CLIMATE HEROES

LESSONS AND ACTIVITIES FOR YOUTH TO EXPLORE AND CONNECT WITH THE ENVIRONMENT

EARTH CARE CLEAN AIR CLEAN WATER CLEAN EARTH HEALTHY HABITAT CLIMATE

Dear Reader,

Thank you for your interest in teaching climate change curriculum to our youth! In this moment in human history there has never been a more pressing time to teach our youth to understand, make decisions, and be the future leaders in regards to the health of our shared planet.

Humans have played a key role in creating these problems, and have a key role to play in solving this mess we've made.

We know – from years of evidence, and consensus of the world's scientists - that human activities have been impacting our environment in negative ways all around the planet that we share. Storms are more powerful; oceans and cities are warming; plants, animals and people are at risk. Climate change is real.

You do not need to be a trained teacher to share your knowledge, passion, and time to help youth learn lessons and practice skills. We hope this curriculum helps you feel prepared to take on the important work of growing youth who are connected to each other, and to the natural world. We believe that if young people have opportunities to make connections with nature they will get to know and love nature. What they know and love they will be more motivated to take care of - by becoming "Climate Heroes."

Youth can earn several Climate Hero Badges: Clean Air; Clean Water; Reduce, Reuse, Recycle; Healthy Habitat; & Earth Care - while learning about the connections between plants, trees, indicator species and growing food and climate health. These six lessons can be done in sequence, individually, or as part of a life-long engagement with these issues.

In addition to 6 lessons, we have created a Climate Change Hero "Passport" which is easily printed and folded (stapling optional) for each student. The passport has activities and actions to support the learning in each lesson, and is a place for accumulating their "Climate Hero Stickers" at the end of the series of lessons. Feel free to use this workbook each session (and collect to distribute the following session), or provide it at the end as a way to reinforce and celebrate all the lessons learned.

With this work we are helping our next generation gain tools of eco-literacy and support to be active citizens taking responsibility for their world.

Let's remember that most city residents are already engaging in Climate Hero actions: reusing, repurposing, using public transportation, and maintaining relatively small carbon footprints for economic, if not environmental, reasons. Many city residents also already plant and care for trees, and grow food and flower gardens because they enjoy creating beauty and being outside. Helping our city residents – young and old – understand the value of choices they already make, and learn more about why they may want to make new choices – is important work.

Thank you for working to be and to grow Climate Heroes.

THIS PROJECT WAS COMPLETED WITH SUPPORT OF CUSP PHILLY
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And all the students and Phila Department of Park & Rec Center leaders
who helped us test our lessons, and who are our first climate heroes!

FIND YOUR PATH

PHILADELPHIA PARKS & RECREATION

CUSP Climate & Urban Systems Partnership

Master Gardeners PennState Extension

EARTH CARE HERO

LESSON 1

MAKING CONNECTIONS

INTRODUCTION TO CLIMATE CHANGE HERO LESSONS

THEME: CLIMATE AND ECOSYSTEM CONNECTIONS
GRADE LEVEL: 1–6
SETTING: INDOOR/OUTDOOR

TIME:

While we aim for each lesson to be about an hour, how you use our curriculum is up to you. The activities in a lesson can be done on one day, over several days, or you can choose to use some activities but not others. We have included many different options, so choose the activities that work best for your age group or time frame.

OBJECTIVES:

- Youth will learn that there are connections within the natural world and that humans are a part of these connections.
- Youth will observe living things that are part of an ecosystem.
- Youth will be able to explain producers and consumers of energy.
- Youth will be able to explain that taking care of the ecosystem has many benefits.
- Youth will be able to explain the difference between renew able and non-renewable energy.

TAKE AWAY:

We are all connected to, and rely on, the natural world. Learning about and taking care of plants, animals and people helps make the world better for everyone.

ESSENTIAL QUESTIONS:

- What is the connection between the sun and all life on earth?
- What does nature provide for humans?
- Why is it important to understand how humans are connected to nature?
- What is a community, and how do our connections support us and help us?
- How has/does human activity impact the world around us?
- What are some actions we can take to foster positive connections with each other and the natural world?

MATERIALS:

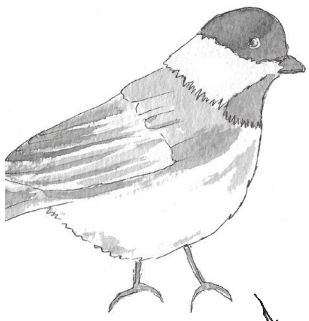
Connection Cards
Clothespins (optional)
Yarn or String
Popsicle Sticks (optional)

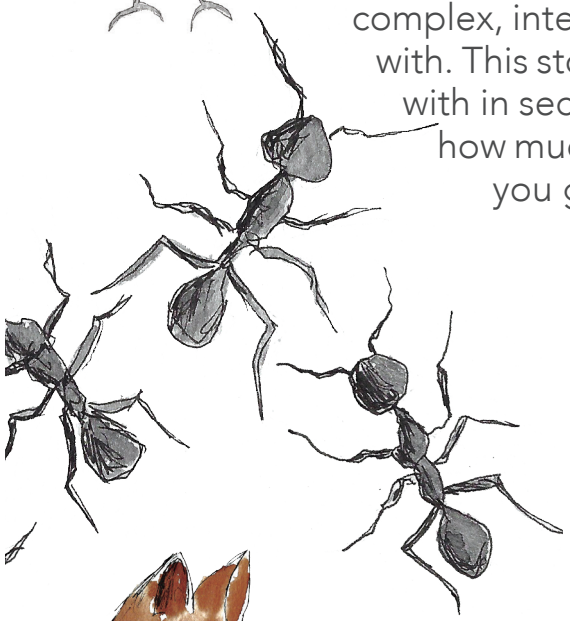
KEY WORDS TO USE:

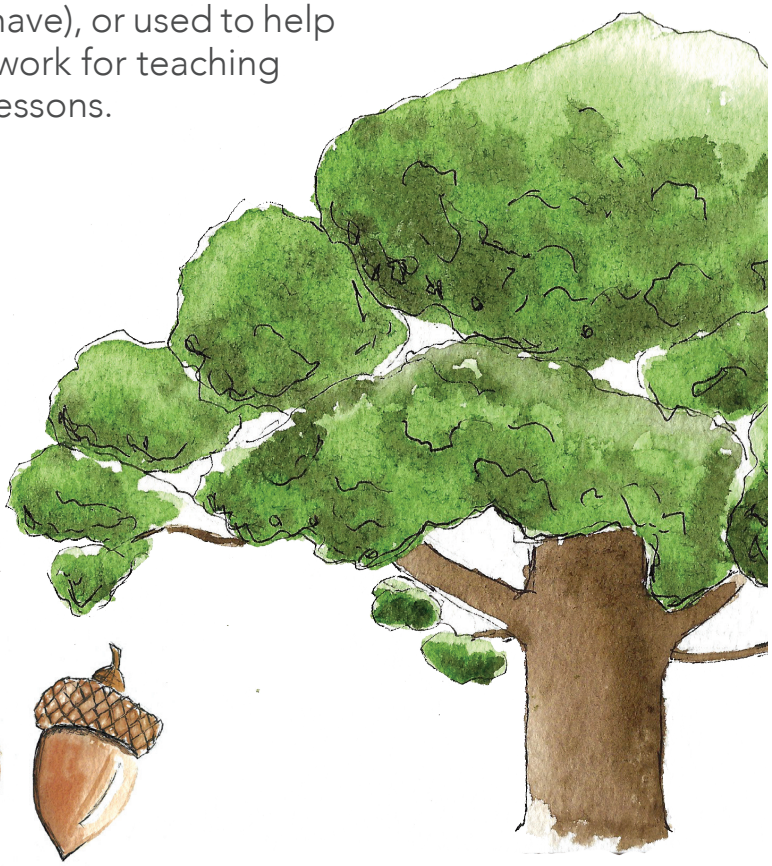
Earth
Sun/Solar
Habitat
Greenhouse Gas
Atmosphere
Climate
Weather
Steward
Photosynthesis
Carbon
(carbon dioxide,
carbon based life forms)
Ecosystem
Food Web
Energy
Producers
Consumers
Fossil Fuel

