

A MATTER OF ACCOUNTABILITY

INTRODUCTION:

When human actions alter the local environment, it is usually the people responsible who must deal with the consequences. However, when human actions affect global systems, the impact can be far-reaching. In this learning activity, students will prepare and participate in a mock trial to try to assign responsibility for the consequences of climate change resulting from the build up of CO₂ emissions in the Earth's atmosphere.

Grade Level:

8-12

Time Required:

One day for the trial; additional time for role preparation

Standards Addressed:

Geography standards

14.

Knows and understands how human actions modify the physical environment.

15.

Knows and understands how physical systems affect human systems.

Science standards

D, grades 9-12

Geochemical cycles

F, grades 5-8

Personal health; Populations, resources, and environments; Natural hazards; Risks and benefits; and Science and technology in society

F, grades 5-8

Population growth; Natural resources; Environmental quality; Natural and human-induced hazards; and Science and technology in local, national, and global challenges

Skills:

This learning activity requires students to:

- ask geographic questions
- acquire geographic information
- organize geographic information
- analyze geographic information
- answer geographic questions

Vocabulary/Concepts:

climate change, greenhouse effect, sea level rising, carbon dioxide (CO₂)

Objectives:

As a result of completing this learning activity, students will:

- understand some of the contributing factors related to the theory of climate change.
- conduct a mock trial: Bangladesh vs. the industrialized nations.
- formulate and defend an opinion based on analysis of facts from different sources.
- consider the issue of accountability in global environmental change.

Materials:

- Copies of handout 1, "Plaintiff: People of Bangladesh"
- Copies of handout 2, "Defendant: Nations of the Industrialized World"
- Copies of handout 3, "Facts About Bangladesh"
- Copies of handout 4, "Climate Change and Greenhouse Gas Emissions: Fact Sheet"
- Map 1, "Bangladesh: Areas at Risk of Coastal Flooding"
- *World Population and the Environment Data Sheet*

THE LEARNING ACTIVITY:

Background:

The United Nations Convention on Climate Change calls for nations to address the potential problem of CO₂ emissions. The Convention also includes a process for nations to settle disputes, including a trial before the International Court of Justice. Faced with the prospect of severe coastal flooding resulting from climate change, many countries, especially poor countries such as Bangladesh, may very well appeal to the international community for assistance in meeting the basic needs of their people in the face of diminished land area.

A MATTER OF ACCOUNTABILITY *continued*

Using the format of a judicial proceeding requires students to weigh evidence from opposing perspectives to arrive at a decision about accountability. Such a scenario also confronts students with the dilemma of their own quality of life at odds with the humanitarian needs of one of the world's poorest countries.

Suggested background reading:

"Global Atmospheric Issues: The Greenhouse Effect," *The State of the Environment* (OECD, 1991), pp. 20-29.

"Climate Change: A Global Concern," *World Resources 1990-91*, pp. 11-31.

Preparing for the Activity:

1. In Part 2 of Lesson 3, "Shopping at the Global Resource Bank," students identified the build up of CO₂ emissions as an example of a consequence of human consumption patterns that has a global environmental impact.

Explain to students that over time, the "greenhouse effect" may result in an increase in average global temperatures by 1.5°C to 4.5°C. This would result in a rise in the level of the world's oceans due to the melting of glaciers and polar ice caps. The extent of future climate change is unknown and at this time remains theoretical. Still, the prospect of higher sea levels is cause for great concern in many coastal countries with extensive low-lying land areas. One such country is Bangladesh.

2. Place Map 1, "Bangladesh: Areas at Risk of Coastal Flooding," on an overhead. Have students speculate about the consequences for this small country if projected flooding should occur. Students may want to refer to the global stress maps or the *World Population and the Environment Data Sheet* to determine the current state of well-being in Bangladesh as they consider consequences of coastal flooding.

