

Carbon and Water Footprint Classroom Activity: Teacher's Guide

- Overview:
 - An interactive classroom activity of around 1 hour, designed to introduce and convey the concepts of water and carbon footprints and environmental consequences to everyday actions.
- Goal:
 - To help students aged 12+ conceptualize resource use and encourage them to take steps to reduce their carbon and water footprints.
- Objectives:
 - Introduce the concepts of water and carbon footprints.
 - Allow students to consider their habits and see for themselves the varying impact their choices have on the environment.
 - Give students the chance to make pledges to change their habits.
 - Engage the students and start a conversation about resource use and conservation.
- Materials:
 - Printouts of the worksheets (Questionnaire, Graph Paper, Block Values, and Reductions)
 - Colored pencils (blue, graphite)
 - Markers (green)
- Instructions:
 - Teacher explains instructions and introduces concepts to the class.
 - Students break into groups of 2.
 - Students take turns reading each other the questions and recording the answers.
 - Teacher hands out the page with corresponding blocks for each question (Block Values). Students fill out their paper accordingly and compare results with their partners. Carbon blocks are represented by regular graphite pencil, and water blocks are represented by blue colored pencil.
 - Teacher explains the value represented by each block.
 - Next, teacher hands out Reductions page, and partners take turns committing to different reductions and adjusting their paper accordingly (reductions are indicated by green marker drawn over the colored pencil).
 - Students compare and reflect.

Explaining the Concept

Consider all of the different “things” you use in your daily life. What you eat for breakfast, the clothes you wear, the desks in the classroom, the car you drive to school—they all come from earth’s resources. They’re powered and transported by earth’s resources, too. An environmental footprint is an annual measure of how much land and water it takes to provide the things we use and consume.

In this activity, we will be focusing on the water and carbon components of your environmental footprint. It does not attempt to estimate a student’s total carbon or water footprint. Rather, it highlights the impact of certain key lifestyle choices, most of which students can take an active role in changing.

Carbon footprint: In this activity, “carbon footprint” refers to the amount of CO₂ emitted annually from the lifestyle choices included in the questionnaire. Each carbon block represents 90 kg. of atmospheric CO₂. 10 of these blocks equals nearly one metric ton of atmospheric CO₂. This measurement can be portrayed to students as a large sphere 10 meters in diameter, full of CO₂. This representation comes from this video (<https://www.youtube.com/watch?v=v9cT-tHoXdI>), which might help to visualize CO₂ emissions. CO₂ emissions are the most plentiful greenhouse gas emissions caused by human activities.

The instructor may find it necessary to explain the importance of CO₂ emissions as it relates to climate change. Basically, greenhouse gases such as carbon dioxide, methane, and others, are released into the atmosphere at rates far exceeding those of the pre-Industrial era. This influx increases the concentration of greenhouse gases, bulking up the greenhouse effect, which prevents the earth from turning into a ball of ice by trapping in some of the heat from the sun. With too many greenhouse gases, however, more and more heat is trapped, warming the planet and disrupting delicate climatic balances. Scientists believe that once certain temperature thresholds are exceeded, chain reactions (known as “feedback loops”) will be set in motion that have far-reaching and sometimes irreversible consequences. The moral of the story is that human-caused greenhouse gas emissions contribute to climate change, which can affect everything from habitat loss and species extinction to rising sea levels, increased intensity of catastrophic weather events, collapse of food systems, and more.

Water footprint: In this activity, “water footprint” refers to the amount of fresh water used by the lifestyle choices included in the questionnaire. We use freshwater in just about every process—each liter of oil, pair of jeans, or chocolate bar uses significant amounts of freshwater along the supply chain. For this activity, we choose to highlight numerous activities that not only account for water coming out of the spout, but water used in production processes as well (since these “hidden” liters tend to represent the bulk of our usage). [This graphic](#) can help students visualize the extent of “hidden” water usage. There are many different estimates for hidden water and water use in general, but our calculations are largely based off of National Geographic water footprint data.

It may be helpful to explain to students the scarcity of freshwater in the U.S. and around the world. From California’s worst drought in 1,200 years to the [projection](#) of half the world’s population living in a water-stressed area in 2025, freshwater scarcity is a significant problem. Today, [1 in 5 people](#) do not have access to safe drinking water. For older students, it might be helpful to lay out the geopolitical consequences of water scarcity. Civil war in Syria, the Arab Spring, revolution in Yemen, the Israel-Palestine conflict, Rwandan genocide, war in Darfur, have all had water scarcity as a stressor. As people are increasingly prone to saying, “wars will be fought over water.” And, to a certain extent, they already have been.

Throughout this activity, there are opportunities for partners to discuss with each other their habits, their impressions of block values and fun facts, and their goals for reductions. Reflection time after the activity can be constructive as well.

