

Earth on Fire

<http://www.cotf.edu/ete/modules/carbon/earthfire.html>

Focus on Inquiry

The student will examine the evidence for global warming, identify the sources of global warming, and provide a way to minimize global warming.

Lesson Overview

Students will examine humankind's impact on the global environment as well as Earth's past in an attempt to answer the ever important question of whether our industrial and agricultural practices are changing Earth's climate.

Duration 4 to 5 - 50 minute class periods	Setting Classroom or Computer Lab	Grouping Small groups	PTI Inquiry Subskills 1.3, 3.1, 3.8, 4.3, 4.4, 5.2, 5.3, 5.4, 5.6, 5.7, 6.1
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Lesson Components	Estimated Time	Inquiry Subskills Used	Technology Used	Level of Student Engagement	Brief Description
<i>Situation</i>	15 min	1.3, 5.2	Internet, LCD projector and screen (optional)	2	Students are introduced to the assignment by observing a graph of Earth's annual mean temperature from 1866-1996. They are informed that the White House staff wants them to conduct investigations on climate change.
<i>Carbon Cycle</i>	50 min	3.8, 4.4, 5.2, 5.3	Internet	3	Using given data in a carbon cycle diagram, students attempt to balance the carbon cycle.
<i>Possible Culprits</i>	3 to 4 – 50 minute class periods	3.1, 4.3, 4.4, 5.2, 5.3, 5.4, 5.6, 5.7	Internet, Microsoft Excel	3	Students complete various remote-sensing activities to identify possible causes of global warming.
<i>Solutions</i>	50 min	5.2, 6.1	Internet	2	Students analyze many possible solutions that have been proposed to stave off global warming. They then propose their own solutions.

Level of Student Engagement

1	Low	Listen to lecture, observe the teacher, individual reading, teacher demonstration, teacher-centered instruction
2	Moderate	Raise questions, lecture with discussion, record data, make predictions, technology interaction with assistance
3	High	Hands-on activity or inquiry; critique others, draw conclusions, make connections, problem-solve, student-centered

National Science Education Standards – Inquiry

Use appropriate tools and techniques to gather, analyze, and interpret data.
 Develop descriptions, explanations, predictions, and models using evidence.
 Think critically and logically to make the relationships between evidence and explanations.
 Recognize and analyze alternative explanations and predictions.



National Science Education Standards – Earth Science

Global patterns of atmospheric movement influence local weather. Oceans have a major effect on climate, because water in the oceans holds a large amount of heat.
 The sun is the major source of energy for phenomena on the earth's surface, such as growth of plants, winds, ocean currents, and the water cycle. Seasons result from variations in the amount of the sun's energy hitting the surface, due to the tilt of the earth's rotation on its axis and the length of the day.

Louisiana Grade Level Expectations – Inquiry

Gr. 8, Inquiry GLE#6 – Select and use appropriate equipment, technology, tools, and metric system of units of measurement to make observations (SI-M-A3)
 Gr. 8, Inquiry GLE#9 – Use computers and/or calculators to analyze and interpret quantitative data (SI-M-A3)
 Gr. 8, Inquiry GLE#12 - Use data and information gathered to develop an explanation of experimental results (SI-M-A4)
 Gr. 8, Inquiry GLE#13 - Identify patterns in data to explain natural events (SI-M-A4)



Gr. 8, Inquiry GLE#16 - Use evidence to make inferences and predict trends (SI-M-A5)
 Gr. 8, Inquiry GLE#17 – Recognize that there may be more than one way to interpret a given set of data, which can result in alternative scientific explanations and predictions (SI-M-A6)

Louisiana Grade Level Expectations Earth Science

Gr. 8, GLE#25 - Explain and give examples of how climatic conditions on Earth are affected by the proximity of water (ESS-M-A11)
 Gr. 8, GLE#27 - Identify different air masses, jet streams, global wind patterns, and other atmospheric phenomena and describe how they relate to weather events, such as El Niño and La Niña (ESS-M-A12)
 Gr. 8, GLE#29 - Make predictions about future weather conditions based on collected weather data (ESS-M-A12)
 Gr. 8, GLE#35 - Describe how processes seen today are similar to those in the past (e.g., weathering, erosion, lithospheric plate movement) (ESS-M-B3)
 Gr. 8, GLE#51 - Analyze the consequences of human activities on global Earth systems (SE-M-A4)

Materials List (per group)

- Computer with Internet Access and Microsoft Excel (or computer lab so students can work individually or in groups of 2-4)
- Optional – LCD Projector linked to computer with Internet to view activity website

Advance Preparation

1. Teacher should become familiar with the unit layout by reading the teacher pages section of the activity website.
2. Decide whether you would like to have students work in groups, individually, or as a class as a whole

Other Information

Objectives

The learner will...

- examine the evidence for global warming.
- identify the sources of global warming.
- provide a way to minimize global warming.

Prior Knowledge Needed by the Students

- It would be beneficial if students understood the carbon cycle prior to the unit. The website does provide the background information if students have not already learned this concept.

Procedure

The Situation

1. Students are introduced to the assignment by observing a graph of Earth’s annual mean temperature from 1866-1996 and must formulate a hypothesis as to whether or not the Earth’s temperature is rising. They are informed that the Whitehouse staff wants them to conduct investigations to examine the evidence for global warming, identify the sources of global warming, and provide a way to minimize global warming. This information is found on the activity website, under the “Situation” puzzle piece, or here: <http://www.cotf.edu/ete/modules/carbon/efsituation.html>. If available, the teacher could hook up a projector to a computer and go through this section as a class.

Carbon Cycle

1. Teacher explains the carbon cycle to students.
2. Students use data given in a carbon cycle diagram to attempt to mathematically balance the carbon cycle. They are given the amount of carbon moving between various sinks and they must determine the rate at which the various sinks are changing. You can find these diagrams here: <http://www.cotf.edu/ete/modules/carbon/efcarbon.html>.
3. Students discuss and consider the uncertainty in CO₂ data from their calculations.
4. Students consider whether sinks are increasing or decreasing using the Mauna Loa CO₂ data.

**Possible Culprits**

1. Students research various causes of global warming. Through their research, they discover that greenhouse gasses, solar output, and Earth's orbit are possible causes. You can begin your research here: <http://www.cotf.edu/ete/modules/carbon/efculprits.html>, which provides information on each of these three causes.
2. Students conduct several remote-sensing activities to discover the possible causes of global warming. These activities are found in the puzzle piece titled "Remote-Sensing Activities" on the home page of the activity website (<http://www.cotf.edu/ete/modules/carbon/efremoteintro.html>), and include *Yellowstone Biomass Burning*, *Seasonal Vegetation Changes*, *Fossil Fuel Burning*, and *Fit CO₂ Curve*.

Solutions

1. Students consider a number of proposed alternate explanations for solving humans' impact on global warming and discuss and propose their own possible explanations and solutions to this problem. This section can be found here: <http://www.cotf.edu/ete/modules/carbon/efsolutions.html>.

Blackline Master

1. None. NOTE - Teacher may choose to print data sheets from the website if students do not have a computer with Internet access.

Supplementary Resources

A variety of references and related links are located on the activity website.

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