



Climate and CO₂

High School Grades

Lesson Summary

Students will become familiar with CO₂ and its role in the greenhouse effect as well as learning the major producers of CO₂. Students will also learn about the Kyoto conference and understand reasons for CO₂ production.

Prior Knowledge & Skills

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

AAAS Science Benchmarks

Human Society

Global Interdependence

Common Themes

Systems

NSES Science Standards

Life Science

Interdependence of Organisms

Science in Personal and Social Perspectives

Environmental Quality

Natural and Human Induced Hazards

Science and Technology in local, national, and global challenges

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

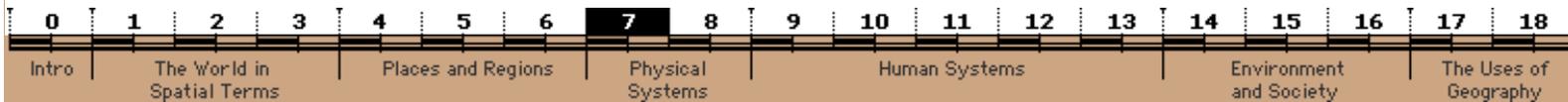
1. Review the instructions
2. Gather the necessary supplies.

Recommended Reading: (attached)

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

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 (CO₂) 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 CO₂ emissions;
- know the leading producers of CO₂ emissions;
- understand the reasons for patterns of CO₂ 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 CO₂ 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 CO₂?
- 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 CO₂ 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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