

LESSON:

The Kyoto Protocol: What Should We Do?

Summary: Students decide if the United States should ratify the Kyoto Protocol by looking at carbon dioxide emission data based on total and per-capita emissions. Then students read an article about the effects of global climate change in Africa and consider how this influences their decision and whether they would be willing to pay for reducing carbon dioxide emissions in the United States. Finally, students discuss their positions as a class and try to reach a group decision about what the United States should do. Lesson type: Extension Lesson—This lesson extends a topic in the *EHP Student Edition* article.

EHP Article: "Continental Divide: Why Africa's Climate Change Burden Is Greater" *EHP Student Edition*, November 2005, p. A534–A537
<http://ehp.niehs.nih.gov/members/2005/113-8/spheres.html>

Objectives: By the end of this lesson students should be able to:

1. explain how scientific data may be organized to frame the debate on controversial issues;
2. describe the primary reason given why the United States did not ratify the Kyoto Protocol; and
3. formulate and defend a position on what the United States should do regarding the Kyoto Protocol.

Class Time: 1 hour

Grade Level: 9–12

Subjects Addressed: Environmental Health, Biology, Health

►Prepping the Lesson (15 minutes)

INSTRUCTIONS:

1. Obtain a class set of *EHP Student Edition*, November 2005, or download the article "Continental Divide: Why Africa's Climate Change Burden Is Greater."
2. Read the article "Continental Divide: Why Africa's Climate Change Burden Is Greater" and review the Background Information and Student Instructions.
3. Make copies of the Student Instructions and, if necessary, the article.

MATERIALS: (per student)

- 1 copy of *EHP Student Edition*, November 2005, or 1 copy of the article "Continental Divide: Why Africa's Climate Change Burden Is Greater"
- 1 copy of the Student Instructions

VOCABULARY:

- global climate change
- global warming
- greenhouse gas
- Kyoto Protocol
- metric tons



BACKGROUND INFORMATION:

Global climate change refers to how weather and temperature are changing throughout the world as a result of natural and man-made effects. It is generally accepted that the Earth's atmosphere is getting warmer, affecting global weather patterns. What is not universally accepted is what is causing this warming pattern. Many scientists and governments are convinced that man-made emissions of greenhouse gases such as carbon dioxide are responsible. In response, an amendment to the United Nations Framework Convention of Climate Change called the Kyoto Protocol was drafted in Kyoto, Japan, in 1997. The Kyoto Protocol is an international treaty on global warming that commits industrialized countries to reducing their emissions of carbon dioxide and five other greenhouse gases (methane, nitrous oxide, hydrofluorocarbons, perfluorocarbons, and sulfur hexafluoride) by 2012. With the ratification by Russia, the treaty became effective 16 February 2005. As of August 2005, 153 countries had ratified the treaty. The United States and some other countries have not ratified the treaty because they believe the treaty is flawed. The United States government has said the requirement of the treaty would be too costly to implement and would not effectively deal with the problem because many large polluters such as China are excluded.

RESOURCES:

Environmental Health Perspectives, Environews by Topic page, <http://ehp.niehs.nih.gov/topic>. Choose Climate Change/Global Warming.

CIA, The World Factbook, Gross Domestic Product information:

By country, <http://www.odci.gov/cia/publications/factbook/rankorder/2001rank.html>.

Per capita, <http://www.odci.gov/cia/publications/factbook/rankorder/2004rank.html>.

Energy Information Administration, U.S. Department of Energy, Summary of the report on the impact of the Kyoto Protocol on the U.S. energy markets & economic analysis, <http://www.eia.doe.gov/oiaf/kyoto/execsum.html>.

Energy Information Administration, U.S. Department of Energy, International Energy Annual 2003 Carbon Dioxide Emissions from Use of Fossil Fuels, <http://www.eia.doe.gov/emeu/iea/carbon.html>.

Global Warming: Early Warning Signs, clickable map of weather records and extremes across the world, <http://www.climatehotmap.org/>.

U.S. Environmental Protection Agency, Global Warming, <http://yosemite.epa.gov/oar/globalwarming.nsf/content/index.html>.