Introducing the Activity:

3. Announce to students that they are going to conduct a mock trial focusing on the responsibilities of developing and industrialized countries concerning global environmental issues, specifically CO₂ emissions and climate change.
4. Divide the class into 11 small groups and distribute appropriate materials for each group to portray one of the following roles: 1) lawyer for plaintiff; 2) lawyer for defendant; 3) judge; 4) climatologist for the plaintiff; 5) geographer for the plaintiff; 6) agricultural expert for the plaintiff; 7) demographer for the plaintiff; 8) climatologist for the defendant; 9) environmental scientist for the defendant; 10) demographer for the defendant; and 11) United Nations representative for the defendant.
5. Allow time for each group to evaluate the evidence and prepare a statement representing their respective area of interest or expertise. Remind students that they must focus on evidence rather than opinion. Direct students to the following resources to help them with background information:
 - a. Climate Change Fact Sheets-INDEX (<http://www.unep.ch/iucc/fs-index.html>)
 - b. Michael D. Lemonick, "Heading for Apocalypse?" *Time* Vol. 146, No. 14 (New York: Time Inc., October 2, 1995) pp. 54-55.
 - c. Charles E. Cobb, Jr., "Bangladesh: When the Water Comes," *National Geographic* Vol. 183, No. 6 (Washington, DC: National Geographic Society, June 1993) pp. 118-134.
 - d. Houghton and Woodwell, "Global Climate Change," *Scientific American* Vol. 260, No. 4 (New York: Scientific American, Inc., April 1989) pp. 36-44.
6. Explain that each group should select a person to portray the role, but the groups should develop responses to the questions collectively. Witnesses should be prepared to respond to the questions, while the lawyers should prepare opening and closing statements and be prepared to question their witnesses.

A MATTER OF ACCOUNTABILITY *continued*

Executing the Activity:

7. Set up the classroom for the trial: presiding judge in center front; plaintiff's and defendant's tables on either side; area for expert witnesses; witness stand; etc., as simply or as elaborately as time permits.

Note: Each student should have note-taking paper available so that important information on both sides of the question can be recorded and used to formulate an opinion.

- a. Lawyers present opening arguments.
- b. Plaintiff's lawyer calls witnesses, and asks each witness the prepared questions. Witnesses (who have prepared for their roles) answer in character, and can use props, maps, etc., to make positions clear.
- c. Defendant's lawyer calls witnesses.
- d. Lawyers present closing arguments, drawing on the information presented by witness from both sides.
- e. Judge thanks lawyers and witnesses and adjourns to deliberate and prepare opinion.

Concluding the Activity:

8. Each student should complete his/her notes during this class discussion time. The teacher should review relevant information and lead a discussion on the judge's freedom in decisionmaking. The decision does not have to be all or nothing, for or against Bangladesh. As an example, the judge could render an opinion that finds in favor of Bangladesh, but directs the industrialized nations to focus attention and money on reducing CO₂ emissions, rather than preparing for the consequences of rising sea levels.

Evaluating the Activity:

Each student should write an opinion. The opinion should state the decision regarding the damages requested by Bangladesh and be supported with facts from the case.

Extensions & Variations:

Allow time for rebuttal.

PLAINTIFF: PEOPLE OF BANGLADESH

Opening Statement

The people of Bangladesh are suing the industrialized nations of the world for potential damages to our country, our people, and our way of life, due to the effects of high rates of carbon dioxide (CO₂) emissions. Carbon dioxide emissions are primarily the result of the burning of fossil fuels, either for transportation or industry. Bangladesh admittedly emits some carbon dioxide into the atmosphere, but the rate is far lower than the rate in industrialized nations. We will hear from the following witnesses:

1. A **climatologist** will discuss the greenhouse effect, climate change, and carbon dioxide emissions.
2. A **geographer** will describe Bangladesh's physical geography and the effects of carbon dioxide emissions.
3. An **agricultural expert** will discuss the impact that climate change will have on agricultural production in Bangladesh.
4. A **demographer** will describe the people of Bangladesh, where they live, and how their lives will be affected by climate change.

CLIMATOLOGIST

Explain the greenhouse effect and what is meant by climate change.

What are the "greenhouse gases?"

What are the major sources of greenhouse gas emissions?

What will happen if carbon dioxide emissions continue?

GEOGRAPHER

Describe the physical geography of Bangladesh.

How might the land and weather patterns be affected by climate change?

AGRICULTURAL EXPERT

Explain the type of agriculture practiced in Bangladesh.

Currently, is Bangladesh able to adequately feed its population?

How would farming and agricultural production be affected by climate change?

DEMOGRAPHER

Describe the population of Bangladesh, its size, and distribution.

How would you describe Bangladesh's current level of well-being?

How would the lives of the people of Bangladesh be affected if predictions of sea-level rising prove to be true?

