

Climate Change and the Carbon Footprint

Sara Sattler, Pine Middle School

Grade Level: Middle School Earth Science

Introduction

Students will participate in four distinct lessons building a background for understanding Global Climate Change: cycles of matter group poster presentation; graphing local weather patterns to compare weather and climate; web investigation of the Greenhouse Effect; and comparing densities of liquids labs. The lessons can be done as a cohesive unit or be spread out over the course of a semester in order to tie climate change science concepts into other units of study.

Lesson Objectives

By the end of this lesson, students will:

1. Form definitions of the greenhouse effect based on prior knowledge, class discussion, and viewing diagrams.
2. Participate in group brainstorming sessions and class discussions related to the impact of the greenhouse effect and global warming.
3. Analyze global warming diagrams and resources to obtain a clear understanding of this scientific process.
4. Hypothesize about the effects of global warming on the climate and the world's populations.



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5. Conduct research using a variety of primary sources to explore perspectives in the global warming debate.
6. Complete a Venn Diagram that compares various points of view on global warming issues.
7. Take a position on global warming and support this viewpoint with reasons, facts, and examples gathered during lesson activities.
8. Create a project that supports their point of view about global warming issues.

Lesson Outcomes

Students will:

- Participate in group brainstorming sessions and class discussions related to the impacts the greenhouse effect and global warming and submit proposals on how to reduce carbon emissions.
- Analyze computer carbon footprint resources to obtain a clear understanding of the impacts of individual carbon emissions.
- Develop and present a personalized Carbon Footprint Inventory for their entire family detailing energy usage by week and by month.
- Conduct research using a variety of primary and secondary sources to explore perspectives on green living.
- Take a position on global warming and support this viewpoint with reasons, facts, examples gathered during lesson activities.
- Create a project that supports their point of view about combating global warming.

Pre-Lesson

Take advantage of Earth Science Week's Make a Poster Contest (Second week of October in most years) in the Climate Change category. Create a poster to place in the classroom, around school, or for home about anything you have learned about Global Warming and Climate Change.

Handout: Earth Science Week. Read and say, "Yippy" anytime it says "Earth Science Week"

Homework: Please ask your family to help you answer these questions:

What is a 'carbon footprint'? How many loads of laundry does your family wash every week? How many miles of driving do you do? Do you recycle? Does your family subscribe to magazines or newspapers? Are low-flow water faucets installed? Do you always turn off the



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lights when you leave a room? Are your parents buying local and/or organic foods? Do you use public transportation instead of the car? Do you walk or ride your bike instead of using the car? If lesson is done in the spring focus on Earth Day instead.

Lesson One: Engage

Website: Carbon Footprint zerofootprintkids.com

Instructions: Go to zerofootprintkids.com and take the test “What You Use”. Place your name and carbon footprint number on a post-it.

When you get back to class, place your number, in numerical order, on the Carbon Footprint Comparison Graph.

Discussion- What did this test show you? What does your carbon footprint say about you? Who has the smallest footprint, why? Largest, why? How did your footprint compare to that of the average footprint in Canada and other places. Does this make sense since the U.S. is the leader in carbon emissions?

Place the question sheet on the overhead.

The idea behind the calculator is that all of our decisions and patterns of behavior add up to a "footprint," which is just a way of measuring people's demands on nature. The more we consume, the bigger our footprint is. Indeed, our footprint is global. Much of our food, our goods, our fuel, and our resources come from somewhere else. Plus, our waste, particularly our greenhouse gas emissions, can have an effect on people everywhere.

Freewrite (Prior Knowledge Check)

How do America's carbon emissions affect other countries? What are some of the environmental effects of CO₂? How does CO₂ cause the Greenhouse Effect? What is the worst thing that could happen if 'we' keep living the way we do? How do we get rid of CO₂ gases in the atmosphere? Discuss answers, address any misunderstandings.

Lesson Two: Explore

Watch Video: Carbon Sequestering?

Board: Ask the students to offer facts that they know about global warming and CO₂ and write them on the board or on easel paper.

Examples: Fact: CO₂ emissions are rising and this is causing the earth's climates to change.



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Fact: There is no way of reducing the carbons that are in the air.

Exploration questions: What does this mean about CO₂ emissions rising? If we can't reduce carbon compounds in the air, what else can we do?

Watch Video: The Most Terrifying Video You'll Ever See (9 min., 30 sec.).

<http://www.elephantjournal.com/2009/12/the-most-terrifying-video-youll-ever-see/>

Have students reproduce the chart from the video in poster form and address the issue of Taking a Stance - should we sit around and do nothing, or should we take responsibility and change our way of living? Each team should be able to answer this question.

Lesson Three: Explanation

Student Designed and Enforced Debate.

Divide the classroom into two sections: those arguing for and those arguing against.

