



## Activity 4.2: Calculating Your Carbon Footprint

**Grades 10 – 12**

**Description:** Students will calculate their ecological footprint and determine how many “earths” would be needed if everyone on Earth lived the same lifestyle as they do. By doing this, students will begin to understand the individual impacts they personally have on the environment. Students will then discuss ways that they can lower their ecological footprint.

**Time:** 1 class period

**Materials:**

- LCD projector

**Per Student**

- Completed “Assessing My Carbon Footprint” information sheet
- “Calculating my Carbon Footprint” worksheet
- Calculator

**Per Group**

- Computer with Internet and Excel

**National Science Education Standards:**

**F3.b** Human activities can also introduce hazards through resource acquisition, urban growth, land-use decisions, and waste disposal.

**F4.d** Important personal and social decisions are made based on perceptions of benefits and risks.

**AAAS Benchmarks:**

**3C/M7** Societies influence what aspects of technology are developed and how these are used. People control technology (as well as science) and are responsible for its effects.

**5D/H3** Human beings are part of the Earth's ecosystems. Human activities can, deliberately or inadvertently, alter the equilibrium in ecosystems.

**3C/H4** The human species has a major impact on other species in many ways: reducing the amount of the Earth's surface available to those other species, interfering with their food sources, changing the temperature and chemical composition of their habitats, introducing foreign species into their ecosystems, and altering organisms directly through selective breeding and genetic engineering.

**4B/H9** Although the Earth has a great capacity to absorb and recycle materials naturally, ecosystems have only a finite capacity to withstand change without experiencing major ecological alterations that may also have adverse effects on human activities.

**4B/H6** ...The burning of fossil fuels in the last century has increased the amount of greenhouse gases in the atmosphere, which has contributed to Earth's warming.

**Guiding Questions:**

- What is the impact of my lifestyle on the planet?
- What steps can I take to reduce my impact on the planet?

**Pre-Activity Preparation:**

- At least one day before beginning this activity, for homework, have students complete the “Assessing My Carbon Footprint” information sheet. It is likely that students will need to



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ask their parents for some of the information needed to calculate their, and their family's, carbon footprints.

- Explore the different carbon footprint calculator options and choose the one you like best for your students.
  - *Earth Day Network* <http://www.earthday.net/footprint/flash.html> This site is very visual, and covers most contributors to one's carbon footprint. Students can customize an avatar, and a "virtual neighborhood" is built based on their answers. Students particularly enjoy this site.
  - *Environmental Protection Agency* [http://www.epa.gov/climatechange/ghgemissions/ind-calculator.html#c=homeEnergy&p=reduceOnTheRoad&m=calc\\_instructions](http://www.epa.gov/climatechange/ghgemissions/ind-calculator.html#c=homeEnergy&p=reduceOnTheRoad&m=calc_instructions) The EPA calculator does not include food, but has more detail about household energy use, transportation choices, and waste, and provides an interface for selecting conservation actions to reduce emissions and calculating cost savings.
  - *The Nature Conservancy* <http://www.nature.org/greenliving/carboncalculator/> This site is fairly comprehensive and includes food choices and any conservation actions people may have taken (e.g. energy-efficient light bulbs, recycling, etc.) in the footprint calculations.
  - *Zerofootprint* <http://calc.zerofootprint.net/youth/> This calculator was made specifically for children, so they will likely know the answers to all questions.

### Vocabulary:

**Carbon footprint:** The total amount of carbon dioxide you are responsible for releasing into the atmosphere, directly (through driving a car), and indirectly (through the things you use and/or purchase).

**Primary footprint:** CO<sub>2</sub> that you directly release into the atmosphere, such as from driving a car

**Secondary footprint:** CO<sub>2</sub> that is emitted from things you use or purchase. For example, if you eat a steak, your secondary footprint would include the amount fossil fuels burned to raise the feed corn, ship the cow to market, and package it for sale.