BACKGROUND AND CONTEXT:

Youth will explore how our lives are connected in multiple ways, to each other, to our communities, to our environment. These concepts will help us frame the larger conversation about the connection between human actions, climate change, and climate change solutions. We will explore how understanding the connections between humans and the natural world can lead to actions that positively impact our shared world. Read the climate story to help you frame an overall understanding of the big picture, and find some language to discuss these complex, interwoven issues with the youth you work with. This story can be read to the youth you work with in sections (depending on their age, and how much time you have), or used to help you gain a framework for teaching these lessons.







INDOOR OR OUTDOOR ACTIVITY:
CONNECTION CARDS (10–20 MINUTES)

1. Prior to the lesson, print out the connection cards. They can be laminated so that they are sturdier and reusable.

2. Have each student choose a connection card. If you have clothespins, the students can pin the card to their shirt. (This just keeps kids from fidgeting with them and helps make them visible to everyone in the group).

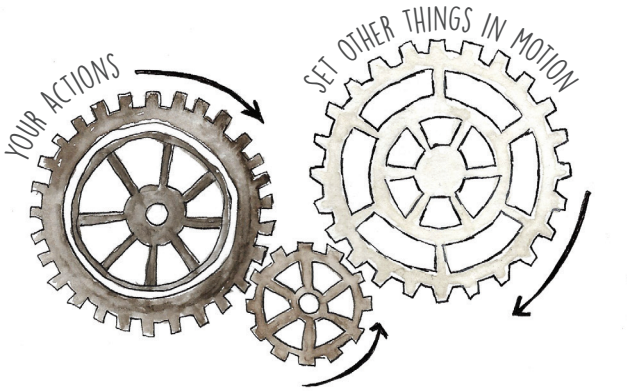
3. Have everyone sit in a circle. Each person will say what their card is, and something else in the circle that they are connected to. Explain that there are no wrong answers, because everything is connected in some way to everything else. But if anyone feels stuck, you can offer to help. By the time you have gone around the circle and everyone has had a turn, they should have made many connections. People may want to point out multiple things that they are connected to, and that is OK as well.

4. In addition to talking about and naming our connections, you can also have students toss or roll a ball of yarn. This will create a "web" of connections.

Select one person who will hold the end of the yarn or string. They will look around the circle and select someone whose card they can articulate a connection to.

For example "I am a worm, and I am connected to a bird because birds eat worms" and roll (or gently toss) the ball of yarn or string to the person holding the bird card. The worm could also choose soil - since worms live in soil.

As you can see there are many right answers. Younger students will have to be instructed and supported to both hold their section of string, and pass the ball of yarn along. This should continue from person to person until everyone is holding the string. With younger students it can be helpful to give them each a large popsicle stick, which they hold firmly in front on them.



EVERYTHING IS CONNECTED!

The instructor can then walk the yarn between students and wraps the yarn around the stick. If the students are enthusiastic the yarn can go around multiple times until there are multiple connections between different elements.

Ask students: Why isn't there only one right connection?
Answer: *Because in nature everything can be connected to everything else.*

5. After everyone is connected the leader can ask everyone to hold their yarn firmly, and then pluck the yarn between two students.

Ask the students who could feel the vibrations.
Ask students why they think that happened.
Answer: Because things are connected when one thing is impacted (storm, drought, wind) other parts of the ecosystem are impacted.

Ask one of the students (for example the tree) to drop their piece of yarn. Then ask "what happened when we cut down the tree ?"

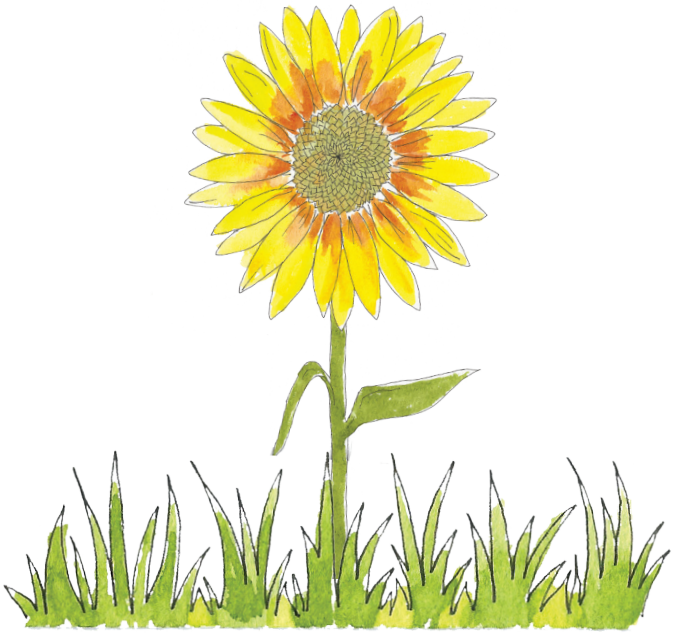
Losing one element affects all the parts of the ecosystem. The object is to show that the connections between parts of the ecosystems in our world are mutually dependent and interconnected.

WHAT AFFECTS ONE PART, AFFECTS ALL PARTS.

6. If you want to extend this activity further, everyone should keep their cards, and we will do the next activity - the Climate Change Story.

INSIDE OR OUTDOOR ACTIVITY:
CLIMATE CHANGE STORY

Explain that you will be telling a story, and they will be helping to illustrate the story with their pictures (these are the connection cards from the previous activity). Tell students they should raise their hand (or stand up if they are seated) when their picture is mentioned in the story. Read the first two paragraphs of climate change story - or have an interactive discussion based on this story.



OUTDOOR ACTIVITY:
EXPLORING OUR HABITAT WITH THE I SPY GAME (15 MINUTES)

Gather group outdoors (ideally in a place where at least some trees and plants are growing) and explain that everything that lives in the world has basic needs.