Print double-sided if possible!

Questionnaire

Mark whichever answer best fits your habits

- How do you get to school? (assumes 8 km drive to school)
 - Truck/minivan
 - Hybrid car
 - Car
 - Bike
 - Walk
 - Bus
 - Subway
 - Electric Vehicle
- If you drive, do you carpool with anyone?
 - Yes
 - No
- How many times did you fly this year? (1 includes roundtrip)
 - 0
 - 1
 - 2
 - 3
 - 4 or more
- How often do you eat red meat (beef, lamb, pork) as the main course?
 - More than once a day
 - Once a day
 - A few times per week
 - Once or twice a week
 - Never
- Do you look at the labels (sustainable, organic, local, etc.) when you go shopping and/or do you ever go to farmer's markets?
 - Often
 - Sometimes
 - Never
- How many new clothes do you buy each year?
 - A lot, more than average
 - Just about average
 - Not that many, less than average
- Does your family purchase bottled water?
 - Yes
 - No, I use a reusable water bottle
- How long are your showers?
 - Under 5 minutes
 - 5-10 minutes
 - Over 10 minutes
- Do you have a low-flow shower head?

- Yes
- No
- Do you leave the tap running when you brush?
 - Yes
 - No
- Do you turn off the lights when you leave a room?
 - Always
 - Sometimes
 - Never
 - My house is powered by solar
- Do you leave your electronics plugged in when you're not using them?
 - Yes
 - No
 - My house is powered by solar
- Does your family have any appliances with the energy star logo on them?
 - Yes
 - No
- What kind of bags do you use when you go shopping?
 - Plastic bags from the store
 - We bring our own
- Which do your family recycle?
 - Plastic
 - Glass
 - Paper
 - Metal
 - None



Block Values

Follow the instructions given for each choice that you selected.

- How do you get to school? *(read the next question before you draw your blocks)*
 - Truck/minivan (+18 carbon blocks)
 - Hybrid car (+7 carbon blocks)
 - Car (+13 carbon blocks)
 - Bike (0 carbon blocks)
 - Walk (0 carbon blocks)
 - Bus (+4 carbon blocks)
 - Subway (+2 carbon blocks)
 - Electric Vehicle (+1 carbon block)
 - *Leaving your car engine on without driving (this is called “idling”) gives off as much CO₂ as when you are driving.*
- If you drive, do you carpool with anyone?
 - Yes (divide above number with # of friends you carpool with—family members don’t count!)
 - No (0 carbon blocks)
- How many times did you fly this year? *(If flight was longer than 5 hours, multiply # of blocks by 2)*
 - 0 (0 carbon blocks)
 - 1 (+2 carbon blocks)
 - 2 (+5 carbon blocks)
 - 3 (+7 carbon blocks)
 - 4 or more (+11 carbon blocks)
- How often do you eat red meat as the main course?
 - More than once a day (+8 carbon blocks) (+40 water blocks)
 - Once a day (+7 carbon blocks) (+25 water blocks)
 - A few times per week (+5 carbon blocks) (+15 water blocks)
 - Once or twice a week (+4 carbon blocks) (+10 water blocks)
 - Never (0 carbon blocks) (0 water blocks)
 - *Meat, especially red meat, uses a lot of water! Eating 6 fewer hamburgers has the same water footprint impact as choosing not to shower for the whole year. Also, burps and farts from cows and pigs make up 18% of the world’s greenhouse gas emissions, more than all car and plane emissions combined!*
- Do you look at the labels (sustainable, organic, local, etc.) when you go shopping and/or do you ever go to farmer’s markets?
 - Often (+1 carbon block)
 - Sometimes (+2 carbon blocks)
 - Never (+4 carbon blocks)
 - *Labels are often an indicator of food produced and sourced either locally or in a low-carbon way. Farmer’s markets are a good bet for tasty, low-impact food as well. Check out the labels on your fruit. Where did they come from?*
- How many new clothes do you buy each year?