**Carbon offset:** A reduction in emissions of carbon dioxide or greenhouse gases made in order to compensate for an emission made elsewhere. One carbon offset represents the reduction of one metric ton of carbon dioxide or its equivalent in other greenhouse gases. Offsets are typically achieved through financial support of projects, usually renewable-energy projects, that will reduce the emission of greenhouse gases in the short or long term.

**Carbon credit:** A carbon credit is the term used for a tradable certificate or permit representing the right to emit one ton of carbon dioxide (or the equivalent of another greenhouse gas). Carbon credits and carbon markets are a component of national and international attempts to mitigate the growth in concentrations of greenhouse gases.



### **Background Information:**

This lesson focuses on student choices and their affect on the planet. They will first look at their personal contribution to greenhouse gases by calculating their carbon footprint. Carbon dioxide (CO<sub>2</sub>) emissions are what contribute to a person's carbon footprint. Students should be familiar with the following terms in order to calculate a carbon footprint: primary footprint, secondary footprint, carbon offsets, and carbon credits. Your primary footprint is what you have directly emitted, such as the carbon dioxide given off as you drive your car. Your secondary footprint is CO<sub>2</sub> that is emitted from things you use or purchase. For example, if you eat a steak, your secondary footprint would include the vast amount of fossil fuels burned to raise the feed corn, ship the cow to market, etc. Once students are more aware of the effects of their daily habits, they can begin to look at positive steps they can take to help reduce climate change. This will be the focus of days 2-5 of the unit.

### **Notes:**

- If you are unable to use many computers for the carbon footprint, photocopy worksheets with all the categories and have students calculate footprints without the computer.

### **Procedure:**

1. Trace a footprint with construction paper and leave it on the board in front of the class. Begin with the conversation starter: *What does this footprint mean to you and how does it relate to climate change? You may have heard about carbon footprints in the news, what does it mean to you?*
2. Walk class through the process of creating a one-minute carbon footprint, to understand the complex process of an extensive carbon footprint. This is a very general calculator, but it highlights the important aspects that need to be considered.  
[http://calc.zerofootprint.net/one\\_minute/personal/](http://calc.zerofootprint.net/one_minute/personal/)
3. After you have walked students through the process, make sure they are familiar with key vocabulary terms: primary footprint, secondary footprint, carbon offsets, and carbon credits.
4. Have students individually calculate their household carbon footprint using the carbon calculator of your choice. A number of good calculators are described in the Pre-Activity preparation notes. If students have completed the "Assessing My Carbon Footprint" information sheet, they will have all the information they need to complete their carbon footprint using any of the calculators, though they may not need it all depending on the one you have chosen to use.
5. In small groups, students will calculate the whole group's carbon footprint. Compare the similarities and differences among individuals.
6. Have each group present their group and individual carbon footprints. Have students explain how they will reduce their carbon footprint in realistic ways.



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7. Discuss the results: Many of the calculators generate graphs or charts of carbon usage by category (travel, energy, food, etc.). Discuss which categories contribute the most to carbon emissions and why. If students did not need all the information they collected on their “Assessing My Carbon Footprint, you may also wish to discuss how accurate these calculators are, what they take into account and what they don’t, and the effect that may have on the results.
8. If there is extra time, search the Internet for “carbon footprint calculator.” Have a discussion about the different options of calculators. Why would an oil company be interested in a carbon footprint calculator? Nonprofit? Government agency? Have students investigate the biases of each of the agencies’ carbon footprint calculators. Regardless of biases, ask students which website has the most user-friendly carbon footprint calculator?
9. Closure: Give students an exit slip. Here are ten ways my family and I decided that we could realistically reduce our carbon footprints.

### **Homework:**

- As a homework assignment, students complete the exit slip and bring it into the next class as an entrance slip: Here are ten ways my family and I decided that we could realistically reduce our carbon footprints.
- Students’ completion of class work, exit slips, contributions to class discussion, and small group discussion, participation rubric.

