling and clearing acres until one of your forests is gone.

**a.** Which forest was eliminated first? _____

**b.** How many rolls did it take to eliminate that forest? _____

**9.** Draw a pair of line graphs on the same axes to show the fates of the forests. The roll number can go on the x-axis, number of species remaining goes on the y-axis.

**TABLE 4**

| Roll Number | Forest (Circle One) | | Area Cleared (A-F) | Number of Temperate Species Remaining | Number of Tropical Species Remaining |
|---|---|---|---|---|---|
| 1 | Temperate | Tropical | | | |
| 2 | Temperate | Tropical | | | |
| 3 | Temperate | Tropical | | | |
| 4 | Temperate | Tropical | | | |
| 5 | Temperate | Tropical | | | |
| 6 | Temperate | Tropical | | | |
| 7 | Temperate | Tropical | | | |
| 8 | Temperate | Tropical | | | |
| 9 | Temperate | Tropical | | | |
| 10 | Temperate | Tropical | | | |
| 11 | Temperate | Tropical | | | |
| 12 | Temperate | Tropical | | | |

## COUNTING GRID

| Temperate Forest (USA) | | |
|---|---|---|
| A | B | C |
| D | E | F |

| Tropical Rainforest (Madagascar) | | |
|---|---|---|
| A | B | C |
| D | E | F |