Ask if students know what those are?
Answer - everyone needs air, water, shelter, food (in other words, a habitat). Animals (including people), plants and insects have adapted to live in certain climates. No penguins live in Philadelphia (except, of course, at the zoo). Ask students to describe today's weather. Ask them to describe their favorite weather (snowy, windy, cool, warm and breezy etc.), ask them if they know what the climate is like in the Arctic? In Florida? Discuss the difference between climate and weather. (Find info in the climate change story to use). How do climate and weather affect animal and plant adaptations?

Tell students that today we will play a game of "I Spy" to observe the things that we see in Philadelphia. In other words, this is their habitat. Feel free to make up your own - the following are some examples:

I spy something an insect could eat.
I spy an animal
I spy something a human could eat.
I spy something that needs the sun to live.
I spy something that is not alive.
I spy something that lives in the soil.
I spy something that is camouflaged.
I spy something that breathes air.
I spy something that is not part of nature.
I spy someplace that a plant could NOT grow.
I spy something that flies in the air.
I spy something that lives in a tree.
I spy something cool that I will tell you about.

If you want to print this I spy activity, here is a separate link:
https://drive.google.com/file/d/1NCJuHpFnH3R-WQQXV9hNcBOFISZsCktuL/view?usp=sharing

INDOOR OR OUTDOOR ACTIVITY:
SHORT INTRO TO RENEWABLE AND NONRENEWABLE ENERGY (15 MINUTES)

Use connection cards or photos:
Show a picture of the sun and pictures of a (or several types) of power plants- gas & coal powered with smokestacks.

There is also a link to a slideshow on the resource page if using computer or tablet is easier than printing photos.

Ask and discuss
How are they alike and how are they different?

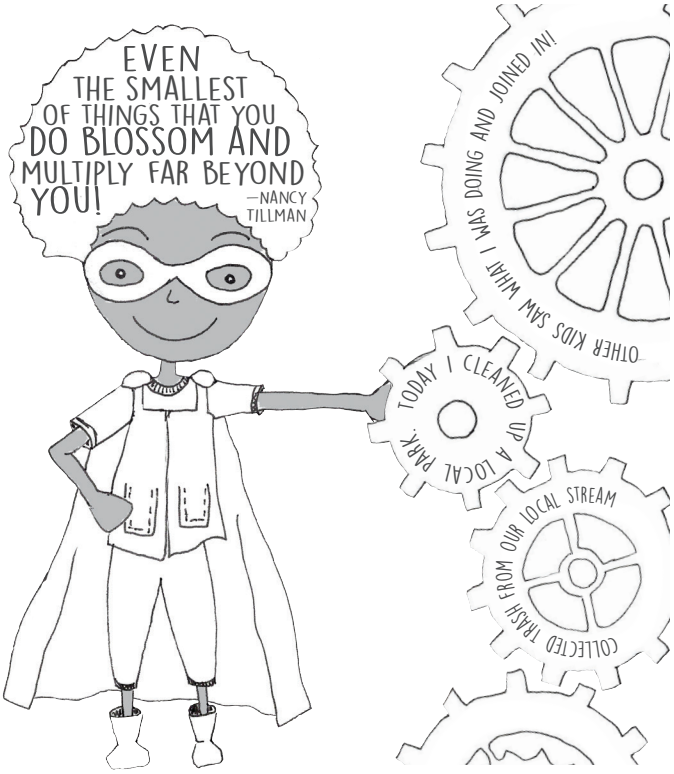
Alike: all create energy, or power. Without energy from the sun, plants could not grow and there would be no life on earth.

Different: Solar energy is renewable – it does not run out. Power plants burn fossil fuels like coal, oil, and gas. They are non-renewable because there is a limited amount in the ground. It also creates more pollution to burn things in a power plant. When things are burnt, it creates smoke or pollution.

Using the pictures of solar panels & wind turbines discuss how solar power uses the sun's energy to make electricity, and wind turbines use wind energy. These are "renewable" meaning the sun and the wind are available and won't run out - like oil and gas underground.

What are some ways that we can reduce the amount of electricity that we use, so that there is less pollution?

Answers: Use less. Use efficient appliances. Change light bulbs. Using renewable energy (solar, geo-thermal, wind turbines etc.) will also reduce pollution.



EARTH CARE HERO ACTIONS:

Each week we will list some activities that youth can do today and during the week. All participants can earn a badge for each session they attend.

- PARTICIPATE IN MAKING CONNECTIONS GROUP ACTIVITY
- BE ABLE TO EXPLAIN HOW HUMANS ARE CONNECTED TO EACH OTHER AND THE NATURAL WORLD. (ANSWERS CAN INCLUDE FOOD WEB CONNECTIONS, HOW HUMANS USE AND/OR HELP NATURE)
- COMPLETE THE "HOW AM I CONNECTED? WORKSHEET FROM THE PASSPORT BOOK.
- EXPLAIN THE DIFFERENCE BETWEEN RENEWABLE AND NON-RENEWABLE ENERGY.

You may choose to print out and provide each student with their *Climate Hero Passport*. You may also wait until Lesson 2 - connecting what was learned in lesson 1 with lesson 2 and passport activities to reinforce the idea of "making connections". Or you may hand them out at the end of the series of lessons.

CLEAN AIR HERO

LESSON 2

THE AIR WE BREATHE

BE A CLEAN AIR HERO

THEME: AIR POLLUTION
GRADE LEVEL: 1–6
SETTING: INDOOR/OUTDOOR

TIME:

30 minutes - 2 hours.
Use these ideas to fit your time-frame & group.

OBJECTIVES:

- Youth will be able to define air pollution and greenhouse gases.
- Youth will explore the connection between humans and air pollution, and discover actions that individuals and communities can do to keep the air clean.
- Youth will understand how gardens & plants connect to air quality.
- Youth will be able to define an "Urban Heat Island", and will learn ways that trees and gardens can help make our cities cooler in the summer.

TAKE AWAY:

Trees and plants are already "Clean Air Heroes" since they remove air pollutants and produce oxygen. What are some ways that we can help trees and plants to grow in the city?

ESSENTIAL QUESTIONS:

- What is air?
- What is air pollution?
- What is the greenhouse effect?
- How does air pollution affect people? (smog, difficulty breathing, greenhouse gases trap heat).
- How does man-made air pollution contribute to climate change?
- How do trees/plants help keep air cool and clean?
- How else do trees & plants help keep our cities more livable? (shade/cooling, transpiration/cooling, habitat for wildlife)
- How can we help keep trees and plants healthy?
- What are some actions we can take to be a Clean Air Hero

MATERIALS:

Paper/Poster
Crayon/Marker
3 Empty, clear 2 liter soda bottles
4 Thermometers
Water
3 Alka-seltzer Tablets

KEY WORDS TO USE:

Air Quality
Atmosphere
Climate
Emissions
Exhaust
Fossil Fuels
Gas
Greenhouse Effect
Greenhouse Gases
Heat Island
Lungs
Oxygen
Pollution
Temperature
Transpiration
Vapor

BACKGROUND/CONTEXT:

The increase in greenhouse gases that are impacting climate change come from human activities that cause air pollution. The activities include agriculture (transportation & chemicals), meat production (transportation & methane from cow burps & farts), car/truck emissions, coal and oil burning power plants that provide electricity. Climate change has made smog worse, and this makes the air unhealthy for humans and animals to breathe. This can be especially dangerous for children and for people with asthma. In parts of a city where there are fewer trees it is much hotter, and air quality is worse.

