



# The Greenhouse Effect, Carbon, and Carbon Dioxide

NS 696 V: Weather and Climate for Educators

5<sup>th</sup> Grade

## Background Information:

According to a 2008 United States Environmental Protection Agency report, the typical US household of two people generates approximately 41,500 pounds of carbon dioxide (CO<sub>2</sub>) emissions every year from household activities and personal transportation.

While this is a startling figure, the numbers increase significantly, as the size of a household increases. Children also leave a carbon footprint as they walk alongside their parents through the adventures of life. If adults are asked to look at their own carbon footprints, and make mitigating changes, then is it fair to ask children to evaluate and mitigate their smaller, but lasting carbon footprints? The simple answer is, yes. Not only is it fair to ask this of children and young adults, it is a necessary step toward climate change awareness and improvement. Clearly, children are tomorrow's adults and "heads of household". By developing awareness of climate change and the human impact on increasing CO<sub>2</sub> emissions at a young age, the learning curve will be reduced, leading to environmentally conscious generations of tomorrow. Additionally, children have a strong desire to help, change, and take action toward the wrong in the world. The follow lesson set is a small, yet empowering step toward autonomy and climate consciousness.

<b>Part 1:</b> What is the greenhouse effect?	<b>Part 2:</b> Carbon & CO <sub>2</sub> : The good, the bad, and the ugly.
<b>Duration:</b> 30 minute lesson	<b>Duration:</b> 2-3, 30 minute lessons
<b>Supplies:</b> 1-clear plastic bag 2-thermometers Sunlight	<b>Supplies:</b> Duplication Master: Carbon cycle illustration Computer Lab access Website: <a href="http://www.windows.ucar.edu/earth/climate/carbon_cycle.html">http://www.windows.ucar.edu/earth/climate/carbon_cycle.html</a>

## Part 1:

For students to understand what carbon dioxide emissions are, and why they are harmful to the atmosphere, a simple, yet scientific look at the greenhouse effect is required. 5<sup>th</sup> grade students are 9-10 years of age, and are relatively concrete thinkers. This engaging activity provides a tangible simulation of a more abstract and large scale phenomenon. While this activity is concrete in production, inquiry is encouraged and required for students to apply to the larger concepts required throughout this process.

**Engage:** The Greenhouse Effect: All Earth is warmed by the greenhouse effect. What is it?

**Explore:** Put a thermometer into a closed, clear plastic bag and place the bag on a sunny windowsill. Place the second thermometer on the same windowsill. After five or ten minutes, read both thermometers.

The thermometer inside the bag reads several degrees higher than the one outside.

**Explain:** The Sun's rays pass through the bag easily. Once inside, however, they convert into heat, which cannot get out as easily. Therefore, the temperature inside the plastic rises. The bag warms up like a greenhouse, in which gardeners grow plants.

The sun's rays pass through Earth's atmosphere in the same way. And when they convert into heat rays, they cannot get out easily. They are absorbed by the surface of the earth, warming it as if it were a large greenhouse.

Increased amounts of carbon dioxide are in the air, formed by our use of industrial of fuels like oil and coal, which have increased the greenhouse effect. Carbon dioxide absorbs heat rays, and so they are radiated back to the earth instead of escaping into space.

**Extend:** United Streaming Video (Discovery Education [www.discoveryeducation.com](http://www.discoveryeducation.com)) "Power Up: Energy in our Environment

Video Running Time 24:00

Segment 4: "The Greenhouse Effect" 2:19

Segment 5: "Industrialization, fossil Fuels, and Global Warming" 2:10

This entire video is a great overview with helpful visual effects. If time doesn't permit viewing the entire video, the two segments listed above are useful for reinforcing the lesson concept.

## **Part 2:**

**Engage:** Offer students a delicious glass of ice cold soda. Allow them to enjoy the beverage and ask them to jot down some adjectives describing the soda. Some possible adjectives could include sweet, bubbly, fizzy, carbonated. Explain that the bubbles and "fizzy fun" in the soda are created using carbon dioxide gas. Students will hopefully make the connection between the common vocabulary/terms 'carbon dioxide' from the previous lesson. This will generate questions such as, isn't co2 bad? Is this like we're drinking pollution? How come carbon dioxide gas is okay in soda, but not in the air or atmosphere? While this is a loose and highly novel connection, it is one that is highly engaging and conceptually easy for ten year olds to grasp.

This leads to the important discussion about the "The good, the bad, and the ugly of carbon". Students need to know that carbon is found naturally in the environment. Carbon is vital to maintaining systemic balance in nature, and more importantly, carbon is vital to maintaining life-including human life, on earth. Much like other elements found in nature, manipulation of carbon and its structure can be harmful to this fine balance.

## **Explore:**

[http://www.windows.ucar.edu/earth/climate/carbon\\_cycle.html](http://www.windows.ucar.edu/earth/climate/carbon_cycle.html)

To explore the concept of the carbon cycle, students will play the "Carbon Cycle Game", as designed by the University Corporation for Atmospheric Research (UCAR). This is a fun and engaging game that let's students explore the carbon cycle, while making choices that can impact the balance found within the carbon cycle. Additionally, this game asks questions throughout the adventure, testing comprehension, and rewarding students of their newly acquired knowledge. Have students jot down notes about their adventures throughout the carbon cycle game, as they will use this information later.

## **Explain:**

CO<sub>2</sub> is vital to life. Plants use it to make food and then release oxygen as waste. Animals breathe oxygen and exhale CO<sub>2</sub> as waste. This exchange maintains a proper balance of CO<sub>2</sub>. However, humans have altered the balance. Our cars and machines burn fossil fuels, which increase the amount of CO<sub>2</sub> in the atmosphere. At the same time, cutting down tropical rain forests to clear land for farming has significantly reduced the amount of plants available to change the CO<sub>2</sub> to oxygen. As a result of the increases in greenhouse gases like CO<sub>2</sub>, temperatures will rise, melting the polar ice caps, and sea levels will rise. To help prevent increases in greenhouse gases, we must educate people about reducing carbon dioxide levels by exploring alternative energy sources and becoming more energy efficient.

### Extend:

After students have had ample time to play the carbon cycle game, bring them back as a group to discuss their adventures. Discussion questions:

- How many stops *can* you make on your trip?
- Will your journey ever end? Why or why not?
- Was everyone's adventure through the carbon cycle the same? Why not?
- What would happen if we burned more fossil fuels?
- Were you surprised by any stops while traveling through the carbon cycle? Explain.

### Evaluate:

After discussing their trips through the carbon cycle, ask students to reflect, in writing, on their adventure. Have students write a paragraph detailing their trip through the carbon cycle. Instruct students to include information on where they went, how they got to each destination, and how they felt at one or more of the specific stops on their journey. By adding this somewhat "value laden" question, students will have to rely on their knowledge of the benefits of carbon in the environment as well as the danger that carbon causes when in various forms. For example, they may feel "good" about being a carbon atom during the photosynthesis process, yet may not feel good about being CO<sub>2</sub> released from a factory.

**Carbon Cycle Diagram:** University Corporation for Atmospheric Research (UCAR)