U.S. Overseas Private Investment Corporation, Byrd-Hagel Resolution (Senate Resolution 98), expressing the sense of the Senate regarding the conditions for the United States becoming a signatory to the Kyoto Protocol, <http://www.opic.gov/GeneralOPIC/senateresolution98.htm>.

Union of Concerned Scientists, Global Warming, http://www.ucsusa.org/global_warming/.

UN Framework Convention on Climate Change, <http://unfccc.int/2860.php>.

UN Framework Convention on Climate Change, Kyoto Protocol, http://unfccc.int/essential_background/kyoto_protocol/background/items/1351.php.

Implementing the Lesson**INSTRUCTIONS:**

1. Lead a brief discussion about global climate change and global warming.
2. Hand out the Student Instructions and the article "Continental Divide: Why Africa's Climate Change Burden Is Greater."
3. In groups or as individuals, ask students to complete the questions on the Student Instructions and read the article.
4. Conclude with a class discussion and try to reach a class decision about whether or not the United States should sign the Kyoto Protocol.

NOTES & HELPFUL HINTS:

- This lesson could be done as homework.
- Students could be asked to research the arguments for and against the man-made causes of global warming.
- Students could investigate the atmospheres and temperatures of other planets in our solar system and discuss them with respect to global warming.
- Conduct greenhouse experiments or experiments using carbon dioxide.
- Have the class research the forecasted effects of global warming where you live.

Aligning with Standards**SKILLS USED OR DEVELOPED:**

- Communication (note-taking, oral, written—including summarization)
- Comprehension (listening, reading)



- Critical thinking and response
- Graph reading
- Tables and figures (reading)

SPECIFIC CONTENT ADDRESSED:

- Carbon dioxide emissions
- Climate change
- Global warming
- Public health

NATIONAL SCIENCE EDUCATION STANDARDS MET:**Unifying Concepts and Processes Standard**

- Systems, order, and organization
- Evidence, models, and explanation
- Change, constancy, and measurement
- Form and function

Science As Inquiry Standard

- Abilities necessary to do scientific inquiry
- Understanding about scientific inquiry

Earth and Space Science Standard

- Energy in the Earth system

Science in Personal and Social Perspectives Standard

- Personal and community health
- Environmental quality
- Natural and human-induced hazards

▶Assessing the Lesson

Step 1: Using this information, do you agree or disagree with the position of the United States that the Kyoto Protocol is unfair? Explain.

There is no right or wrong answer to this question. Assess students' responses based on the quality of their arguments for their position. Be sure students accurately and logically refer to Figures 1 and 2 in the Student Instructions.

Step 2: Using this new information, has your position changed or remained the same in regards to the United States considering the Kyoto Protocol unfair? Explain.

Again, there is no right or wrong answer to this question. The issue is whether presenting carbon dioxide data per capita changes students' position on the issue. Assess students' responses based on the quality of their arguments for their position.

Step 4: How many metric tons of carbon dioxide did Africa as a whole produce in 2002?

918.49 million metric tons. One metric ton = 1,000 kg

Step 5: What are the potential health effects in Africa attributed to global climate change?

Drought-triggered famine

Increased HIV/AIDS due to decreased immunity that is caused by poor nutrition and adverse living conditions

Increased vectorborne diseases such as malaria, meningitis, dengue fever, and tickborne borreliosis

Increased dust averaging 2.5 micrometers in diameter or less, which has respiratory and cardiovascular consequences

Increased dust that carries bacteria, fungi, and chemical pollutants that adversely affect health

Increased chances of war due to decreases in food supplies and population migration

Increased disease in general due to poor nutrition and adverse living conditions



Step 6: One estimate states that \$200 per year per person is how much it would cost to reduce CO₂ levels by 3% over 1990 levels, the amount necessary to bring the United States into compliance with the Kyoto Protocol. Would you be willing to pay an extra \$200 per year to reduce CO₂ levels by this amount? Explain why or why not.

There is no right or wrong answer to this question. Assess students' responses based on the quality of their arguments for their position.

Step 7: If you wanted to defend the United States for not ratifying the Kyoto Protocol, would you present CO₂ emissions data per country or per capita? Explain why.

