

Calculate Your Carbon Footprint



Topics

Climate Change,
Conservation Actions

Grades

6–adult

Site

Indoors

Duration

30 minutes

Materials

- Computers
- Internet access

Vocabulary

carbon footprint,
climate change,
greenhouse gases

National Science Education Standards

*Unifying Concepts and
Processes (6-12)*

Evidence, models and
explanation

Change, constancy and
measurement

*Science in Personal and
Social Perspectives*

(6-12)

Environmental quality
Natural and human-
induced hazards

Overview

What is global climate change? How do human actions affect climate change? Students learn that human-induced emissions of carbon dioxide and other greenhouse gases are contributing to climate change. They use an online carbon footprint calculator to quantify their personal carbon dioxide emissions and analyze their behaviors to evaluate their impact. Students then brainstorm actions they can take to minimize their carbon footprint and slow the rate of global climate change.

Objectives

Students will be able to:

- Describe how carbon dioxide emissions can influence global climate change.
- Use the calculation of their carbon footprint to recognize their personal contribution to carbon dioxide emissions.
- Identify behaviors that decrease carbon dioxide emissions.

Background

Carbon is a naturally-abundant element which forms the basis of all living organisms. It is found in many forms all around us. Carbon plays an important role in our daily activities and in global biogeochemical cycles. In the atmosphere, carbon is found primarily in the form of carbon dioxide (CO₂) gas. CO₂ is absorbed in the process of photosynthesis and through ocean chemical processes. CO₂ is released back into the atmosphere through various means: respiration of plants and animals, decay of plant and animal matter, combustion of organic material, production of cement, and/or release from the ocean and volcanic eruptions.

Carbon dioxide is the most significant of the **greenhouse gases**. Greenhouse gases are atmospheric gases that reflect some of the sun's heat back toward the Earth's surface, instead of allowing it to escape into space. Methane, nitrous oxide, ozone and water vapor are other significant greenhouse gases. These gases moderate the temperature of the Earth's surface.



VOCABULARY

Carbon footprint: a quantitative measure of carbon dioxide and other greenhouse gas emissions based on calculation of carbon-emitting behaviors

Climate change: any change in global temperature, precipitation or other weather patterns over the long term due to natural variability and human activity, primarily the rapid increase in greenhouse gas emissions in the atmosphere

Greenhouse gases: atmospheric gases that moderate the temperature of Earth's surface by reflecting some of the sun's heat back toward the Earth's surface instead of allowing it to escape into space

Human activities that include the burning of fossil fuels (combustion of organic material) release carbon dioxide into the atmosphere. The increasing amount of these human-released carbon dioxide emissions combine with the natural greenhouse gases to cause an increase in captured heat within our atmosphere. This increase in emissions is contributing to global **climate change**.

The fact that climate change is occurring is not debated among scientists. However, its implications for the ocean and our environment continue to be researched and discussed. There are many potential outcomes to continued climate change. Three critical areas of concern for our oceans are:

- **Ocean acidification** The increased amount of carbon dioxide absorbed by the oceans is changing ocean chemistry by decreasing pH and increasing acidity. Ocean acidification inhibits the ability of some zooplankton to form calcium carbonate shells - potentially undermining the base of a food web that supports all marine life and human fisheries - and poses a serious threat to coral reef ecosystems and marine biodiversity.
- **Disruptions in marine food webs and habitats** Alterations in the timing and intensity of coastal upwelling threaten the health of coastal marine ecosystems - the waters that have historically produced 20 percent of global fisheries.
- **Coastal impacts** Sea level rise, sea temperature increase and a higher intensity of storms will affect human and marine life in a multitude of ways. These impacts include: loss of productive coastal estuaries and wetlands, saltwater contamination of coastal aquifers, alteration of traditional ecosystems as cold-water species are displaced and succeeded by migrants from warm-water regions, and dramatic increases in coastal erosion affecting human structures.

Individuals contribute to rising levels of carbon dioxide and greenhouse gas emissions through their behaviors relating to home energy use, travel, diet and waste production. A **carbon footprint** is a quantitative measure of personal carbon dioxide and other greenhouse gas emissions based on calculation of carbon-emitting behaviors. A city, state or country can also calculate their carbon footprint.