- A lot, more than average (+3 water blocks)
- Just about average (+2 water blocks)
- Not that many, less than average (+1 water block)
- Consider all the water needed to grow the cotton for your clothes. It takes **11,300 liters of water** to make one pair of blues jeans, which is the same as letting a garden hose run for **8 hours straight!**
- Does your family purchase bottled water?
 - Yes (+1 carbon block) (+½ water block)
 - No, I use a reusable water bottle (0 carbon blocks) (0 water blocks)
 - Plastic water bottles don't have the biggest effect on carbon or water footprints, but they impact the environment in other ways. **35 billion water bottles** are thrown out each year, which would stretch from the U.S. East Coast to the U.S. West Coast *and back 800 times*. These bottles often end up in the ocean, where they are toxic to turtles, fish, and other sea creatures.
- How long are your showers? *(read the next question before you draw your blocks)*
 - Under 5 minutes (+1 carbon block) (+½ water block)
 - 5-10 minutes (+2 carbon blocks) (+1 water block)
 - Over 10 minutes (+4 carbon blocks) (+2 water blocks)
 - Carbon emissions come from heating up the water.
- Do you have a low-flow showerhead?
 - Yes (Divide shower carbon blocks by 2) (divide shower water blocks by 2)
 - No (0 carbon blocks)
- Do you leave the tap running while you brush your teeth?
 - Yes (+½ water block)
 - No (0 water blocks)
- Do you turn off the lights when you leave a room?
 - Always (0 carbon blocks)
 - Sometimes (+½ carbon block)
 - Never (+1 carbon block)
 - My house is powered by solar (0 carbon blocks)
- Do you leave your electronics plugged in when you're not using them?
 - Yes (+4 carbon blocks)
 - No (0 carbon blocks)
 - My house is powered by solar (0 carbon blocks)
 - Even when your electronics are turned off, they still use energy as long as they're plugged in.
- Does your family have any appliances with the Energy Star logo on them?
 - Yes (0 carbon blocks)
 - No (+6 carbon blocks)
- What kind of bags do you use when you go shopping?
 - Plastic bags from the store (+3 carbon blocks)
 - We bring our own (+½ carbon block)
 - Yep, plastic bags are made of oil. Even some reusable bags have oil as an ingredient, too. But bringing your own is always better than using plastic ones!



- Which ones do your family recycle? (*start with +3 ½ blocks and subtract from there*)
 - Plastic (-1/2 carbon block)
 - Glass (-1/2 carbon block)
 - Paper (-1 ½ carbon blocks)
 - Metal (-1 carbon block)
 - None (-0 carbon blocks)
- **90 kg. of CO₂** per carbon block. 10 carbon blocks equals a sphere of CO₂ 10 meters high and heavier than a car. That's big enough to burst through your classroom ceiling *and* the one above it.
- **10,000 liters of fresh water per water block.** 4 water blocks equals a large backyard swimming pool.

Reductions

Check off whichever pledges you want to commit to and use a green marker to color in the carbon and water blocks that match your reductions. Remember not to pledge to do something that you already do.

- I pledge to (*pick one*):
 - Walk or bike to school (reduce all of your transportation carbon blocks)
 - Take the bus to school (reduce transportation carbon blocks to 4) (for example, if you previously took a car to school, reduce 9 blocks, so that your transportation blocks are 4 instead of 13).
 - Take the subway to school (reduce transportation carbon blocks to 2)
- I pledge to:
 - Carpool to school (Divide your remaining transportation carbon blocks in half)
 - Convince my parents to turn one flight into a road trip instead (reduce 2 carbon blocks)
- I pledge to (*pick one*):
 - Go one more day a week without red meat (reduce 1 carbon block and 5 water blocks)
 - Go two more days a week without red meat (reduce 2 carbon blocks and 10 water blocks)
 - Go three more days a week without red meat (reduce 3 carbon blocks and 15 water blocks)
 - Go four more days a week without red meat (reduce 4 carbon blocks and 20 water blocks)
- I pledge to:
 - Try to buy food with eco-friendly labels and/or go to the farmer's market (reduce 1 carbon block if you said "often," 2 blocks if you said "sometimes," and 4 blocks if you said "never")
 - Buy more secondhand clothes instead of new ones (reduce 1 water block)
 - Use a reusable water bottle instead of disposable plastic ones (reduce ½ water block)
 - Cut my shower length by a few minutes (reduce 1 carbon block and ½ water block)
 - Use a low-flow showerhead (divide shower water blocks by 2)
 - Turn off the tap while I brush my teeth (reduce ½ water block)
 - Always turn off the lights when I leave the room (reduce ½ carbon block if you said "sometimes" and 2 carbon blocks if you said "never".)
 - Unplug my electronics when I'm not using them (Reduce 4 carbon blocks if you said "yes")
 - Bring my own reusable bags to the store (reduce 2 ½ carbon blocks)
- I pledge to:
 - Recycle plastic (reduce ½ carbon block)
 - Recycle glass (reduce ½ carbon block)
 - Recycle paper (reduce 1 ½ carbon blocks)
 - Recycle metal (reduce 1 carbon block)

Carbon and Water Footprint Activity

1 carbon block = 90 kg. of atmospheric CO₂. 10 carbon blocks is equal to a **sphere 10 meters high and as heavy as a car.** That's big enough to burst through your classroom and the one above it.

1 water block = 10,000 liters of fresh water. 4 water blocks is equal to a **large backyard swimming pool.**

Water Blocks 

Carbon Blocks 

How big are your carbon and water footprints? Think about how much CO₂ and how much fresh water you use each year, only from the activities in these questions. And still, this isn't even close to the size of your actual footprint!