Pass out sample debate instructions.

Example of students that have taken a stance and are fighting for the environment (out book).

Homework: Name three things that you can do to reduce your carbon foot print.

Name one law that Americans abide by in order to sustain a healthy environment.

Name one thing that America could do to reduce carbon dioxide emissions.

Name one thing that our school does in order to reduce their carbon footprint.

Lesson Four: Elaboration

Goal: Students will be accountable for their carbon footprint, living responsibly, and reducing CO₂ emissions, working to make our communities more carbon-friendly.

Questions/Lecture

What does it mean when someone says, "Living Green"?

Example: Electro Power plant

Study: In class the information on the blogsite:

<http://blog.thenewcenturyschool.com/tag/carbon-footprint/>

Produce: In class, with team members, a four-point plan to canvas neighborhoods and help other families with reducing their carbon footprints.

Homework: Find an alternate source for energy that you can use. Keep in mind the carbon footprint. Write a paragraph about your energy choice.



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Lesson Five: Evaluation

Going Green Project: <http://goinggreenproject.blogspot.com/>

Choose a project based on one of the articles in the website.

Complete Outcomes listed at the beginning of the Activity.

Make presentations as scheduled.

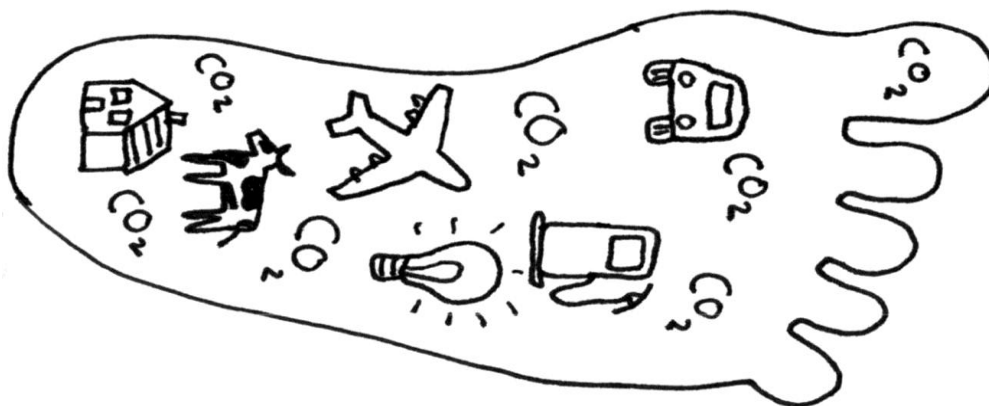
Background for Teachers

Is human activity bringing about alarming global warming scenarios and related catastrophes? Or is such thinking a myth brought about by flawed or incomplete science? Finding the answers to these questions has turned global warming into a highly politicized and contentious issue.

Until about 1960, most scientists thought it implausible that humans could actually affect average global temperatures. (See NOW's "History of Global Warming" at <http://www.pbs.org/now/science/climatechange.html>)

Today, most scientists agree that Earth's temperature has risen over the past century and that carbon dioxide is one of the primary greenhouse gases that contribute to global warming. Disagreement persists, however, over whether or not global climate change is a normal environmental variation, and over how big of a problem global warming could become for the planet.

Amidst such controversy, world leaders have met and outlined legal rules, known as the Kyoto Protocol, to limit the emissions of greenhouse gases. One hundred forty countries that collectively represent 61.6% of greenhouse gas emissions worldwide have ratified the Kyoto Protocol.



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The United States does not support the Kyoto Protocol and disagrees with a number of its provisions. Instead, the U.S. is funding additional scientific research on the causes and effects of global warming, encouraging climate change technology research and development efforts, looking at how its own federal and state laws can regulate greenhouse gas emissions in the U.S., backing the research and development of renewable energy sources, and pursuing other strategies that it believes will address global climate change without major upsets to the U.S. economy.

Assumed Student Prior Knowledge Students should be familiar with the terms, "global warming," the "greenhouse effect," and "greenhouse gases." Also, they should be aware that the U.S. is a leading producer of greenhouse gas emissions that contribute to global warming. Adjust lead-in lessons accordingly.



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Climate Change Part 2: The Greenhouse Effect

Teaching Strategies and Instructions

Part 1: Reviewing the Facts: What is The Greenhouse Effect? (30 minutes)

1. Before class begins, post the term, "greenhouse effect" where students can see it.
2. To begin the class, ask students to think without talking about a definition for the greenhouse effect. Give them a minute to formulate their ideas and then have them write down their definitions so they can share them.
3. At the end of the allotted time, ask students to share their definitions with one or two other students sitting nearby and compare the similarities and differences in their definitions. Allow a few minutes for student pairs or groups to then combine their definitions into one that they believe is the most accurate.
4. Begin a class discussion by asking several pairs/groups to share their definitions of the greenhouse effect.
5. Next, show students a Flash animation (found at the U.S. Environmental Protection Agency's Web site: http://www.epa.gov/globalwarming/kids/global_warming_version2.html) that accurately describes the greenhouse effect and how it likely contributes to global warming. You might have students take turns reading the dialogue balloons for the characters shown on the site. Alternatively, the EPA Web site provides a simple diagram with text explanation of the greenhouse effect at: <http://www.epa.gov/globalwarming/kids/greenhouse.html>. Ask students to make any corrections to their definitions based on what they've learned.