By presenting the carbon dioxide emission data per country, it makes it look like countries like China and India are a significant part of the problem that is not being addressed. This is the usual way the data are presented for those who wish to defend the position of the United States. By presenting the carbon dioxide emission data per capita, the size of the emissions are reduced for those countries that have large populations, such as China and India. Typically, per capita data are presented for those people who say the United States should bear a greater share of the cost of reducing carbon dioxide emissions.

Step 8: Consider the information in the article, including the potential effects of global warming and CO₂'s possible contribution to global warming, and consider the CO₂ emissions and GDP data. Using this information, decide whether or not you are in favor of the United States ratifying the Kyoto Protocol. As part of a class discussion, be prepared to defend your position.

There is no right or wrong answer to this question. Assess students' responses based on the quality of their arguments for their position. Students should consider and discuss how the various factors (i.e., effects of global warming, CO₂'s possible contribution to global warming, CO₂ emissions and GDP data) influence their position.

► Authors and Reviewers

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The Kyoto Protocol: What Should We Do?

Step 1: The Kyoto Protocol is an amendment to the United Nations Framework Convention on Climate Change that addresses global warming by requiring countries to control emissions of greenhouse gases. Industrialized countries that ratify the treaty must commit to reducing their emissions of carbon dioxide (CO₂) and five other greenhouse gases. The treaty became effective 16 February 2005, but the United States never ratified the treaty and therefore is not subject to its requirements. The United States objected to the treaty in part because it exempts some developing countries such as China and India from its requirements. Figure 1 below shows the top five countries that emit CO₂ into the atmosphere—China is the second largest producer of CO₂ and India the fifth. Figure 2 on the next page shows that China and India are also strong economic competitors of the United States, having strong gross domestic products (GDPs). The GDP is a measure of total economic output. The U.S. position is that the treaty is unfair because it ignores large contributors to the problem and forces the United States to pay for reducing emissions while its economic competitors do not, thereby placing the United States in a noncompetitive position in the global marketplace.