### **Extensions:**

- Calculate the carbon footprint for your whole school, or the administrative building.
- Calculate the carbon footprint of a business within half a mile of your school.
- Create a tracking system for students’ monthly carbon footprint. Have a contest for those students who are able to reduce their footprint each month. Have the students with the lowest carbon footprint present to the class to share their insights. A month later, you can have the students who have had the greatest reduction in their carbon footprint present on how they made the changes.

### **Useful Websites:**

- [http://www.greenstudentu.com/encyclopedia/carbon\\_footprint](http://www.greenstudentu.com/encyclopedia/carbon_footprint) This is an explanation of various carbon footprint terms.
- <http://www.lnt.org/training/index.php> Leave No Trace is an organization that encourages environmental awareness.
- <http://www.ci.austin.tx.us/acpp/resources.htm> This is a collection of various climate-change organizations. There are also listings of climate-protection plans from many other cities (including Austin).
- [http://www.epa.gov/climatechange/emissions/ind\\_calculator2.html#c=theBasics&p=reduceOnTheRoad&m=calc\\_currentEmissions](http://www.epa.gov/climatechange/emissions/ind_calculator2.html#c=theBasics&p=reduceOnTheRoad&m=calc_currentEmissions) A carbon footprint calculator.



Name: \_\_\_\_\_ Date: \_\_\_\_\_ Room: \_\_\_\_\_

## Assessing My Carbon Footprint

### Living Space

1. How many people live in your home? \_\_\_\_\_
2. What kind of space do you live in? (check one)  
 Free-standing house with running water  
 Free-standing house without running water  
 Duplex (2-4 units)  
 Apartment building  
 Luxury condo  
 Green design residence (LEED certified)
3. What is your zip code? \_\_\_\_\_
4. What is the size of your home? (check one)  
 550 sq.ft. or less  
 550-1050 sq.ft.  
 1050-1600 sq.ft.  
 1600-2200 sq.ft.  
 2200-2700 sq.ft.  
 2700 sq.ft. or more
5. Do you have electricity in your home? (circle one)      Yes      No

### Energy

6. What is your household's primary heating source? (check one)  
 Natural Gas  
 Oil  
 Electric Heat  
 Propane  
 Wood  
 I do not heat my house
7. Does your household currently purchase green power? (circle one)      Yes      No
8. How much natural gas does your household use per month?  
(Use your monthly consumption in thousands of cubic feet, for a more accurate estimate)  
\_\_\_\_\_ dollars  
\_\_\_\_\_ thousands of cubic feet  
\_\_\_\_\_ therms



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9. How much electricity does your household use per month? (Use average kilowatt-hours, for a more accurate estimate.)

\_\_\_\_\_ dollars

\_\_\_\_\_ kilowatt-hours

10. How much fuel oil does your household use per month? (Divide annual fuel oil consumption (gallons or dollars) by 12 to obtain a monthly average.)

\_\_\_\_\_ dollars

\_\_\_\_\_ gallons

11. How much propane does your household use per month? (If you enter your monthly propane use in gallons, you'll get a more accurate estimate.)

\_\_\_\_\_ dollars

\_\_\_\_\_ gallons

**Travel**

12. How many vehicles does your household have? (circle one)    1   2   3   4   5   None

13. For each vehicle answer fill in the information to complete the table below:

- On average, how many miles do you put on each vehicle per week?
- What is the average gas mileage (miles per gallon)?

|                  | Miles/Week | Mileage |
|------------------|------------|---------|
| <b>Vehicle 1</b> |            |         |
| <b>Vehicle 2</b> |            |         |
| <b>Vehicle 3</b> |            |         |
| <b>Vehicle 4</b> |            |         |
| <b>Vehicle 5</b> |            |         |

14. How far does your family travel by bus each week? (check one)

\_\_\_ 0 miles

\_\_\_ 1-5 miles

\_\_\_ 5-25 miles

\_\_\_ 25-50 miles

\_\_\_ 50 or more miles

15. How far does your family travel by train each week? (check one)

\_\_\_ 0 miles

\_\_\_ 1-5 miles

\_\_\_ 5-25 miles

\_\_\_ 25-50 miles

\_\_\_ 50 or more miles



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16. How often do you carpool? (circle one)

