

Teaching Activity: Global Warming and Biodiversity

Introduction: Certain atmospheric gases such as carbon dioxide and methane are called *greenhouse gases*. Such gases allow sunlight to reach Earth, but prevent the infrared radiation that is then produced from returning to space. This natural trapping of infrared rays is called the *greenhouse effect*. The greenhouse effect helps to warm Earth and its atmosphere.

As a result of human activities, the concentrations of some greenhouse gases, such as carbon dioxide, have been building up in the Earth's atmosphere over the past several decades, as indicated by a number of comprehensive studies of the atmosphere. The oceans take up some of the carbon dioxide from the atmosphere; concentrations of CO₂ in the oceans have risen as well. Extra heat is being trapped by these gases in the atmosphere, enhancing the natural greenhouse effect and causing a rise the average global temperature of the Earth. The human - caused increase temperature is referred to as *global warming*. There is strong evidence that climates around the globe may be changing as a result of global warming.

Different kinds of organisms occupy specific ecological niches which are determined by very specific climatic conditions. If temperature changes do occur as a result of global warming, habitats may no longer be able to support the organisms that once lived in them. Certain physical or *abiotic* conditions, such as the amount of rainfall, may change as a result of changes on global temperatures. As these factors change, some of the organisms not adapted to the new conditions will migrate; others will perish. The result could be widespread habitat destruction and loss of biodiversity.

Objectives:

- To infer what will happen to various kinds of organisms as conditions in their habitats change;
- To predict which kinds of organisms will survive and which will become extinct;

Important Terms: Habitat, extinction, biodiversity, abiotic factors, migration;

Materials (Per group): Colored pencils, pencil/paper, **Student Activity Sheet**;

Procedure:

1. Based on the information in the **Introduction**, students should write a one sentence prediction of what they think the outcome of the activity will be.

Information A. Imagine an island made up of two climate zones. The northern half of the island has an average yearly temperature of 15°C and an average yearly precipitation of 50 cm. The climate values for the southern half of the island are 20°C and 40 cm. A nature reserve occupies the lower part of the southern half of the island. Eight kinds of organisms found nowhere else on Earth live within the

reserve. To survive, each requires that the average temperature remain below a certain maximum and that the average rainfall remain above a certain minimum. No organism confined within the reserve can migrate off the island. Below is a chart with detailed information about each type of organism in the reserve.

Information B. Imagine that global warming is taking place at a rapid rate. Scientists have determined that over the next 10 years, the average temperature in the southern half of the island will rise by 0.5°C per year, to a value of 25°C . Average rainfall will decrease by 1 cm per year to a value of 30 cm. In the northern half of the island, the average temperature will be 20°C and the average rainfall will be 40 cm at the end of the 10 year period. (Note: These values are the same as the original values for the southern half of the island.)

Information C. The organisms in the nature reserve are now permitted to migrate in order to save themselves from extinction.

- Students need to consider what will happen to the habitat range of each species.
- They should think in terms of possible migration, changes in food supply, and the ultimate survival or extinction.

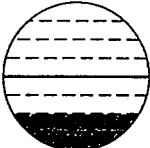
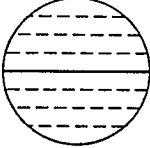
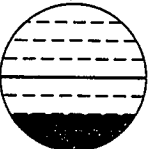
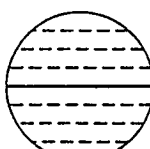
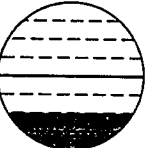
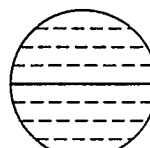
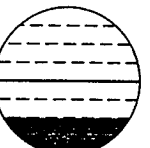
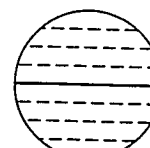
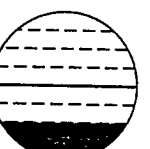
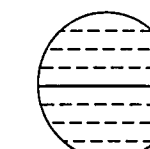
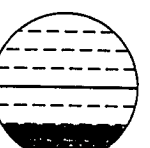
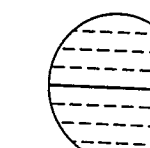
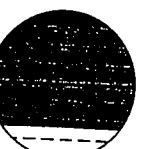
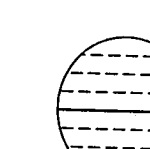
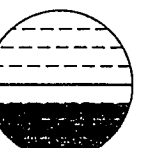

The original habitats of the organisms are shown in the maps on the **Activity Sheet** as darkened areas.

- The distance between each pair of horizontal lines represents 50 km.
- The heavy line across the center represents the climate boundary between the northern and the southern halves of the island.
(Note: The only organisms originally present on the northern half of the island as well as in part of the reserve is **windseed**.)
- Students should use the maps on the **Activity Sheet** and the chart of organism survival requirements to answer the questions in the **Data Analysis** section.

Student Activity Sheet #1 : Global Warming and Biodiversity

I. Prediction _____

II. Maps of Habitats of Organisms

Organism	Original Habitat	Habitat in 10 years
Yellow finch		
Speckled frog		
Furry rat		
Golden panther		
Brown coyote		
Red beetle		
Windseed		
Velvet grass		

Student Activity Sheet #2

A. Data Analysis

1. State whether each species could survive under the new abiotic conditions in the original reserve area (assume that food is not an issue). If a species cannot survive, state which condition, temperature or rainfall, you think the species would find intolerable.

- a. yellow finch _____
- b. brown coyote _____
- c. speckled frog _____
- d. red beetle _____
- e. furry rat _____
- f. windseed _____
- g. golden panther _____
- h. Velvet grass _____

2. Assess each species' ability to migrate quickly enough to reach a habitat where the climatic conditions will support it (assume food is not an issue).

- a. yellow finch _____
- b. brown coyote _____
- c. speckled frog _____
- d. red beetle _____
- e. furry rat _____
- f. windseed _____
- g. golden panther _____
- h. Velvet grass _____

3. State whether each species would have a food source anywhere within the region to which it would migrate. Briefly explain each answer.

- a. yellow finch _____
- b. speckled frog _____
- c. furry rat _____
- d. golden panther _____
- e. brown coyote _____
- f. red beetle _____
- g. windseed _____
- h. velvet grass _____

Student Activity Sheet #3

4. Use your answers to questions #1- 3 to determine the habitat, if any, of each kind of organism after 10 years. In order to survive to this point, an organism would have to be able to reach areas with the right climate and food source for its survival. Show the locations of these final habitats by coloring in the appropriate areas on the maps on the right on Activity Sheet #1.

B. Conclusions:

1. Which kinds organisms on the island will survive the change? Which will become extinct? What will happen to the biodiversity of the island?

2. Given what you have learned from this investigation, why are changes that might result from global warming dangerous to individual species and to life as a whole on Earth? _____
