

RESOURCE LIBRARY | ACTIVITY : 50 MINS

Carbon All Around

Students read an encyclopedia entry to define the terms carbon source and carbon sink. Next, they choose from a variety of resources to annotate a carbon cycle diagram with descriptions of the processes that either absorb or release carbon dioxide. Finally, students teach and learn from their peers' research, strengthening their understanding of carbon sources and sinks.

GRADES

6, 7, 8

SUBJECTS

Earth Science, Climatology

CONTENTS

1 Link, 2 Videos, 1 PDF, 1 Resource

OVERVIEW

Students read an encyclopedia entry to define the terms carbon source and carbon sink. Next, they choose from a variety of resources to annotate a carbon cycle diagram with descriptions of the processes that either absorb or release carbon dioxide. Finally, students teach and learn from their peers' research, strengthening their understanding of carbon sources and sinks.

For the complete activity with media resources, visit:

<http://www.nationalgeographic.org/activity/carbon-all-around/>

In collaboration with

DIRECTIONS

This activity is part of the [Climate Change Challenge](#) unit

1. Prompt students to define carbon source and carbon sink by reading an encyclopedia entry.

- To connect with knowledge from the prior activity, ask students to brainstorm responses to the following prompts:
 - *How does increasing the amount of carbon dioxide in the atmosphere change our planet?* (Students should recall from the previous lesson that additional carbon dioxide increases the greenhouse effect, which warms our planet).
 - *How do you think carbon dioxide gets into our atmosphere in the first place?* (Student answers will vary depending on prior experience, but may include burning fossil fuels).
 - *How do you think it comes out of the atmosphere?* (Student answers will again vary, but may include the uptake of carbon dioxide by green plants during photosynthesis).
- Assign students to read and annotate the *Carbon Sources and Sinks* encyclopedic entry. Explain that this article will help them become experts on the ways carbon dioxide enters and leaves our atmosphere. Ask students to determine:
 - *What is a carbon source, and what are some examples from the article?* (A process that releases carbon dioxide into the atmosphere; examples include burning fossil fuels, and raising livestock such as cattle.)
 - *What is a carbon sink, and what are some examples from the article?* (A process that absorbs carbon dioxide from the atmosphere; examples include carbon dioxide absorption into the oceans and use by plants during photosynthesis.)
- Lead a brief class discussion to elicit student responses.
- Distribute the [Carbon Meaning Maker](#) handout. Direct students to complete the *Definition in your own words* section only for carbon source and carbon sink at this time, using what they learned from the encyclopedia article.

2. Support students as they research specific carbon sources and sinks.

- Distribute the [Carbon Cycle](#) diagram and explain that this image depicts many carbon sources (represented by 'up' arrows) and sinks (represented by 'down' arrows) that are

relevant to global warming on Earth.

- In this diagram, information is presented on the amount of carbon moving between sources and sinks (numbers). This is less relevant to student learning than the direction of the arrows, and their association with physical, biological, and human elements, such as the ocean, organisms, and industry. Draw students' attention to the arrows and their associations. Explain that they will have help interpreting the sources and sinks using text and video sources after the class reviews an example together.
- Project the *Carbon Cycle* diagram and identify a familiar element, such as the smokestack, mentioned in the *Carbon Sources and Sinks* encyclopedia entry. Model this element's classification as a source or sink, as well as a description of the associated process, in a single sentence, for example:
 - *Source*: Burning fuels that contain ancient carbon releases carbon dioxide into the atmosphere
- In jigsaw pairs or small groups, assign students to perform their own research to become experts on either carbon sources or sinks. Have them write one-sentence descriptions of the processes that release or remove carbon from Earth's atmosphere for their diagrams following the one-sentence model above. Resources available to identify a range of carbon sources and sinks include:
 - *Carbon Sources and Sinks* encyclopedic entry
 - [Amazon Deforestation and Climate Change](#) video (4:52)
 - [Climate 101: Causes and Effects](#) video (2:49)
 - [Climate 101: Deforestation](#) video (2:32)
 - [Climate 101: Oceans](#) video (2:38)

3. Facilitate a jigsaw, in which students teach and learn about the carbon cycle from other students.

- Split initial expert pairs or small groups, and create mixed groups of students with one or more member(s) who focused on carbon sources, and one or more member(s) who focused on carbon sinks. Direct students to teach each other in their new pairs or small groups, adding their partners' elements to their diagrams, and asking clarifying questions if necessary. With the *Carbon Cycle* diagram projected, ask for volunteers to share out what

they learned from group members' research. Have the volunteers add their one-sentence descriptions of carbon sources or sinks to the class diagram.

- As students share out, highlight connections between their responses and global warming, as well as climate change.
- In a Think-Pair-Share, ask students to synthesize their understanding of sources and sinks by asking:
 - *Why do we refer to this diagram as the carbon cycle?* (As carbon dioxide transitions between its many sources and sinks, it moves cyclically, hence the name "Carbon Cycle.")
- Prompt students to return to their *Carbon Meaning Maker* handout to complete the three additional elements (characteristics/illustration, examples, and non-examples), using what they have learned and recorded on their *Carbon Cycle* diagram. Return to the class *Know and Need to Know* chart, adding any insights or questions associated with the carbon cycle, as well as links between carbon sources/sinks and their previous work on climate change and global warming.

