



# Climate and CO<sub>2</sub>

Middle School Grades

## **Lesson Summary**

Students will become familiar with CO<sub>2</sub> and its role in the greenhouse effect as well as learning the major producers of CO<sub>2</sub>. Students will also learn about the Kyoto conference and establish reasons for CO<sub>2</sub> production.

## **Prior Knowledge & Skills**

- Responsible internet search skills
- Acquiring, organizing, and analyzing geographic information

## **AAAS Science Benchmarks**

### **The Physical Environment**

*Processes that Shape the Earth*

### **Human Society**

*Global Interdependence*

### **Common Themes**

*Systems*

## **NSES Science Standards**

### **Life Science**

*Populations and Ecosystems*

### **Science in Personal and Social Perspectives**

*Populations, Resources and Environments*

## **NCGE Geography Standards**

### **Physical Systems**

*Standard #7*

**Teaching Time:** 60-90 minutes

## **Materials**

- Computer with internet access
- Wall map of the world
- Pencils, pens, or markers
- Climate map of the United States
- Graph paper

## **Advanced Planning**

**Preparation Time:** ~10 minutes

1. Review the instructions
2. Gather the necessary supplies.

## **Recommended Reading: (attached)**

- The Greenhouse Gas Explanation Sheet (connected to the Greenhouse Experiment in grades 3-5)

## **Recommended Extension Activity:**

- Students can debate about:
  - what changes a country could or could not make in order to reduce CO<sub>2</sub> emissions and why these changes would be possible or impossible.
  - the real impact of CO<sub>2</sub> reductions on the greenhouse effect.
  - other topics relevant to public or political policy and climate change.

National Geographic Xpeditions: Geography Standards in Your Classroom

<http://www.nationalgeographic.com/xpeditions/>


**Geography Standard:** **7**
**XPEDITION HALL**

 Check out:  
**X1: Globe Projector**
**STANDARDS**

- **Standard #1:** How to use maps and other geographic representations, tools, and technologies to acquire, process, and report information from a spatial perspective

**ACTIVITIES**

- A Reason for the Season
- Stormy Stories

# Lesson Plans

**Grade Level:** K-2 3-5 6-8 9-12

**Select Lesson Plan:**

## Climate and CO2: Analyzing their Relationship

**Overview:**

In this lesson, students will speculate on various scenarios of future world climates if the greenhouse effect increases.

**Connections to the Curriculum:**

Geography, environmental studies, science

**Connections to the National Geography Standards:**

Standard 7: "The physical processes that shape the patterns of Earth's surface"

**Time:**

Ten to twelve hours

**Materials Required:**

- Computer with Internet access
- Wall map of the world
- Pencils, pens, or markers
- Climate map of the United States
- Graph paper

**Objectives:**

Students will

- be familiar with carbon dioxide (CO<sub>2</sub>) and theories about its role in the greenhouse effect;
- read about the global conference that was held in Kyoto, Japan, in 1997 to set international limits on CO<sub>2</sub> emissions;
- know the leading producers of CO<sub>2</sub> emissions;
- understand the reasons for patterns of CO<sub>2</sub> production;
- understand the implications of the greenhouse effect; and
- understand the processes of possible change in world climates.

**Geographic Skills:**

**Acquiring Geographic Information**  
**Organizing Geographic Information**  
**Analyzing Geographic Information**

## Suggested Procedure

### Opening:

Review the following information about the greenhouse effect with your students. [Note: You can find additional data at [New Scientist: Climate Change](#).]

### Causes of the greenhouse effect

Carbon dioxide, methane, nitrous oxide, and other gases are transparent to incoming sunlight, allowing the heat from the sun to enter Earth's atmosphere. These gases trap the heat close to the Earth's surface, warming the atmosphere. Fuel combustion is the largest human-made source of carbon dioxide. Deforestation is the second largest human-made source.

### Possible outcomes related to the greenhouse effect

From 1860 to 1994 carbon dioxide in the atmosphere rose from 280 to more than 350 parts per million. A network of scientists organized by the United Nations predicts that by 2100 continued emissions of carbon dioxide at current rates might raise global temperatures and sea levels. Islands and shorelines could be inundated, climate zones could shift, and weather could grow more turbulent.

### Uncertainties

Due to the climate system's complexity, computer simulations of warming and its impacts are, by nature, imprecise. Skeptics say that conclusions drawn from such simulations form a weak basis for international action. Major uncertainties include the role of clouds in warming or cooling the atmosphere and the role of oceans in absorbing atmospheric heat and carbon dioxide.

### Development:

Ask students to draw a diagram of the role carbon dioxide plays in the global greenhouse. Discussion should ensure that students understand that an increase in CO<sub>2</sub> means a "thicker" (more efficient) blanket over the Earth's atmosphere, which might cause the temperature of the atmosphere to increase (global warming).

Student groups should tackle these topics and answer the questions that follow:

- What is the present level of atmospheric CO<sub>2</sub>?
- Why has carbon dioxide concentration risen since 1860?
- What was the carbon dioxide level when you were born?
- What was the carbon dioxide level when your parents were born?

Give students data on approximate CO<sub>2</sub> emissions by nation. Data can be found at the Trends in Fossil Fuels site, linked in the list below.

- Is the rate of carbon dioxide emission a factor of population concentration? Why?
- Are there any global patterns of emissions?
- How do these patterns compare to what you know about the development of countries around the world?

Ask students to research the 1997 Kyoto conference on climate change. A summary of the conference can be found at the site linked in the list below.

- Why was a conference held on global warming?
- What countries participated?
- What are some terms of the international treaty produced at the conference?
- Has your country adopted the treaty? Why might it wish to do so? Why might it reject the treaty?

**Closing:**

Have groups speculate on the consequences of global warming, such as melting ice caps and shifting climate zones.

**Suggested Student Assessment:**

Have each student write a fact-based story illustrating a possible greenhouse-effect scenario. The story should be set in the future and begin, "If we knew in 1998 what we know now...."

*Aaron Doering of Century High School in Rochester, Minnesota, contributed classroom ideas for Standard 7.*

**Related Links:**

[BBC: 1997 Kyoto Conference on Climate Change](#)

[Environmental Literacy Council](#)

[NOAA: Climatic Extremes and Weather Events](#)

[Trends in Fossil Fuel Carbon Dioxide Emissions](#)



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