DEFENDANT: NATIONS OF THE INDUSTRIALIZED WORLD

Opening Statement

The people of the world's industrialized nations are here today to refute the charges brought by the representatives from Bangladesh. While we admit that we are responsible for a portion of the carbon dioxide emissions worldwide, we are not the only responsible parties. China, a developing nation, by virtue of its great population, is responsible for a significant percentage of carbon dioxide emissions, and is not included as a defendant in this suit. Bangladesh itself emits some carbon dioxide into its atmosphere. In addition, carbon dioxide is not the only greenhouse gas that could affect climate change; others, such as methane, are also responsible and are largely the result of nonindustrial processes. These factors alone should be enough to decide in our favor. But they are not the most important piece of the puzzle. While the fact of carbon dioxide and other greenhouse gas emissions cannot be disputed, the effect on Bangladesh is unknown. In addition, some of Bangladesh's problems are due to deforestation in the Himalayan mountains. We will call the following witnesses:

1. A **climatologist** will explain the sources of greenhouse gas emissions and will explain the tentative nature of the charges brought by Bangladesh.
2. An **environmental scientist** will describe the current quality of the environment in Bangladesh and explain the problems caused by deforestation.
3. A **demographer** will discuss increasing population growth in developing countries and the trend of increasing carbon dioxide emissions from these countries.
4. A **representative from the United Nations** will describe the work of the UN "Framework Convention on Climate Change" and the ideas of shared responsibility.

CLIMATOLOGIST

What are the various sources of greenhouse gas emissions, and more importantly, carbon dioxide emissions?

Are industrialized nations the only countries who contribute significant levels of carbon dioxide?

Are scientists in agreement and certain about the effects of continued carbon dioxide emissions on the Earth's climate and on Bangladesh?

ENVIRONMENTAL SCIENTIST

Comment on the quality of Bangladesh's environment.

What activities occur at the local level in Bangladesh, and contribute to environmental stress at the regional level?

DEMOGRAPHER

Describe the current and projected (future) population growth in developing nations.

How will population growth in developing countries contribute to the levels of carbon dioxide and methane emissions? Specifically discuss China and India.

UN REPRESENTATIVE

What is the purpose of the United Nations Framework Convention for Climate Change?

How is this initiative attempting to solve the problems addressed in this suit?

Do international resolutions on climate change target industrialized nations with sole responsibility?

What are the responsibilities of less developed nations?

FACTS ABOUT BANGLADESH

Bangladesh is about the size of Wisconsin.

Apart from city-states such as Hong Kong and Singapore, Bangladesh is the most densely populated country in the world with 832 people per km².

In 1996, 40 percent of the population was under age 15.

Life expectancy at birth is 57 years. The literacy rate is 51 percent for men and 74 percent for women.

Forty-five percent of the population has access to health services.

The high population density is made possible largely by the fertile soil, and availability of freshwater for year-round cropping.

Eighty-four percent of the population lives in rural areas and engages in subsistence agricultural activities.

Most of the population relies on fishing and water-intensive agriculture for subsistence.

Bangladesh struggles constantly to produce or import enough food for its rapidly growing population.

An estimated 10 to 15 percent of the population is at serious nutritional risk; the majority faces food insecurity.

Almost all of Bangladesh lies on the largest delta in the world born of the silt carried by three major river systems: the Ganges, the Brahmaputra, and the Meghna.

The intensively farmed, low-lying alluvial plain is frequently subject to flooding, particularly during the peak of the wet monsoon period.

Annual floods can cover as much as 35 percent of the country.

Bangladesh's predominantly agricultural economy depends heavily on an erratic monsoonal cycle, which leads to periodic flooding and drought.

Almost every cultivable acre of land is under crops: rice, wheat, jute, and tea.

The southern part of the country lying on the Bay of Bengal is subject to tropical storms.

Half of the country is less than five meters above sea level.

Bangladesh has few mineral resources.

Bangladesh has a weak industrial base and a largely unskilled labor force; 60 percent of the labor force is engaged in agriculture.

CLIMATE CHANGE AND GREENHOUSE GAS EMISSIONS

BACKGROUND

Atmosphere:

The Earth's atmosphere is made up of a combination of gases and suspended particles. These properties are essential to sustain life. The atmosphere provides humans with oxygen to breathe and water to drink; plants with carbon dioxide and water to grow; and the whole planet with a regulated temperature. • The climate of a particular region is determined by the state of the atmosphere and its chemical components. Climate changes result from altering the concentration of such gases and particles.