TREES ARE CLEAN AIR MACHINES - they breathe in carbon dioxide and hold the carbon in their leaves, branches and trunk. Trees & plants breathe out oxygen for humans and animals. Trees and plants can store (sequester) carbon keeping it out of the atmosphere. Trees provide shade and moisture (evaporative transpiration) to keep the air cooler. Trees and plants make cities healthier places, and more trees and plants can help combat climate change.

OPTIONAL:

Watch: Bill Nye - Climate Change 101
https://www.youtube.com/watch?v=3v-w8Cyfoq8
For a little more background:
https://climate.nasa.gov/news/2491/10-interesting-things-about-air/

INTRO:

Read Air Paragraph from the Climate Story - it is labeled for "lesson 2":

INDOOR OR OUTDOOR ACTIVITY

USING OUR LUNGS (10 MINUTES)

(BEST FOR YOUNGER STUDENTS)

1. Start out in a circle (either sitting or standing) and have students close their eyes, and quietly take 5 slow, deep breaths in and out.

Ask students to notice how they feel. What was happening with their lungs, or with their breath?

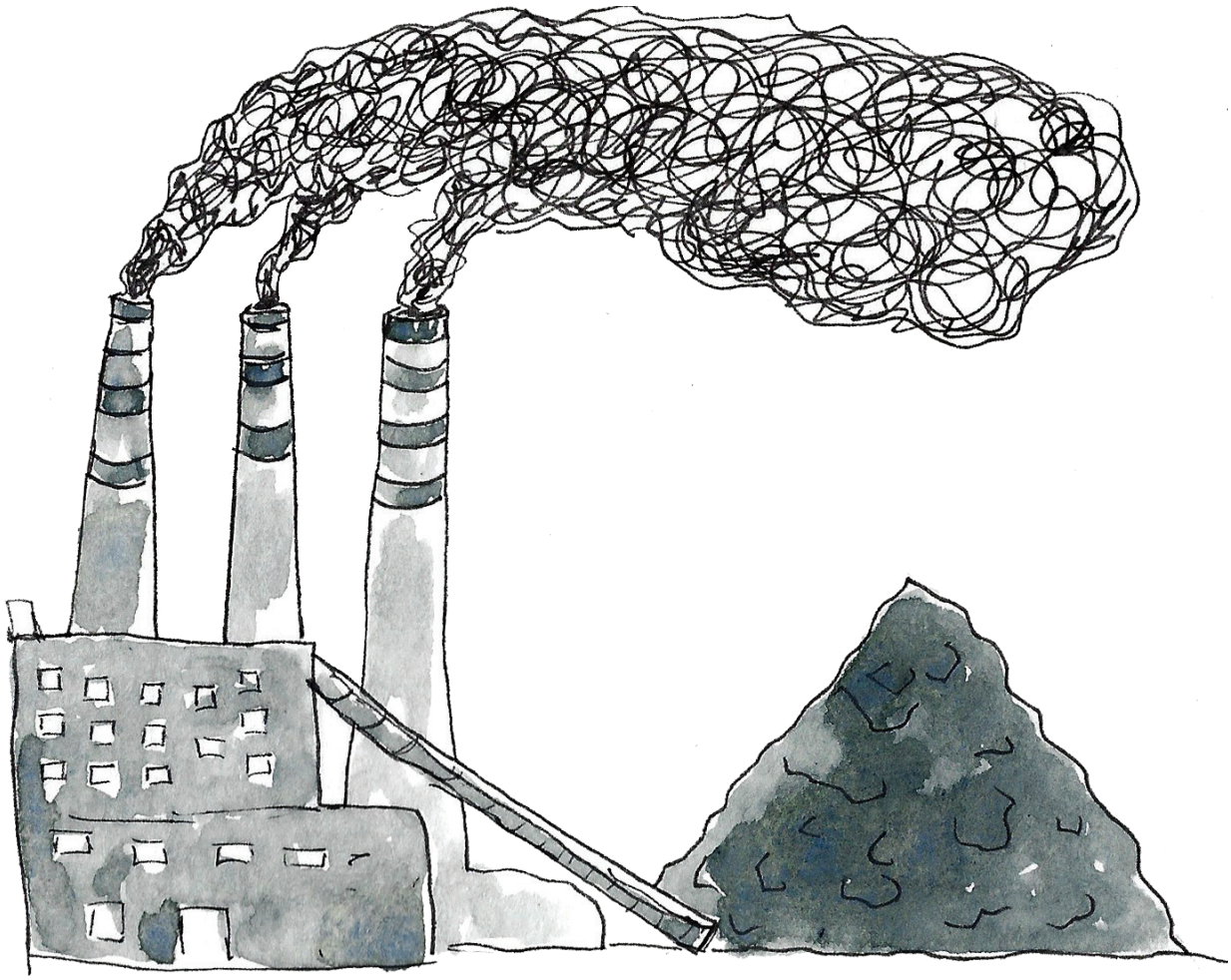
2. Students will do an exercise for 30-60 seconds, and compare how their breath felt before and after exercise. You can time the students and tell them when to stop. Exercise could be running, jumping jacks, etc.

3. When they are finished, ask them if they are breathing slower or faster? Explain that when they breathe, they are taking in oxygen from the air. This goes into their lungs, and then the oxygen is pumped by their blood to all the muscles and organs of the body. When you exercise, you start to breathe harder and faster because your muscles need more oxygen.

You can show a picture of the lungs and respiratory system while you talk about this "How Lungs Work" poster from Wisconsin DNR.

4. We cannot see the air, and only part of the air contains oxygen. Where does that oxygen in the air come from? Plants! We have a very important relationship with plants. We breathe in oxygen and breathe out carbon dioxide. The plants take in the carbon dioxide and release oxygen.

5. Ask students to explain how breathing air full of water (on a hot humid day), smoke (near a BBQ or smoker), vehicle exhaust (on a busy street) might make them feel? Help them make the connection between how they feel and the quality of the air they are breathing.



INDOOR OR OUTDOOR ACTIVITY

DEFINING POLLUTION (10 MINUTES)

MATERIALS:
Paper/poster or whiteboard
Marker

PROCEDURE:
Write the words "Air Pollution" in the center of your whiteboard or large sheet piece of paper. Ask the students what they know about air pollution and write down all of their thoughts about pollution. You can connect ideas in a mind-map, or just list them.

At the end go over all the answers and give a definition of air pollution.

Sample definition: The air is full of gases, but when we burn things (fossil fuels, wood) it can add smoke or gases to the air. This is not good for anyone, and can make it more difficult for people with asthma to breathe. The gases can also trap in heat causing the greenhouse effect. Explain how air gets polluted: there are emissions from power plants (burning fossil fuels), car exhaust (burning gasoline), raising cows for meat (methane burps and farts). Not ALL air pollution is man-made since forest fires also create a lot of smoke and cause pollution. However, there have been more forest fires lately in places like California, and that could be caused by climate change and drought.