Part 2: Making Predictions about the Effects of Global Warming (20 minutes)

With an understanding of the greenhouse effect and global climate change, students can now make predictions about the potential impact of global warming.

1. Ask students to hypothesize about how the world's climate could change over the next 100 years if humans do nothing to limit the levels of their greenhouse gas emissions. Have them also make predictions about the effects such climate changes could have on humans.
2. Working in pairs, small groups, or as a class, students should brainstorm a list of their ideas related to these questions. Each student should record a copy of the list in order to refer back to it later in the lesson.



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Part 3: Comparing Points of View on Global Warming (90 minutes)

1. Begin by discussing the fact that not everyone agrees about global warming and climate change. Use content from three NOW broadcasts to illustrate some of the controversy surrounding global warming.

The Heat Over Global Warming

<http://www.pbs.org/now/shows/304/>

Climate Change and the Media Senate Hearings

<http://www.pbs.org/now/shows/249/climate-change.html>

God and Global Warming

<http://www.pbs.org/now/shows/343/index.html>

Climate Change and the Media Senate Hearings

<http://www.pbs.org/now/shows/249/climate-change.html>

God and Global Warming

<http://www.pbs.org/now/shows/343/index.html>

- Handout: Global Warming Venn Diagram (PDF file)
<http://www.pbs.org/now/classroom/globalvenn.pdf>
- Handout: Global Warming Project Ideas (PDF file)
<http://www.pbs.org/now/classroom/globalproject.pdf>

2. Pose the following question: In your opinion, has human activity caused the world's climate to change over the past 100 years?

3. Distribute copies of the Handout: Global Warming Venn Diagram (see above) and review the directions for completing the diagram.

4. Using the resources listed on the handout, have students work in pairs, small groups, or as a class to complete the graphic organizer. Encourage students to examine at least 4 of the programs listed as a means of gathering information representative of a number of different sources and points of view. Students should use at least two programs from the “NOW Programs” list and at least 2 resources from the “Other Global Warming Resources” list. As students research, direct them to note specific facts and use the back of the sheet to note more in-depth details and cite their sources. This information will be used in class discussion as well as in a later project.



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Part 4: Forming Opinions about Global Warming (30 minutes)

Now that students have explored a variety of perspectives on global climate change, they will take a position on the issue and support it with data from their previous research.

1. Ask students to write 2-3 persuasive paragraphs to answer the following questions:
 - In your opinion, is global warming an imminent world threat? Why or why not?
 - Based on your opinion, what actions do you believe should be taken to address the global warming issue? Remind students to support their opinions with specific information from the brainstorming lists created in Part 2 and their completed Venn Diagrams from Part 3.
2. Once students have organized their thinking on paper, give them the opportunity to share their opinions with at least one other student in class. Do not allow discussion or debate; rather, allow students to practice sharing what they have written so that others can hear the reasons behind their positions.

Part 5: Final Project (45 minutes, plus outside preparation time)

1. Invite students to choose a project from the [Handout: Global Warming Project List](#) (see above). Alternatively, students could design a project of their own with teacher approval. The goal of the project is for students to create something substantive that they can use to share their positions on global warming and to increase awareness about its related issues.
2. Allow students one class period to begin work on their projects, then assign a completion date. When projects are completed, display student projects and/or have students present them to the class as a way of demonstrating their point of view on global warming issues.

Assessment Recommendations

Consider the following assessment ideas:

1. Give students completion grades for participating in class discussions and filling in the Venn Diagram worksheet.
2. Using a scoring guide or a peer-evaluation rubric, provide students with feedback about the effectiveness of their persuasive writing responses to the questions posed in Part 4 of the lesson.
3. Using a scoring guide and a self-evaluation rubric, have the teacher and the student evaluate his/her project using criteria established prior to completion of the assignment.
4. As students present their projects to one another, have their classmates complete a peer evaluation form that assesses the effectiveness of the project in terms of providing factual information to others.



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Please share your comments about successes with this method with Sara Sattler, c/o Pine Middle School, 4800 Neil Road Reno, Nevada 89502, 775- 689-2550, or by e-mail: Sara Sattler <ssattler@washoeschools.net>

Hand drawn illustrations by Jen johansOn.



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