

CARBON DIOXIDE & THE CARBON CYCLE

PCEP Web Interactive Series #1 | Teacher Supporting Document

Discussion Questions

Explore the interactive and then consider the following:

Where is carbon located on our planet, and how are these carbon reservoirs different from each other?

Which reservoir of the carbon cycle changes the most and the quickest?

What are the main differences between the carbon flows 300 years ago and today?

Compare the Illustration View and the Chart View of carbon flows into and out of the atmosphere. Why is it helpful to see two different models to explain the same situation?

Over the past 300 years, how did the role of the ocean change with respect to the amount of carbon dioxide in the atmosphere?

What has happened to atmospheric carbon dioxide level and global temperature since the graph in the interactive, which was created in the year 2014?

Explore how human activities alter the carbon cycle and cause atmospheric carbon dioxide to increase. Learn about the reservoirs and flows of the carbon cycle and how human activities increase the amount of carbon dioxide in the air and ocean. This increased atmospheric carbon dioxide causes global warming.

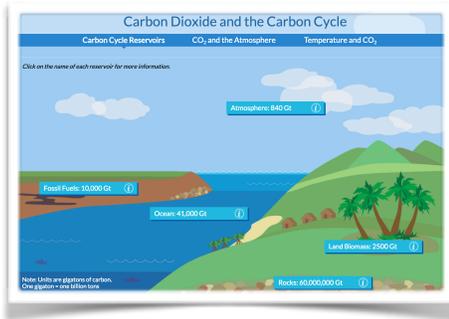
This interactive is first of a three-part series of web interactives. Two upcoming interactives from the Pacific Islands Climate Education Partnership and WGBH show how higher carbon dioxide levels cause global warming (Earth's Energy Flows and Climate) and highlight climate change impacts and adaptation strategies for ecosystems and human communities (Impacts of Climate Change in the Pacific Region).

All interactives are available online at <http://pcep.prel.org/resources/?collection=interactives>

Background Essay

Our planet has been around for a very long time—more than four billion years. During that time, the climate of the planet has changed many times. Sometimes the climate has been very cold, with large amounts of ice covering most of the land and even large parts of the ocean. Sometimes the climate has been very warm, and even the polar regions have had little or no ice.

For the past 10,000 years, Earth's climate has generally been very comfortable for ecosystems and human communities. However, our climate is changing because of human activities, especially our burning of fossil fuels (oil, coal, and natural gas). We use oil to make the fuels that power transportation, such as gasoline for cars, boats, and trucks. Utilities also burn fossil fuels to make electricity. When we burn oil, natural gas, and coal, the burning emits carbon dioxide, a heat-trapping gas, into the atmosphere. Other human activities are also emitting heat-trapping gases into the atmosphere. Since human activities result in more trapped



Teaching Tip

Ask students to work in groups to create a model of the current carbon cycle where they compare the amounts in the reservoirs and the flows into and out of the atmosphere. They can use physical materials (e.g., balloons) and/or virtual media (e.g., animations or video).

Students can ignore the rock reservoir since the flows do not significantly affect Earth in the short term and the enormous amount in the reservoir poses a representational challenge.

Student groups should then share their models with each other, and politely critique each other's models focusing on evidence relating to accuracy, positive feedback relating to effective features, and constructive suggestions for improving the various models.

heat that causes the global climate to become warmer, this change is often called global warming.

Carbon dioxide in the atmosphere plays a very important role in global climate in general, and especially in the current global warming. Carbon on our planet rapidly cycles among land biomass, the ocean, and the atmosphere. The carbon cycle includes natural flows of carbon into and out of the atmosphere, as well as the relatively recent addition of carbon dioxide into the atmosphere caused by human activities. As shown in this interactive, about half of the emitted carbon dioxide is absorbed by the ocean and by land biomass. Without this absorption, today's global warming would be significantly larger than it is.

Earth's climate is getting warmer than it has been in millions of years. As in prior global climate changes, this change in global temperature correlates very closely with the amount of carbon dioxide in the atmosphere. Over the past 100 years, Earth's temperature has increased about 1.6 °F (0.9 °C). While this amount may not seem very much to us, it is actually a lot for planet Earth. A decrease in global temperature of about 10 °F (5.6 °C) can cause an Ice Age. In the geologic past when Earth's average temperature was 10 °F higher, most of Earth's ice was gone and sea levels were 100 feet higher. The interactive Earth's Energy Flows and Climate explains how the emitted carbon dioxide causes global temperatures to increase.

Higher average global temperatures cause many other changes to weather patterns and conditions on the planet. As a result, scientists tend to use the broader term global climate change to describe this issue, rather than global warming. Some of these global climate changes are listed below:

- Glaciers everywhere in the world are melting.
- Sea level is rising.
- The oceans are getting warmer.
- Ecosystems are moving away from current locations toward locations that are not as hot.
- Spring is coming earlier in places with 4 climate seasons.
- More of the planet is having a tropical climate.

Generally wet places are getting wetter (flooding) and dry places are getting dryer (drought).