Procedure

1. CONNECT THE CONCEPT OF CLIMATE CHANGE WITH A CARBON FOOTPRINT.

Discuss with students how an excess of carbon dioxide and other greenhouse gases in the atmosphere contributes to climate change. Be sure to point out that while carbon dioxide is not in itself bad, the speed at which modern behaviors are increasing the levels causes a greater rate of change in a shorter time frame. You may ask them to brainstorm emission-producing behaviors (*driving, heating houses, farming, etc.*). Describe a carbon footprint for the class (*a way to calculate one's personal contributions to overall carbon dioxide and other greenhouse gas emissions which focuses on areas where people take steps to lower emissions*). Ask students how they think their carbon footprint compares with the rest of the U.S. and the world.

2. STUDENTS CALCULATE THEIR CARBON FOOTPRINTS.

Have students go to the Nature Conservancy's website at www.nature.org/initiatives/climatechange/calculator and follow the online procedures to calculate their carbon footprint. (There are other online carbon footprint calculators available. If you prefer, type "carbon footprint" in an internet search box for options.) Decide whether you want them to calculate individual or household footprints.

3. ANALYZE RESULTS INDIVIDUALLY AND DISCUSS AS A CLASS.

Students should read their personal results and analyze their contribution to carbon dioxide emissions. How many tons of carbon dioxide and other greenhouse gas emissions do they produce each year? Which area is their highest percentage: home energy, driving and flying, food and diet, recycling and waste? You may choose to add up students footprints to get a total for the class. How do they think the classroom's carbon footprint compares to that of their personal footprint? You may want to help students understand what a ton of carbon looks like in emissions (*released by traveling 5,000 miles in an airplane, driving 2,500 miles in a medium-sized car or cutting down and burning a tree about a foot in diameter and 40 feet tall*).

4. BRAINSTORM WAYS TO REDUCE CARBON FOOTPRINTS AS A CLASS.

Have students read the climate saving tips link in the online calculator at <http://www.nature.org/initiatives/climatechange/activities/art19630.html>. Ask them to consider which suggestions they can implement. Are there any other ways they could reduce their footprints? As a class, discuss strategies to reduce emissions at home and in school.

Extensions

- Challenge students to brainstorm national and community (versus personal and individual) actions that could reduce carbon emissions. Are there examples of changes proposed by environmental groups, corporations, legislators? What are some of the difficulties in implementing these changes?
- Check the *Facing the Future* website listed on the next page for other ideas. In the *Solving Inequalities: Carbon Emissions Budgeting for Climate Change* section, students can analyze and calculate the benefit of different climate saving tips. Examples include how to determine the number of miles they can drive per day and how many minutes of hot water they can use taking a shower without exceeding a daily carbon dioxide emission limit of 24.8 pounds. They can also compare the emissions of some food choices (a peanut butter and jelly sandwich versus a cheeseburger).

IN ORDER TO PROTECT THE ENVIRONMENT, THE PRECAUTIONARY APPROACH SHALL BE WIDELY APPLIED BY STATES ACCORDING TO THEIR CAPABILITIES. WHERE THERE ARE THREATS OF SERIOUS OR IRREVERSIBLE DAMAGE, LACK OF FULL SCIENTIFIC CERTAINTY SHALL NOT BE USED AS A REASON FOR POSTPONING COST-EFFECTIVE MEASURES TO PREVENT ENVIRONMENTAL DEGRADATION.

From Principle #15 of the 1992 Earth Summit in Rio De Janiero

**THE MISSION OF THE
MONTEREY BAY
AQUARIUM
IS TO INSPIRE
CONSERVATION OF THE
OCEANS.**

Resources

Websites

Environmental Protection Agency. www.epa.gov/climatechange/index.html

Find a carbon footprint calculator that focuses on household emissions, general climate change information and links to activities.

The Greens. www.meetthegreens.org/features/carbon-calculator.html

View a kid-friendly carbon footprint calculator and links to conservation teaching activities.

Facing the Future. www.facingthefuture.org

Find information, curriculum and professional development on conservation education.

NASA. climate.nasa.gov/esw/videoseries/

Watch online videos about climate change.

References

Nature Conservancy. www.nature.org/initiatives/climatechange/calculator

Use this carbon footprint online calculator with your class and access other resources regarding carbon emissions.

Standards

Grade 6: 3a, b, c, d; 4a, b, c, d, e; 5e; 6a, b, c; 7b, d

Grade 7: 3e; 4g; 7a, b, c

Grade 8: 6a; 7c

Grades 9-12: Biology/Life Sciences 6b, d

Chemistry 7a, b, d; 10b

Earth Sciences 4b, c; 5a; 6a, c, d; 7a, b; 8a, c

Investigation & Experimentation 1a, d, f, g, k, l, m