

# The CO<sub>2</sub> Budget

**Subject:** Mathematics, Social Studies, Art, Science

**Duration:** 1-2 class periods

**Location:** Classroom

**Next Generation Sunshine State Standards:**

SC.5.L.14.2 SC.5.L.15.1 SS.5.C.2.4 SS.5.C.2.5

LA.5.5.2.2

**Key Vocabulary:** Carbon budget, carbon source, carbon sink



**Objectives** Students will be able to

A) Use simple math to re-create the 2008 global carbon budget. B) Explain where CO<sub>2</sub> is trapped (carbon sink) and where CO<sub>2</sub> is released (carbon source). C) ID the three ways that the earth's temperature increases. D) Talk about the importance of the industrial revolution and the imbalance of CO<sub>2</sub>.

**Method** Students will use props and diagrams to show where carbon is trapped (sink) and where carbon is released (source). Using marbles to represent billions of tons of carbon dioxide, students will see and hear representations the carbon budget.

**Background** Carbon is a naturally occurring element, it also is the most common greenhouse gas. Greenhouse gasses trap infrared radiation in the atmosphere that warm a planet. "Carbon sources" are places where carbon is released into the atmosphere. Carbon sources can be natural (volcanic eruptions, lightning started forest fires, dying of vegetation). Sources also are human caused (all burning of fossil fuels, deforestation, most forest fires). "Carbon sinks" are where carbon is stored or removed from the atmosphere- these can be natural or human caused too. Natural carbon sinks are all vegetation, oceans, soil biota, permafrost, plankton and photosynthesis. There is a lot more carbon being released than there is carbon being removed.

The 2008 International Panel on Climate Change (IPCC) report compiled thousands of scientifically verified observations relating to climate change. It detailed natural and unnatural variables relating to the global carbon budget. The IPCC report and the global carbon budget for 2008 showed...

10 billion tones of CO<sub>2</sub> added annually to the atmosphere by human activities and deforestation.

6-7 billion tones of CO<sub>2</sub> naturally being removed by natural and human processes.

The remaining annual 3-4 billion tons of CO<sub>2</sub> accumulates. This is the fundamental imbalance that causes climate change.

## Materials

- Diagrams and props to show the carbon cycle
- The 2008 global carbon budget
- Examples of fossil fuels
- Paper, calculator, markers, two paper cups
- 100 red marbles
- 60-70 green marbles

## Suggested Procedure

1. As a class, identify the different (natural and human caused) CO<sub>2</sub> sources and sinks.
2. Diagram and use props to teach about the carbon cycle.
3. Introduce the raw data of the carbon budget from the IPCC report.
4. Use marbles as visual / auditory tool to show tons of carbon.  
Red = carbon source. Green = carbon sink.
5. 1 marble = 100 million tons. Thus, count 100 red marbles, and 60-70 green marbles
6. Have students observe / listen as teacher pours the marbles into "source" and "sink" cups.
7. Use suitable comparisons about tons of carbon to weight of elephants, or school buses.  
Equate that to how long the line of those school buses would be.