Figure 1: CO₂ emissions in 2000 for the five countries releasing the most CO₂

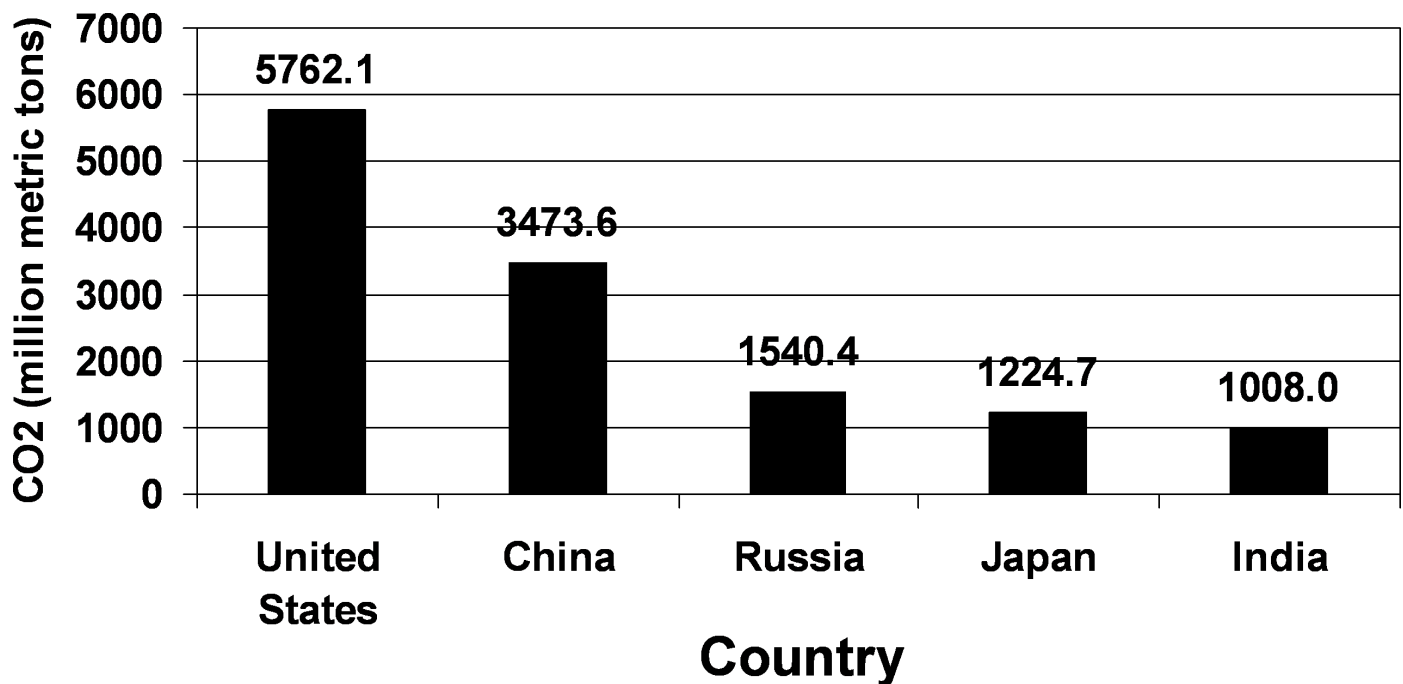
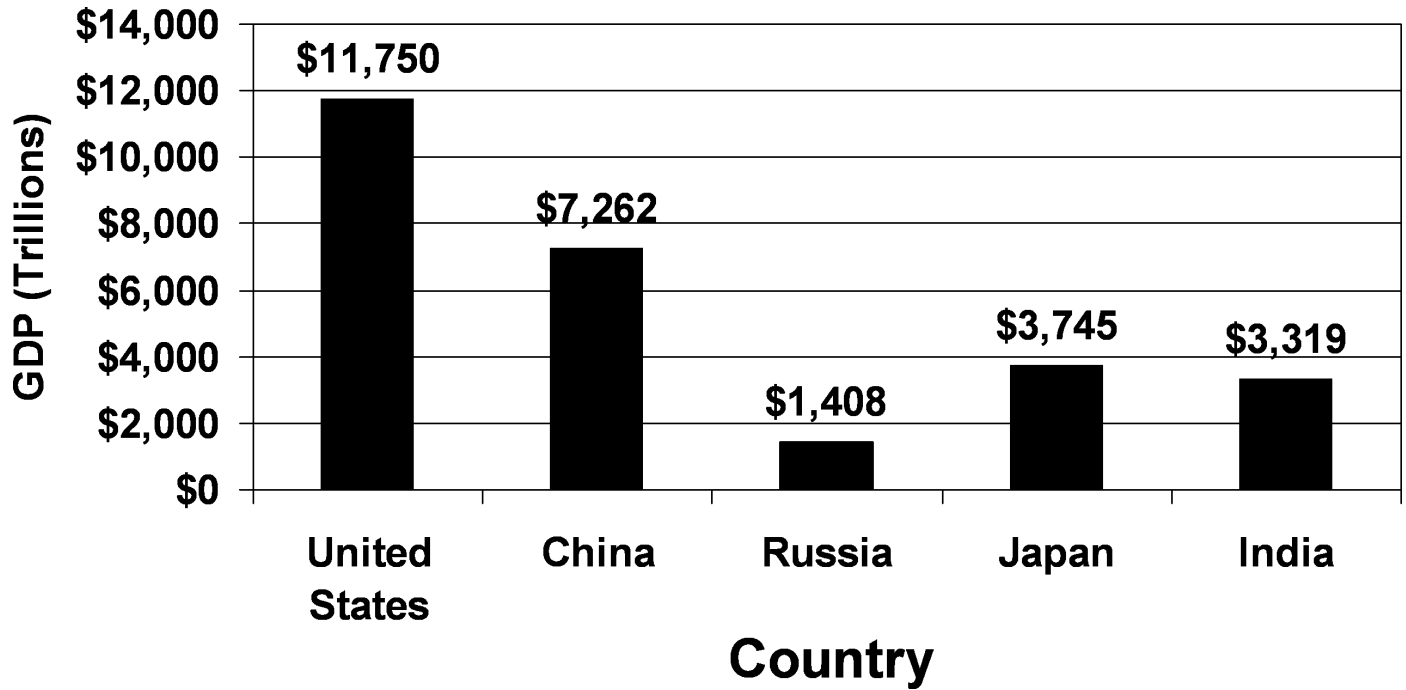


Figure 2: GDP in 2004 for the five countries releasing the most CO₂

Using this information, do you agree or disagree with the position of the United States that the Kyoto Protocol is unfair? Explain.