Now, think about the difference your reductions made. You can save huge amounts of CO₂ and fresh water each year by making some of these changes. The world needs people to step up and fight against climate change, habitat destruction, pollution, and wasteful water use. You always have a choice—**what do you want your world to look like?**

Sources and Extra Information

- How do you get to school? (assumes 5 mile drive to school) (only takes into account getting to and from school)
 - Truck/minivan (1624 kg) 18 blocks
 - Hybrid car (612 kg) 7 blocks
 - Car (1130 kg) 13 blocks
 - Bike (0) 0 blocks
 - Walk (0) blocks
 - Bus (370 kg) 4 blocks
 - Subway (181 kg) 2 blocks
 - Electric Vehicle (91 kg) 1 block
- If you drive, do you carpool with anyone?
 - Yes (divide above number with # of friends you carpool with)
 - No
- How many times did you fly this year? (1 includes roundtrip) (assumes NY to Chi flight) If flight was international or cross-country, double the blocks.
 - None
 - 1 (227 kg) 2 blocks
 - 2 (454 kg) 5 blocks
 - 3 (680 kg) 7 blocks
 - 4 or more (1020 kg) 11 blocks
- How often do you eat red meat as the main course?
 - More than once a day (726 kg) 8 blocks (400,000 liters) **40 blocks**
 - Once a day (680 kg) 7 blocks (250,000 liters) **25 blocks**
 - A few times per week (635 kg) 5 blocks (150,000 liters) **15 blocks**
 - Once or twice a week (454 kg) 4 blocks (100,000 liters) **10 blocks**
 - Never (0) 0 blocks (0 liters) **0 blocks**
- Do you look at the labels (sustainable, organic, local, etc.) when you go shopping or do you ever go to farmer's markets?
 - Usually (91 kg) 1 blocks
 - Sometimes (182 kg) 2 blocks
 - Never (363 kg) 4 blocks
- How many new clothes do you buy each year?
 - A lot, more than average (30,000 liters) **3 blocks**
 - Just about average (20,000 liters) **2 blocks**
 - Not that many, less than average (10,000 liters) **1 block**
- Does your family purchase bottled water?
 - Yes (45 kg) 1 block (300 liters water) **½ block**
 - Rarely (4.5 kg) 0 blocks (30 liters water) **0 blocks**
 - Only use a reusable water bottle (0 blocks) **0 blocks**
- How long are your showers?
 - Under 5 minutes (113 kg) 1 block(5,500 liters) **½ block**
 - 5-10 minutes (227 kg) 2 blocks (11,000 liters) **1 block**
 - Over 10 minutes (340 kg) 4 blocks (17,000 liters) **2 blocks**

- Do you have a low-flow shower head?
 - Yes (0) (divide above water total by 2)
 - No (136 kg)
- Do you leave the tap running when you brush?
 - Yes (3,000 liters) ½ block
 - No (0 liters)
- Do you turn off the lights when you leave a room?
 - Always (23 kg) 0 blocks
 - Sometimes (46 kg) ½ block
 - Never (91 kg) 1 block
 - My house is powered by solar (0)
- Do you leave your electronics plugged in when you're not using them?
 - Yes (363 kg) 4 blocks
 - No (0) 0 blocks
 - My house is powered by solar (0)
- Does your family have appliances with the energy star logo on it?
 - Yes (0 kg) 0 blocks
 - No (550 kg) 6 blocks
- What kind of bags do you use at the store?
 - Plastic bags at the store (272 kg) 3 blocks
 - We bring our own (45 kg) ½ block
- Which ones do your family recycle? (start with 136 kg, subtract accordingly) 3 ½ blocks
 - Plastic (-18 kg) -1/2 block
 - Glass (-9 kg) -1/2 block
 - Paper (-68 kg) -1 ½ blocks
 - Metal (-41 kg) -1 block
 - None (-0 kg) -0 blocks

Water: <http://environment.nationalgeographic.com/environment/freshwater/water-calculator-methodology/>

Blue jeans: 11,000 liters

http://www.wwf.org.uk/what_we_do/rivers_and_lakes/the_hidden_cost_of_water.cfm)

Hose: 23 liters per minute (<http://www.epa.gov/WaterSense/kids/hose.html>)

Carbon: <https://www.americanforests.org/assumptions-and-sources/>,
<http://www.homepower.com/articles/home-efficiency/electricity/half-plan-reducing-your-carbon-footprint-part-two>, <http://www.stopglobalwarming.org/take-action/action-items/>,
<http://www.countdownyourcarbon.org/our-assumptions.html>

4 water blocks equals a large backyard swimming pool (15' x 30' x 4' x 5.9 = 10,620 Gallons, 40,200 liters)

10 carbon blocks equals a balloon of CO₂ 10 meters across.