Greenhouse Effect:

Energy from the Sun strikes the Earth's atmosphere. Much of it bounces back into space, but some is absorbed by carbon dioxide and other gases as heat. This phenomena, which warms the atmosphere, is called the "greenhouse effect." • The right amount of greenhouse effect is necessary for maintaining life on this planet. If heat were not absorbed, the world would be colder and uninhabitable; as more greenhouse gases are released into the atmosphere, more of the Sun's energy is trapped and the world temperature is raised. • There have been fluctuations of greenhouse gases throughout history.

Greenhouse Gases:

Both natural processes and human activities result in emissions of greenhouse gases, which include carbon dioxide (CO₂), methane, and chlorofluorocarbons (CFCs). CO₂ accounts for 50 percent of greenhouse gases. Methane and CFCs account for about 30 percent of the greenhouse effect, and their concentrations are rapidly increasing. The source of methane emissions include rice fields, cattle, biomass burning, and mining. CFCs are used primarily as refrigerants in air conditioners and refrigerators, aerosols, and packaging.

Carbon Dioxide:

Carbon dioxide is emitted by the respiration of animals and plants, the burning of biomass and of fossil fuels, and the manufacturing of cement. People burn fossil fuels for many different purposes, including electricity generation, motorized transportation, air conditioning, heating, etc. • The large scale clearing of tropical forests puts more carbon dioxide into the atmosphere as the cut trees decompose and stop converting carbon dioxide to oxygen.

FACTS:

- Carbon dioxide and other greenhouse gases have become more concentrated in the atmosphere because of greater industrial and agricultural production.
- Carbon dioxide emissions have increased exponentially since the mid-19th century. The amount of carbon dioxide in the world's atmosphere has increased from about 265 parts per million by volume (ppmv) to 350 ppmv today.
- Most scientists agree that the rising level of greenhouse gas emissions is contributing to global warming and if the trend in carbon dioxide emissions continues, world temperatures will increase.
- During the last century, global surface temperatures have risen approximately 1°C and the global average sea level has risen approximately 10 cm.
- Projections of future sea-level rise range from 0.3 meters to 3.5 meters by the year 2100.

CLIMATE CHANGE AND GREENHOUSE GAS EMISSIONS *continued*

POTENTIAL CONSEQUENCES:

- If CO₂ concentrations double, the temperature rise could range from 1.5 to 4.5°C (3 to 8°F). It is currently projected that this will happen by 2050.
- Large scale climate changes may occur unless other climatic systems counteract the warming effect of carbon dioxide and other greenhouse gases.
- Several degrees of warming will mean greater variations in both temperature and weather patterns as ice caps and glaciers melt and ocean levels rise. These changes will produce higher sea levels and flooding of low-lying coastal lands worldwide. Melting of just half the world's current volume of ice would produce a rise in sea level of 40 meters (130 feet).
- Given the latest forecasts of atmospheric warming, by 2050 sea level will be 3 to 6 meters (10-20 feet) higher. That could submerge vast areas of low-lying coastal land, including major river deltas. Some major population centers that would be greatly affected because of their low-lying locations include: 1) New Orleans, most of which lies at or below sea level; 2) The Netherlands, where most of the 14 million people live at elevations ranging from a few meters above to several meters below sea level; 3) Alexandria, Egypt, which lies only 1 meter above sea level; and 4) New York and Hong Kong. More than 100 million people worldwide would be displaced.
- Winters could get warmer and warm weather hot spots could become more frequent and severe.
- Rainfall would increase, but the pattern of change would be unequal. Some areas already prone to flooding might flood more often and more severely, and some arid areas might become even dryer. Hurricanes could become stronger as the oceans heat up.
- Climate change would affect agriculture because of changing temperature, rainfall patterns, shifting climate zones, and reduced soil moisture. Farmers may be able to adapt by changing the types of crops that they plant. In some areas, the growing season could become longer, and in other areas, yields would be reduced due to less favorable rains, extreme weather conditions, and reduced soil productivity.
- The physical impacts of sea-level rise include inundation of low-lying areas, erosion, saltwater intrusion, higher water tables, and increased storm damage and flooding.

POTENTIAL CONSEQUENCES FOR BANGLADESH:

People living in the world's river deltas and coastal lowlands will be among the first to suffer from sea-level rise. The effects will be worse where, as in many areas, the land is sinking anyway, compounding the impact of the swelling oceans.