Never      Occasionally      Often      Very Often      Almost Always

17. How many hours does your family fly each year? (check one)

- We never fly
- 0-4 hours
- 4-10 hours
- 10-25 hours
- 25-100 hours
- More than 100 hours

**Food**

18. How often do you eat the following foods? (circle one for each type of food)

|               |       |           |            |                  |            |
|---------------|-------|-----------|------------|------------------|------------|
| Beef/Lamb:    | Never | 1 x/month | 1-3 x/week | almost every day | every meal |
| Pork:         | Never | 1 x/month | 1-3 x/week | almost every day | every meal |
| Poultry:      | Never | 1 x/month | 1-3 x/week | almost every day | every meal |
| Fish/Seafood: | Never | 1 x/month | 1-3 x/week | almost every day | every meal |
| Eggs/Dairy:   | Never | 1 x/month | 1-3 x/week | almost every day | every meal |

19. How much of your diet is based on fresh, unpackaged, foods? (circle one)

None      Some      Half      Most      All

20. How much of the food you eat is locally grown or produced (less than 200 miles away)? (circle one)

None      Some      Half      Most      All

**Waste**

21. How much stuff do you buy each month (clothing, sports equipment, shoes, etc.) (check one)

- Little (a few pairs of socks)
- Pants & a shirt
- Pants, a few shirts, shoes
- All the latest fashions

22. How much furniture does your family buy each year?

- We haven't redecorated in years
- A new lamp or end table
- Couch, new bedroom set, we update regularly
- We redecorate every year



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23. How many appliances does your family buy each year? (check one)
- Almost never, and then only small appliances, like a blender or coffee maker
  - Infrequently, only when things are broken
  - Occasionally, we replace old stuff with newer models
  - Often, we always have the most up to date model
24. How often do you buy electronics (stereo, TV, computer etc.)? (check one)
- Almost never, we have a cellphone, but that's it
  - Infrequently, only when the TV or computer is broken
  - Occasionally, we replace old stuff with newer models
  - Often, we always have the newest technology
25. How often do you buy new books, magazines and newspapers? (check one)
- Almost never (1-2 books/year)
  - Infrequently (we buy used, borrow what we read, or read online)
  - Occasionally (we subscribe to a newspaper and a magazine)
  - Often (daily delivery of papers, subscribe to magazines, and buy books every week)
26. How much paper waste do you recycle? (check one)
- Almost none
  - Only newspapers and office paper
  - Most (newspapers, cardboard magazines)
  - All, and we buy recycled products when possible
27. How much plastic waste do you recycle? (check one)
- Almost none
  - Only plastic beverage containers
  - Most (all plastic packaging)
  - All, and we buy recycled products when possible
28. Which of the following products do you currently recycle in your household?
- Aluminum and steel cans?    Yes    No
  - Plastic?    Yes    No
  - Glass?    Yes    No
  - Newspaper?    Yes    No
  - Magazines?    Yes    No



Name: \_\_\_\_\_ Date: \_\_\_\_\_ Room: \_\_\_\_\_

## Calculating your Carbon Footprint

1. Define the following terms in your own words:
  - a. primary footprint
  - b. secondary footprint
  - c. carbon offsets
  - d. carbon credits
2. Have students individually calculate their own and their family's carbon footprint.  
[http://www.epa.gov/climatechange/ghgemissions/ind-calculator.html#c=homeEnergy&p=reduceOnTheRoad&m=calc\\_instructions](http://www.epa.gov/climatechange/ghgemissions/ind-calculator.html#c=homeEnergy&p=reduceOnTheRoad&m=calc_instructions)
  - a. What is your footprint? Your family's footprint?
  - b. What aspect of your life increases your and your family's footprint the most?
3. What are the differences between your family's footprint and the others in your group?
4. What are the similarities?
5. On the back of this sheet or in your notebook, list ten things you and your family can do to reduce your carbon footprint.