

Scenario 2: The Science of Global Warming

In this activity, students will use “box” models of the carbon cycle to study the effect of greenhouse gas emissions on global warming. Boxes will represent places where carbon accumulates (storages or stocks); arrows will indicate the movement of carbon (flows or fluxes) among these boxes. This exercise leads to an understanding that although carbon moves continuously, the rate of movement varies between the atmosphere, lithosphere (i.e., rocks and soil), hydrosphere (i.e., water) and biosphere (i.e., living organisms). Students will find that in some parts of the ecosystem, carbon is recycled rapidly, but in others—such as when shells sink to the bottom of the ocean or when plants become fossil fuels—carbon cycles very slowly. It is important that students understand the concept of rate differentials.

In addition, this activity on the carbon cycle provides a deeper understanding of several of the scientific conclusions that were introduced in the film *An Inconvenient Truth*. The problem of global warming is exacerbated by human activities that alter the rates of the carbon cycle’s flows or fluxes. When we choose to release much of the carbon stored in fossil fuels, we are drastically altering the quantity of carbon in the atmosphere at a particular time. This means that changes must occur in other Earth systems.

Carbon has been trapped for millennia in fossil fuels. Since the Industrial Revolution, we have been releasing it into the atmosphere at an alarming rate.

Remind students:

- Everything is connected to everything else in ecology which means that changes must occur in other Earth systems.
- The First Law of Thermodynamics states that energy can be changed from one form to another, but it cannot be created or destroyed.
- Photosynthesis is the basis of life on Earth: carbon dioxide + water + sunlight = organic material (sugar) + oxygen $6\text{CO}_2 + 6\text{H}_2\text{O} \text{ yields } \text{C}_6\text{H}_{12}\text{O}_6 + 6\text{O}_2$.
- Respiration is the reverse of photosynthesis: organic material + oxygen = carbon dioxide + water + energy.

As a result of this activity, students will understand how the carbon cycle works and what causes it to change by integrating information from biology, chemistry, oceanography and geology.

Helpful hint:

Ask students to read *Global Warming 101* on pages 13-21.



Summary:

Students study the carbon cycle in the context of global warming

Grade level: 9-12

Time: 2-3 Weeks

Subjects:

Social Studies
Science
Government
Economics

Skills:

- Communication
- Analysis
- Conceptual thinking
- Problem identification
- Perception
- Creative problem solving
- Research

Learning Objectives:

- Students will understand that matter and energy are neither created nor destroyed, but may change forms and locations
- Students will be able to create and explain the carbon cycle

Materials:

- Paper and pen
- Flip chart with markers and tape
- Access to the Internet for community and/or school contacts