## Data for 2008 Carbon Budget

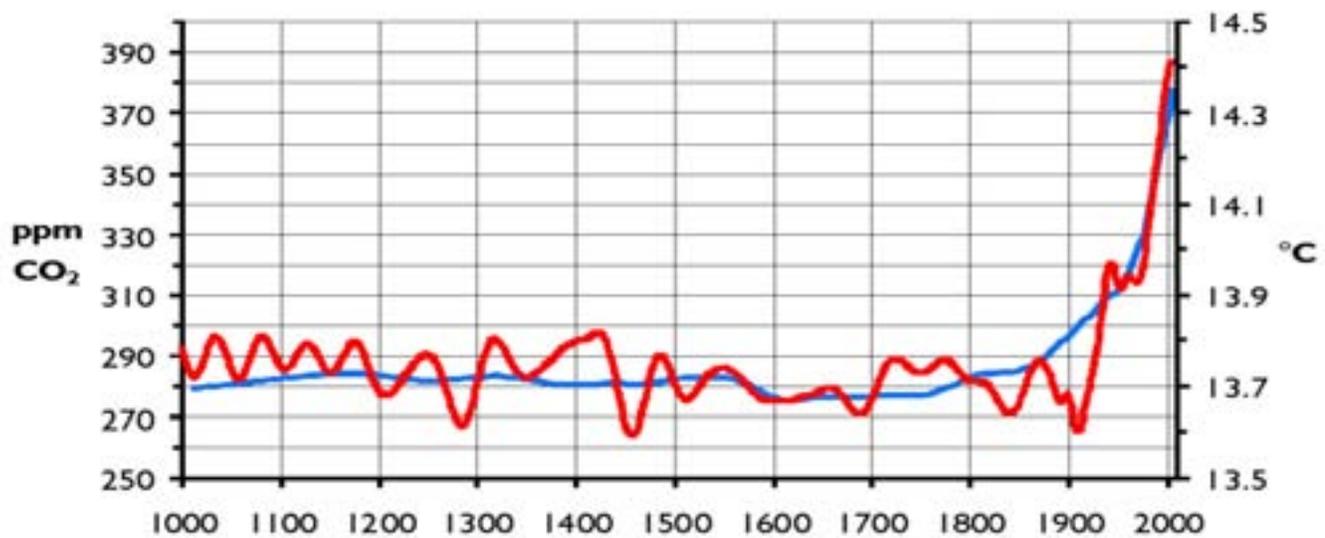
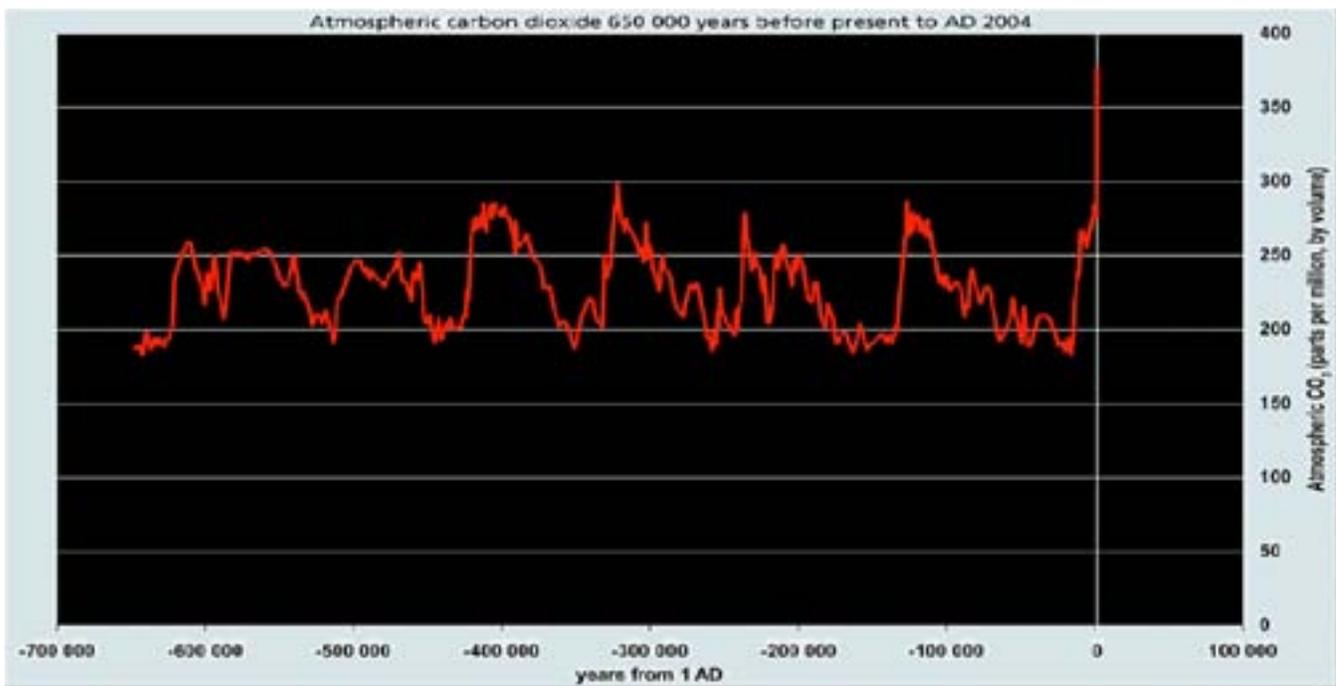
\* In 2008, humans added the same amount of CO<sub>2</sub> (by weight) to the atmosphere as line of school busses (by weight) that go to the moon and back 31 ½ times \*

- 1 US Ton = 2,000 pounds = 907 kilograms
- 1 African male elephant = 15,000 pounds = 6.8 US tons
- 1 US yellow school bus = 20,000 pounds = 10 US tons = 40 feet long.

- 1 marble = 100 million
- 40 marbles = 4 billion
- 60 marbles = 6 billion
- 70 marbles = 7 billion
- Nine zeros in a billion.
- One thousand million = one billion
- 1 mile = 5,280 feet
- Earth is 24,901 miles circumference at the equator
- Moon is on average 240,000 miles away
- Mars is on average 35 million miles away

- 1 billion tons of CO<sub>2</sub> = 147,058,823 African Elephants
- 4 billion tons of CO<sub>2</sub> = 588,235,294 African Elephants
- 6 billion tons of CO<sub>2</sub> = 882,352,938 African Elephants
- 7 billion tons of CO<sub>2</sub> = 1,029,411,764 African Elephants
- 10 billion tons of CO<sub>2</sub> = 1,470,588,230 African Elephants

- 1 billion tons of CO<sub>2</sub> = 100,000,000 school buses = 757,575 miles of school busses
- 4 billion tons of CO<sub>2</sub> = 400,000,000 school buses = 3,030,300 miles of school busses
- 6 billion tons of CO<sub>2</sub> = 600,000,000 school buses = 4,545,450 miles of school busses
- 7 billion tons of CO<sub>2</sub> = 700,000,000 school buses = 5,303,025 miles of school busses
- 10 billion tons of CO<sub>2</sub> = 1,000,000,000 school buses = 7,575,750 miles of school busses



## Evaluation

- Discuss the carbon budget.
- Did seeing / hearing the marbles help students with understanding the math?
- How did students feel seeing / hearing the imbalance?

## Extension

Students can research additional information at;

<http://www.epa.gov/climatechange/kids/basics/index.html>

<http://www.globalcarbonproject.org/carbonbudget/>

**Related Activities:** Is it Getting Hot in Here?, Sea Level Rise