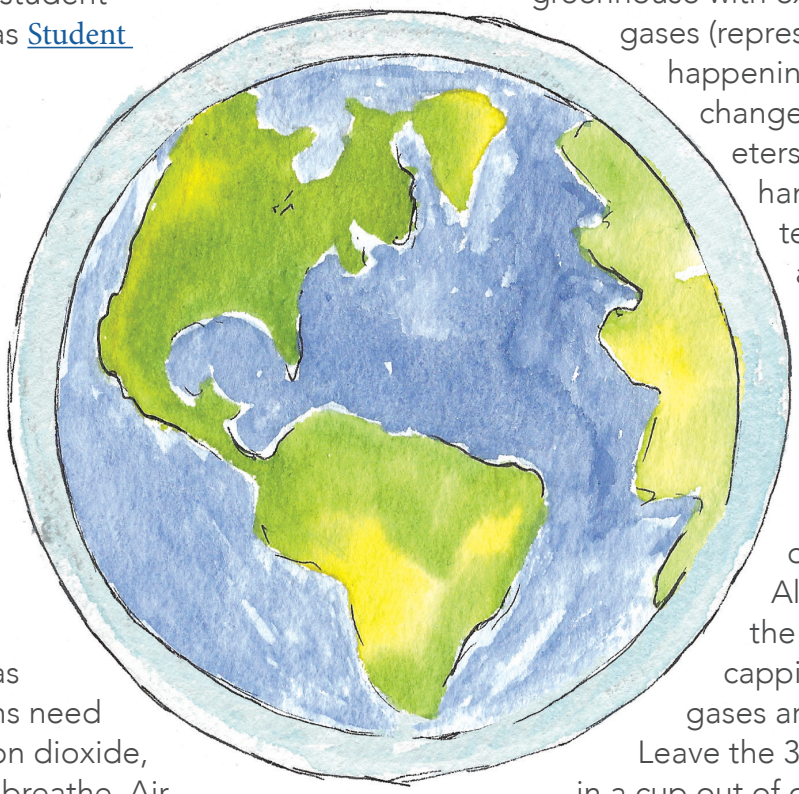
DEBRIEF: Discuss some of the ways that humans have added more carbon dioxide to the atmosphere (generally by burning fossil fuels). For this lesson, focus on transportation and air pollution. If you are outdoors, take a look at the cars, buses and people walking on the street. What are some choices that we can make that would produce less air pollution? We can use cars less, and we can walk, bike, or take the bus instead of driving.

INDOOR OR OUTDOOR:
EXPLORING THE GREENHOUSE EFFECT
45 MINUTES

NOTE: this experiment will only work outdoors on a SUNNY day! If it is overcast it will take longer for any changes in temperature to become apparent. If it is not sunny or you cannot go outdoors, then you can set up the same experiment using a desk lamp and an incandescent light bulb.

MATERIALS:

2 empty, clear 2-liter soda bottles
3 inexpensive plastic student Thermometers such as Student Thermometer for Sale
Water
3 alka-seltzer tablets
Optional - Desk lamp with incandescent bulb. This is only needed if you are doing the experiment indoors.



PROCEDURE:

Ask students to tell you what they know about air. Explain that it is a mixture of different gases such as oxygen, which humans need to breathe, and carbon dioxide, which plants need to breathe. Air also contains other gases (nitrogen, methane, etc.) that we can learn about another time.

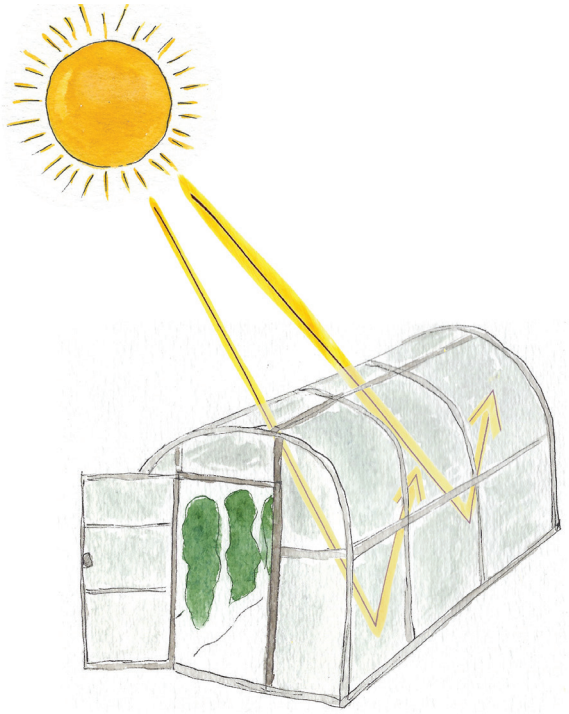
Remind students that our atmosphere is a layer of these gases that surround the earth, and keep some of the heat in - like a thin blanket that wraps the earth and keeps just the right amount of heat in. We call these greenhouse gases. Show a picture of a greenhouse and explain how the glass of a greenhouse keeps the heat from the sun inside a greenhouse, like the gases around the earth keep some of the heat around the earth. When more CO_2 and methane get into the air (from cows farting, and oil and gas burning) the blanket around the Earth gets thicker and the temperatures change.

Explain that we are going to do an experiment to see how a greenhouse works and what happens when there are too many greenhouse gases in the air.

Gather your supplies. Fill two bottles half-way with room temperature -not cold - water (this is important). One bottle will function as a greenhouse. One will function as a greenhouse with extra greenhouse gases (representing what is happening with climate change). Tie the thermometers to a string and hang the thermometers inside the bottle, above the water, with the other end of the string coming through the opening of the bottle. Screw the bottle cap back on one bottle. Add 3 Alka-Seltzer tablets to the other bottle, quickly capping it so the extra gases are trapped inside. Leave the 3rd thermometer in a cup out of direct sun, just to get a reading of the outside air temperature. You can use other types of bottles or jars, and should adjust the number of Alka-Seltzer tablets accordingly.

Tell students that we are going to leave our experiment in the sun to see what happens. Ask them to guess (hypothesize) what will happen. Move on to another activity (see below) while you wait.

When you return you will see differences in temperature between the two bottles - and between the bottles and the ambient temperature (3rd thermometer). The bottle with water and air (no alka-seltzer) will be a



GREENHOUSE EFFECT

THE SUN'S HEAT IS TRAPPED INSIDE THE GREENHOUSE BY THE GLASS ROOF JUST AS CARBON DIOXIDE IN THE EARTH'S ATMOSPHERE TRAPS THE HEAT OF THE SUN AS IT BOUNCES OFF THE EARTH.

little warmer than the outside temperature - like a greenhouse. If you use cold water, and don't have time to leave the bottles outside in the sun long enough this temperature change may not occur. If you are short on time, or it is a cloudy day, just note the difference between the two bottles - but do not worry about comparing these temperatures to the air. The bottle with the alka-seltzer released extra carbon dioxide (CO2) into the air and the temperature inside this bottle will be higher than the bottle with just the regular amount of CO2 in the air.