Step 2: Supporters of the Kyoto Protocol argue that the treaty is fair because when you look at CO₂ emissions and GDP on a per-capita basis, China and India are no longer significant contributors to the problem (see Figures 3 and 4, next page).

Figure 3: CO₂ emissions per capita in 2000 for the five countries releasing the most CO₂

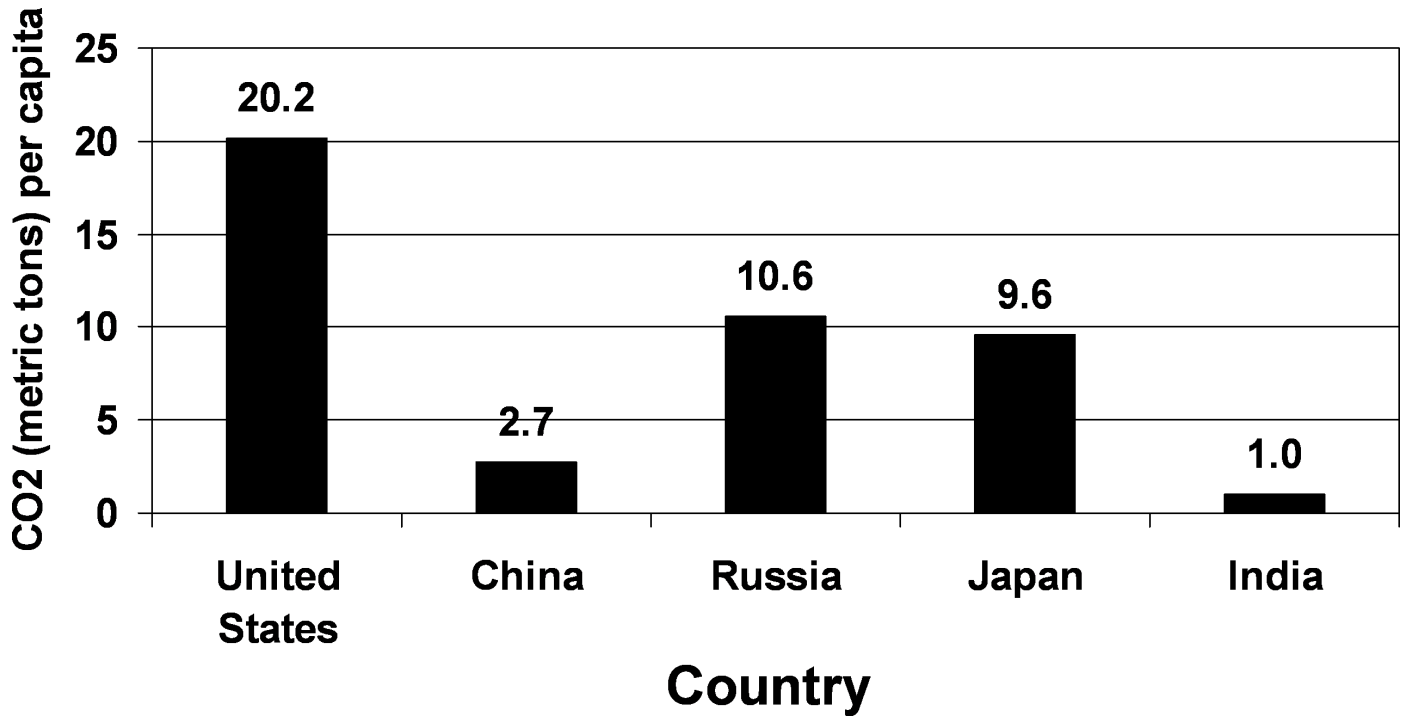
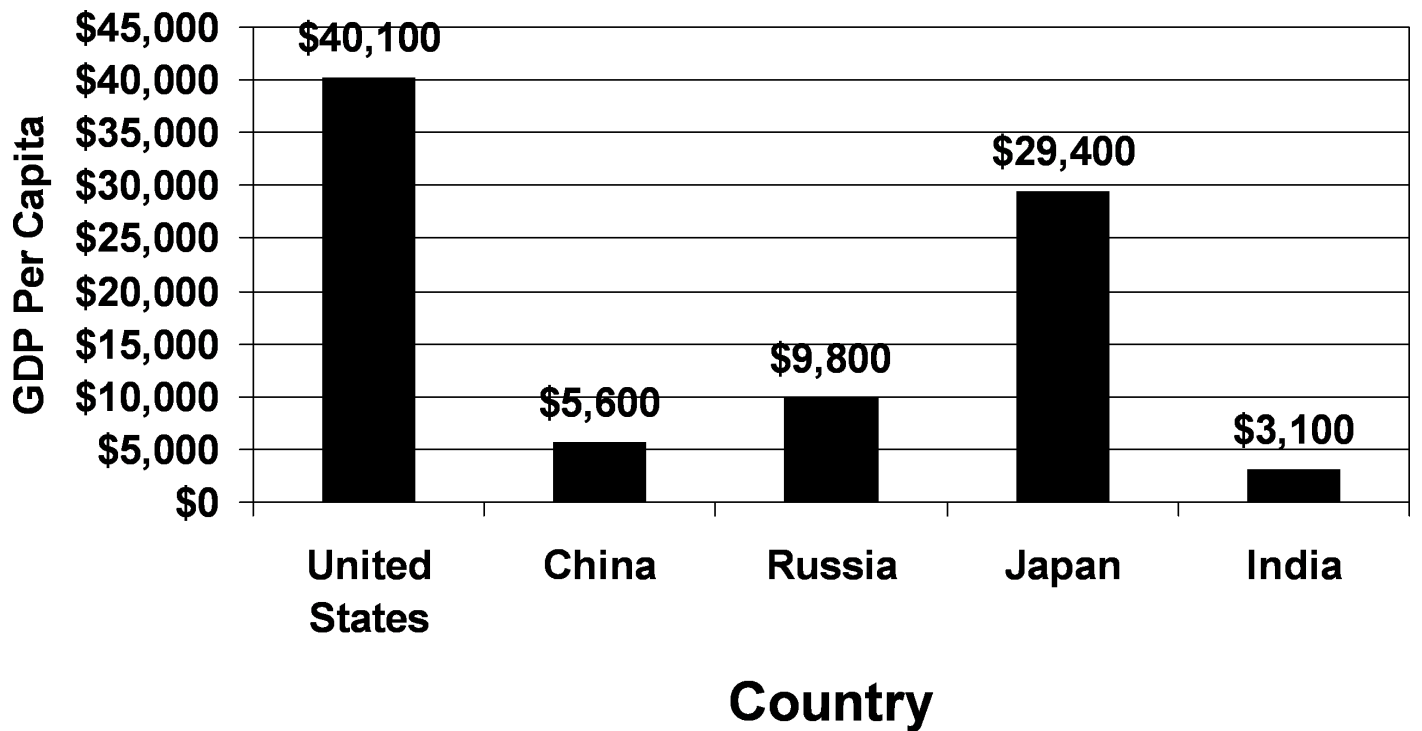


Figure 4: GDP per capita in 2004 for the five countries releasing the most CO₂



Using this new information, has your position changed or remained the same in regards to the United States considering the Kyoto Protocol unfair? Explain.

Step 3: Read the article "Continental Divide: Why Africa's Climate Change Burden Is Greater," *EHP Student Edition*, November 2005, p. A535–537.

Step 4: How many metric tons of carbon dioxide did Africa as a whole produce in 2002?

Step 5: What are the potential health effects in Africa attributed to global climate change?

Step 6: One estimate states that \$200 per year per person is how much it would cost to reduce CO₂ levels by 3% over 1990 levels, the amount necessary to bring the United States into compliance with the Kyoto Protocol. Would you be willing to pay an extra \$200 per year to reduce CO₂ levels by this amount? Explain why or why not.



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