Tip

Steps 1 and 3: The *Meaning Maker* is a version of the [Frayer Model chart](#). The video and resource linked here can help you adapt this vocabulary-building tool to meet the needs of your students.

Informal Assessment

Informally assess students' understanding of the carbon cycle by reading their one-sentence descriptions of carbon sources and sinks on the *Carbon Cycle* diagram and the *Carbon Meaning Maker* handout.

Extending the Learning

Step 2: Students can perform additional online research using search engines to classify and describe some of the more obscure carbon sources and sinks depicted in the *Carbon Cycle* diagram. They may benefit from teacher modeling of this task, asking questions such as, *What*

role does the surface of the ocean play in the carbon cycle? and working to interpret search engine responses. You may also wish to have students perform research on how marine organisms incorporate carbon into their bodies.

To include information regarding other chemicals involved in the greenhouse effect, in addition to carbon dioxide, consider using NASA's [Climate Kids greenhouse cards](#).

OBJECTIVES

Subjects & Disciplines

Earth Science

- Climatology

Learning Objectives

Students will:

- Read to compare and contrast the terms carbon source and carbon sink.
- Perform research and learn from peers to annotate a diagram of carbon sources and sinks.
- Link specific carbon sources and sinks to the greenhouse effect and global warming.

Teaching Approach

- Project-based learning

Teaching Methods

- Jigsaw
- Multimedia instruction
- Reading

Skills Summary

This activity targets the following skills:

- 21st Century Student Outcomes
 - Information, Media, and Technology Skills
 - Information, Communications, and Technology Literacy
 - Media Literacy
 - Learning and Innovation Skills
 - Communication and Collaboration
 - Life and Career Skills
 - Productivity and Accountability
- 21st Century Themes
 - Environmental Literacy
 - Global Awareness
- Critical Thinking Skills
 - Applying
 - Understanding
- Geographic Skills
 - Acquiring Geographic Information
 - Organizing Geographic Information
- Science and Engineering Practices
 - Obtaining, evaluating, and communicating information

National Standards, Principles, and Practices

COMMON CORE STATE STANDARDS FOR ENGLISH LANGUAGE ARTS & LITERACY

• CCSS.ELA-LITERACY.SL.7.1:

Engage effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with diverse partners on Grade 7 topics, texts, and issues, building on others' ideas and expressing their own clearly.

NEXT GENERATION SCIENCE STANDARDS

• Crosscutting Concept 2: Cause and Effect:

Cause and effect relationships may be used to predict phenomena in natural or designed systems.

- **MS. Earth and Human Activity:**

MS-ESS3-5. Ask questions to clarify evidence of the factors that have caused the rise in global temperatures over the past century.

- **Science and Engineering Practice 8:**

Obtaining, evaluating, and communicating information

Preparation

What You'll Need

REQUIRED TECHNOLOGY

- Internet Access: Required

BACKGROUND & VOCABULARY

Background Information

An increase in the greenhouse effect is responsible for the recent rapid pace of global warming. Carbon dioxide, methane, and nitrous oxide are all examples of greenhouse gases. They let the energy in sunlight pass through on its way towards Earth, but block the heat energy (created by sunlight striking the planet's surface) from leaving the atmosphere. Although each of these greenhouse gases (and others) contributes to the heating of the planet, carbon dioxide emissions are the highest globally, so it contributes most to climate change.

Carbon source and *carbon sink* are two terms that refer to processes or activities that release or take up carbon dioxide, respectively. Major carbon sources include the burning of fossil fuels, as well as agriculture (farming and ranching). Major carbon sinks include Earth's growing forests, as well as the planet's deep oceans. These terms help us understand which processes or activities increase global warming through the production of this greenhouse gas, and which processes or activities reduce global warming instead.

Prior Knowledge

Recommended Prior Activities

- None

Vocabulary

Term	Part of Speech	Definition
carbon cycle	<i>noun</i>	series of processes in which carbon (C) atoms circulate through Earth's land, ocean, atmosphere, and interior.
carbon sink	<i>noun</i>	area or ecosystem that absorbs more carbon dioxide than it releases.
carbon source	<i>noun</i>	process, area, or ecosystem that releases more carbon dioxide than it absorbs.
climate change	<i>noun</i>	gradual changes in all the interconnected weather elements on our planet.
fossil fuel	<i>noun</i>	coal, oil, or natural gas. Fossil fuels formed from the remains of ancient plants and animals.
global warming	<i>noun</i>	increase in the average temperature of the Earth's air and oceans.

For Further Exploration

Instructional Content

- [National Geographic: Resource Library: Collection: Climate](#)
- [National Geographic: Resource Library: Collection: Climate Change](#)



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