DEBRIEF: The empty bottle is like a regular greenhouse. Alka-Seltzer tablets were used because when placed in water they cause a chemical reaction that produces carbon dioxide. This will cause an increase in carbon dioxide in one of the sealed 2-liter bottles which should register higher temperatures when placed near a strong light/heat source. Carbon dioxide is a greenhouse gas that is naturally occurring, but humans have added more to the atmosphere which causes temperatures to rise.

WHEN DOING THIS INDOORS:
Set up a station with the incandescent bulb in a desk lamp. Place the two jars: water only, and alka-seltzer bottles both with thermometers inside side by side equal distances a few inches from the light. Tilt the light as needed so it is shining right on the bottles. The incandescent bulb will function as the sun - as it will emit heat. If you have a second desk lamp with a CFL or LED light turn this on too, and as a bonus, students can use their hands (hovering nearby both light bulbs - or with the infra-red thermometers in your kits) see exactly why CFL bulbs are more efficient - they give us light without wasting the energy on heat! NOTE: take a minute to emphasize the value of CFL/LED lights as energy efficient, cost effective and tangible ways to reduce greenhouse gases in your home, school, rec center etc.

ALTERNATIVE ACTIVITY: if you have access to an unheated greenhouse or high tunnel you can simply let students go inside the greenhouse or high tunnel and experience that it is warmer inside the greenhouse. You can ask them why they think this is so. Explain that the warmth is caused by the sun shining through the glass or plastic and staying trapped inside, which warms up the air just like a thick blanket of gases around the earth traps in the heat of the sun. When the heat bounces off the Earth, it makes the Earth warmer than it would be if the gas "blanket" wasn't there. It is also warmer inside because you are protected from winds.

OUTDOOR ACTIVITY:
URBAN HEAT ISLAND (45 MINUTES)

MATERIALS:
3 thermometers
Sheet of white paper (or a white towel, t-shirt, etc)
String (optional)

PROCEDURE:
Tell students that in the city, it can be a lot hotter than in a forest. Why do they think that is? What would you find in a forest? (trees). What do we have in the city? (buildings, cement, asphalt). We are going to do an experiment to measure the temperature in different places and on different surfaces.

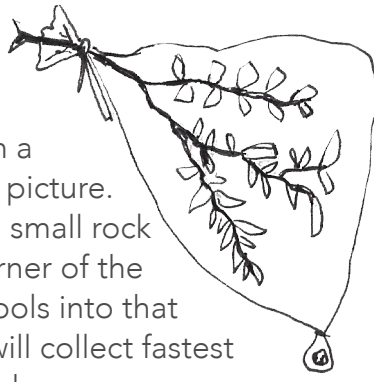
Brainstorm with students – if we want to measure the difference between temperature in a city and temperature in a forest, how can we do that without leaving? Where can we put our thermometers?

While guiding students to come up with the locations themselves, you will place one thermometer in the sun on the asphalt. Place another thermometer in the sun, but on a sheet of white paper. Place the last thermometer in the grass under a tree, or use the string to hang it from a branch so that it is "in the tree". Come back to the thermometers later in the lesson to compare the temperatures. If you have access to a handheld digital thermometer (gun type) students can get immediate temperature readings from a range of places.

DEBRIEF: Cities are several degrees hotter than a forest because dark surfaces like asphalt and pavement absorb heat. A light colored surface (like the white paper) reflects heat. Trees also help to cool the air by releasing water vapor through transpiration. This is like sweating! When you get hot, your body sweats because it cools you down (sort of like running through a sprinkler would cool you down). Trees do this too, only when trees do it, they also cool the air around them. Trees also produce shade, which is cooler than being in the sun.

INDOOR OR OUTDOOR ACTIVITY:
OBSERVING TRANSPIRATION (10 MINUTES)

MATERIALS:
Plastic bag
String
If indoors, a potted houseplant

PROCEDURE:

Outdoors - Tie a plastic bag around a bunch of leaves on a tree as shown in the picture. You can also place a small rock or pebble in one corner of the bag so that water pools into that area. Transpiration will collect fastest on a hot, sunny, dry day.


Indoors – Water your houseplant well. Put a bag around the whole plant, and place the plant in a sunny window. You will probably need to leave the bag on overnight.

Show students the bag with water collected inside of it. Ask what they think happened? Why is there water?

Explain that the water came from the leaves of the tree, and this is transpiration. The water vapor cools down the tree and also cools off the air around it. It is like when a person sweats on a hot day. The sweat is meant to cool you off, much like running through a sprinkler would cool you off. Your breath also has water vapor. If you breathe on a piece of glass or a mirror, you should be able to see moisture on the surface.

Trees are important in the cities for many reasons. The effects of transpiration cool off the air all around the tree, and the shade also helps keep us cool. Trees also help reduce air pollution. The more trees we have in the city, the cooler and healthier we all will be.

OUTDOOR ACTIVITY:
GET TO KNOW A TREE (5–10 MINUTES)

PROCEDURE:
Discuss how to take care of a tree - don't break branches or climb on young trees. Water them when first planted and for first year, mulch them and prune them if needed. Look at a tree nearby (or several trees). Has it been well taken care of? Does it look healthy?

GAME:
WHAT GOOD ARE PLANTS? (5–10 MINUTES)

MATERIALS:
Ball
Paper or whiteboard (optional)

PROCEDURE:
Brainstorm things that come from trees and plants (oxygen, many different fruits and nuts, clothing, houses, furniture, shade, wildlife habitats, beauty/landscape, erosion control). Write these down on a piece of paper or whiteboard for everyone to see the list.

To start the game everyone stands (or sits) in a circle. Toss the ball, and whoever catches it says something that comes from trees. If they can't think of anything within about 5 seconds, they are out.

BONUS: If you are working in a garden, you can mention the idea of Food Miles (which will be discussed again in lesson 6). Mention that the trucks that transport tons and tons of food into our city every day from far away add to air pollution - explain how eating even some food you grow yourself, or that grows nearby, helps keep the air clean.

CLEAN AIR HERO ACTIONS:

Since this day has so many activities - you may choose to work on one or two of these at the beginning of the next session as a review to help connect the lessons.

- MAKE A TREE TAG: "I AM A CLEAN AIR MACHINE" OR "TAKE CARE OF ME BECAUSE I HELP KEEP THE AIR CLEAN"
- MAKE A SIGN TO REMIND EVERYONE TO TURN OFF LIGHTS WHEN NO ONE IS IN THE ROOM, OR TO TURN OFF THE TV WHEN NO ONE IS WATCHING. (USE LESS ENERGY FROM POWER PLANTS)
- MULCH A TREE – PROTECT ROOTS, KEEP MOISTURE IN
- TALK ABOUT TAKING CARE OF TREES.
- HELP IN THE GARDEN TO GROW FOOD THAT DOESN'T HAVE TO TRAVEL

HANDOUTS/RESOURCES TO SHARE:

How to get a street tree or yard tree

CLEAN WATER HERO

LESSON 3
CONNECTING GARDENS TO WATER

BE A CLEAN WATER HERO

THEME: WATER POLLUTION
GRADE LEVEL: 1–6
SETTING: INDOOR/OUTDOOR

TIME:

30 minutes - 2 hours.
Use these ideas to fit your time-frame & group.