Bangladesh probably faces the greatest crises of all. Eighty percent of the country is made up of the delta of the Ganges, Brahmaputra, and Meghna rivers; half of it is less than 5 meters above sea level. The high population density in Bangladesh forces people to live on low-lying, vulnerable land that would be swept away if the sea level were to rise.

CLIMATE CHANGE AND GREENHOUSE GAS EMISSIONS *continued*

- In one best case scenario, researchers find that sea level would rise about 13 centimeters by 2050, and less than 1 percent of the nation's land area would be lost to advancing seas. In a worse case scenario, 18 percent of the land, which currently supports about 15 percent of the nation's people, would be lost. In the worst case, by 2100 waters would rise to 4.5 meters and cover an area currently supporting 35 percent of the nation's population. The land area that supports nearly one-third of the nation's current GNP would vanish into the sea.
- Estimates show that a 1 meter sea-level rise would destroy 2 million houses and leave 10 percent of the people homeless. An additional sea-level rise would also be felt upstream. Salinity would penetrate inland, poisoning cropland and polluting the water supplies of cities.

UNCERTAINTIES:

- It is unknown exactly how much Earth's surface temperature will rise.
- The level of climate change is dependent on many factors, such as clouds. As the atmosphere gets warmer, it should get cloudier. An increase in certain types of clouds could reduce the warming.
- It is unclear exactly how the accelerated warming will translate into sea-level rise, because the dynamics between the atmosphere and the ocean are not well understood.
- Much is unknown in the area of climate change. Scientists do not yet fully understand the carbon cycle, and cannot account for all the carbon dioxide in the atmosphere. But what changes can be measured, as well as the threat that damage done so far may be irreversible, have made action on climate change urgent.
- The exact effects of climate change are not known.

INTERNATIONAL RESOLUTIONS

- In 1988, the United Nations Environment Programme and the World Meteorological Organization set up the Intergovernmental Panel on Climate Change as an independent scientific and technical body to assess knowledge on climate change; examine the environmental, economic, and social impacts of climate change; and formulate responses and strategies.
- In 1988, the United Nations General Assembly adopted a resolution recognizing climate change as a common concern of humankind and urging the world community to deal with it as an urgent priority.
- In 1989, at an international conference held in India, industrialized countries were reminded that they were mostly responsible for causing climate change, and therefore had an obligation to help developing countries find appropriate answers and finance responses.
- Before the 1992 Earth Summit, 154 nations and the Economic Community had signed the Framework Convention on Climate Change (FCCC). The FCCC's ultimate objective is to stabilize greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous interference with the climate system.

CLIMATE CHANGE AND GREENHOUSE GAS EMISSIONS *continued*

The Key Principles of the Convention

The climate system should be protected for the benefit of present and future generations. The idea of “common but differentiated responsibility” was put forward, meaning that all countries must prevent any further damage of the atmosphere, but some countries have a greater responsibility than others because their contribution to degradation has been greater. Developed countries bear a special responsibility to take action, since they are the largest source of the problem.

The second principle highlights the particular needs and circumstances of developing countries, especially those particularly vulnerable to the effects of climate change and those which would bear a disproportionate burden under the convention.

The third principle calls on countries to take precautionary measures to “anticipate, prevent, or minimize” the causes of climate change. It specifically says that lack of conclusive scientific evidence should not block efforts to act against causes of climate change. This is based on the understanding that to wait for final proof may be too late.

Commitments and Obligations

Both developed and developing countries must adopt national update programs to mitigate climate change; develop adaptation strategies; promote sustainable management and conservation; develop forests; minimize adverse effects by taking climate change into account when setting relevant social, economic, and environmental policies; cooperate in technical, scientific, and educational matters; and promote scientific research and the exchange of information.

Developed countries must help developing countries by providing technical assistance and financial resources.

Least developed countries and those particularly vulnerable to climate change for geographical reasons are given special consideration. These countries make up a long list that includes small island countries, countries with low-lying coastal areas, areas prone to natural disasters, and areas with high urban atmospheric pollution.

Developed countries are committed to adopting policies that limit human-made emissions of greenhouse gases and enhance greenhouse sinks and reservoirs (forests). These countries must submit the plans that they have developed to reduce emissions to 1990 levels.

BANGLADESH: AREAS AT RISK OF COASTAL FLOODING