OBJECTIVES:

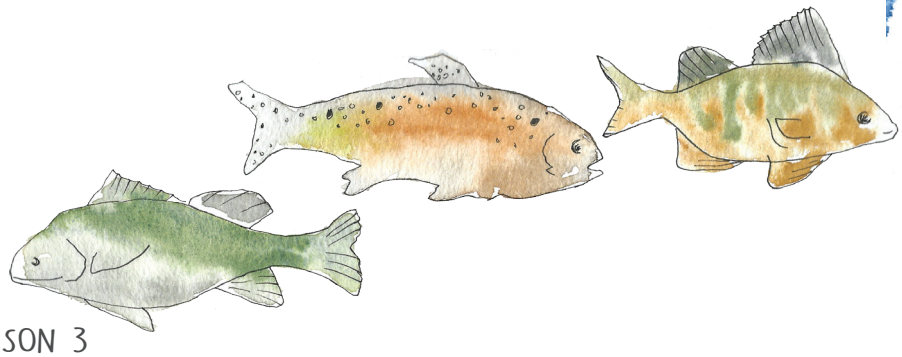
- Youth will be able to explain that water is a valuable and finite resource. Without clean water we would not have life on earth as we know it.
- Youth will be able to describe a storm drain and will understand what happens to trash in the streets when it rains.
- Youth will be able to list several ways that we as individuals can protect waterways.
- Youth will learn that our Phila Tap Water is clean and safe.

TAKE AWAY:

Don't Litter. Keep our streets clean - much of the trash goes from the sewer drains right into rivers. "Street to Stream." Gardens and Trees help keep water clean.

ESSENTIAL QUESTIONS:

- Why is water important?
- Where does our water come from & where does it go?
- What is water pollution?
- How can we keep our water clean? (less trash)
- How do cities differ from forests with respect to water?
- How do trees, plants, gardens & green spaces in cities impact water?
- How does gardening, growing and caring for trees impact clean water?
- What are some actions we can take to be a Clean Water Hero?



MATERIALS

Blank paper (or scrap paper)
Water based markers (not permanent)
1-2 spray bottles
Clear plastic container large enough to hold the aluminum pan.
Aluminum pan
Black duct tape
Yellow duct tape
Grey duct tape
Watering Can

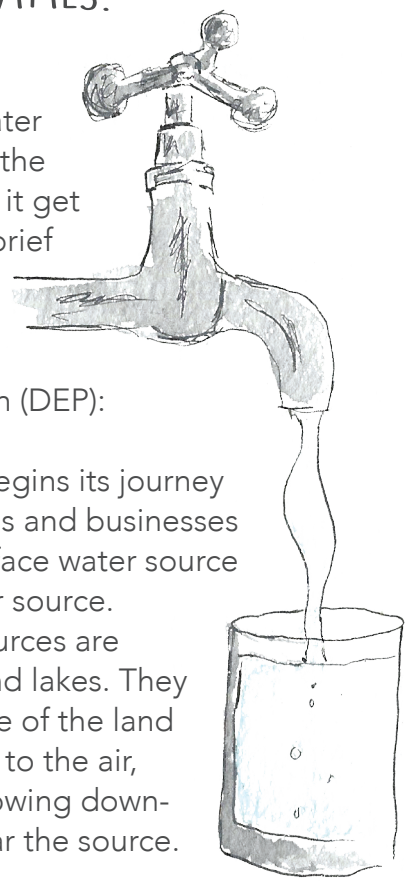
KEY WORDS TO USE:

Watershed
Runoff
Stormwater
Permeable Surface
Impermeable
Drain
Rain Garden
Rain
River
Upstream
Downstream
Groundwater
Pollution
Stream
Litter

BACKGROUND/CONTEXT:

Many Philadelphia storm drains lead directly to Philadelphia's rivers, the Schuylkill and the Delaware. These rivers flow into the Delaware Bay and then out to the ocean (If you have a large map of the area, you can show students on the map where Philadelphia is located, and point out the rivers. If you don't have a printed map, bring it up on the computer). Litter, pet waste, leftover paint, oil from cars, and cigarette butts pollute the water where animals and fish live. These rivers are also the source of the water we use in our houses and schools, although they are cleaned by the Philadelphia Water Department before they reach our homes and are tested for water quality. We have some of the best and safest municipal water! Climate change will impact our region's water supplies in multiple ways. such as when increased precipitation leads to increased levels of pollutants washing into our waterways. The roots of trees and plants are a huge help in filtering pollution and help slow down stormwater runoff that would otherwise end up polluting our creeks and rivers. The Philadelphia Water Department is a great resource for understanding the water that flows through your tap, and also an incredible resource for planting and taking care of gardens around the city to help keep the water in our streams, rivers and our faucets clean and safe.

WATER ACTIVITIES:



Ask students to explain where water comes from- yes the tap! But how did it get there? Here is a brief summary from the PA Department of Environmental Protection (DEP):

Drinking water begins its journey to homes, schools and businesses from either a surface water source or a groundwater source. Surface water sources are streams, rivers and lakes. They are on the surface of the land and are exposed to the air, rain and water flowing downhill from land near the source.

Groundwater is in the ground, not on top of it. We pull it up from wells drilled into the ground. Most groundwater comes from rain and melting snow soaking into the ground. Water fills the spaces between rocks and soils, making an "aquifer."

About half of our nation's drinking water comes from groundwater. Most is supplied through public drinking water systems. Everything we use, wear, buy, sell and eat takes water, and we can learn from nature how to keep our water clean and safe.

AND/OR Explain in your own words hydrologic cycle. Learn more here:

https://pmm.nasa.gov/education/water-cycle/hydrologic-cycle

https://blog.nationalgeographic.org/2014/03/19/the-urban-water-cycle-sustaining-our-modern-cities/

INDOOR OR OUTDOOR ACTIVITY:
STORMWATER RUNOFF (15 MINUTES)

GUIDING QUESTION:
Where does water go when it rains? What is stormwater runoff? Why is it harmful?

MATERIALS:
- **Blank paper** (to be more environmentally friendly, this could use scrap paper that has been printed on one side),
- **Water based markers** (not permanent)
- **1-2 spray bottles** filled with water
- **Clear plastic container** – large enough to hold the aluminum pan.
- **Aluminum pan** (Make it look like a city street with a sidewalk using **black duct tape** (street), **yellow duct tape** (road lines), **gray duct tape** (sidewalk)

Cut a small slit in the side of the aluminum pan - this is the stormwater drain. The water will represent Philadelphia's rain and runoff.

PROCEDURE:
Ask students what sort of trash might be found on a city street? You can talk about plastic bottles, bags from potato chips, plastic grocery bags, cigarette butts.
Ask who has a dog, and do they always pick up the dog poop? Do you ever see dog poop on the street or sidewalk? Explain that cars also sometimes leak oil onto the roads.

Give each student a few small sheets of paper (you could cut a regular sized sheet into 4-6 pieces). Use markers to draw on the paper. Students can draw pictures of trash or pollution, or just do scribbles.

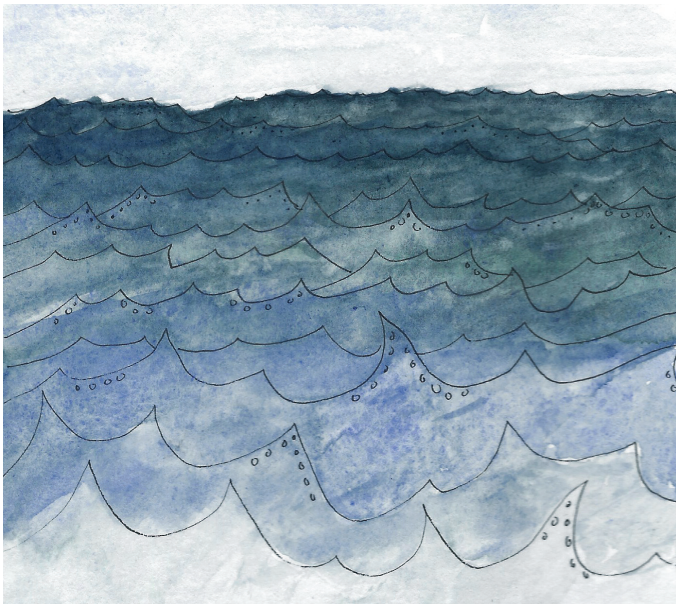
When the drawings are finished put the papers in the tin pan. Place the aluminum pan over the plastic container so that water drains into the plastic container. Have students simulate a rainstorm by filling the pan with a small amount of water using the spray bottle. Pass around the spray bottles so that everyone gets a turn to make a "rainstorm".

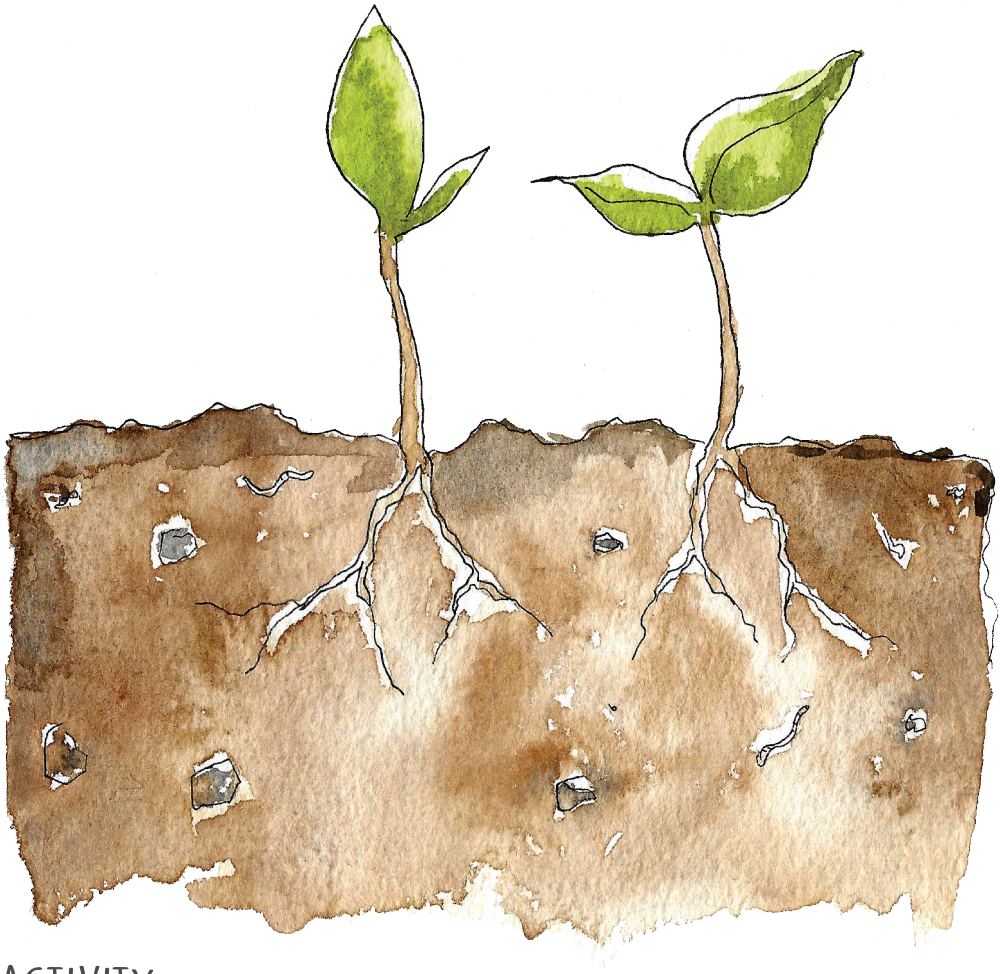
Students will then make observations of where the trash and runoff goes when it rains by looking at how the colors from the markers run into the plastic container below.

Discuss if this water looks safe to drink or swim in. What would happen to the animals who live in the water when there is trash and pollution?

NOTE: Cigarette butts are particularly bad as they contain chemicals that kill aquatic life, and the filters take about 12 years to biodegrade.

DEBRIEF: In Philadelphia, about 40% of our stormwater drains lead directly into the rivers. Trash that is on the street often ends up in the water. The other 60% of storm drains into the city's combined sewer systems - meaning that it also contains the water and sewage from our homes and buildings. During dry days, this water gets treated before going out to the river. However, during heavy rain events, there is too much water for the treatment plants and both trash and raw sewage (from flushing the toilet) can get dumped directly into the rivers - gross!





OUTDOOR ACTIVITY
(CAN BE ADAPTED FOR INDOORS):
PERMEABLE AND IMPERMEABLE SURFACES
(5–10 MINUTES)

Some surfaces allow water to pass through and other surfaces cause the water to run off. Using watering cans, show what happens when it "rains" on grass, a garden or a planted area vs. asphalt or pavement.

The grass/garden/soil will soak the water up, although if it rains a lot, some may end up in groundwater, which is also fine. The water will run off the pavement, and if there was a rainstorm it would flow into the storm drains.

Students saw in the previous activity what happens when litter gets washed into storm drains. Probe students to make the connection between the two activities. (water running off pavement fills goes directly into storm drain, but gardens/grass can soak up water).

NOTE: If you cannot do this activity outside, you can set up a demo indoors. Fill a container or a flower pot with soil (make sure there are plenty of drainage holes). Have a second identical container that is empty (it should also have drainage holes). Put each container over a tray and pour the same amount of water into each. Measure how much water comes through and ends up in the bottom tray.

Explain that there are "permeable pavers" that can be used that can look just like regular pavement, but it allows the water to pass through.

Which would be better for us to use in the city? (more permeable surfaces mean less water in our storm drains, and ultimately less trash/ sewage in the water when there is heavy rain).

INDOOR ACTIVITY:

VIDEO (15 MINUTES)

1. If a laptop or tablet is available, show "Trash Talk" Video from NOAA. https://marinedebris.noaa.gov/discover-issue/trash-talk

2. Show infographic, "How Long Does it Take to Break Down?" Discuss where our trash goes and what happens to it.

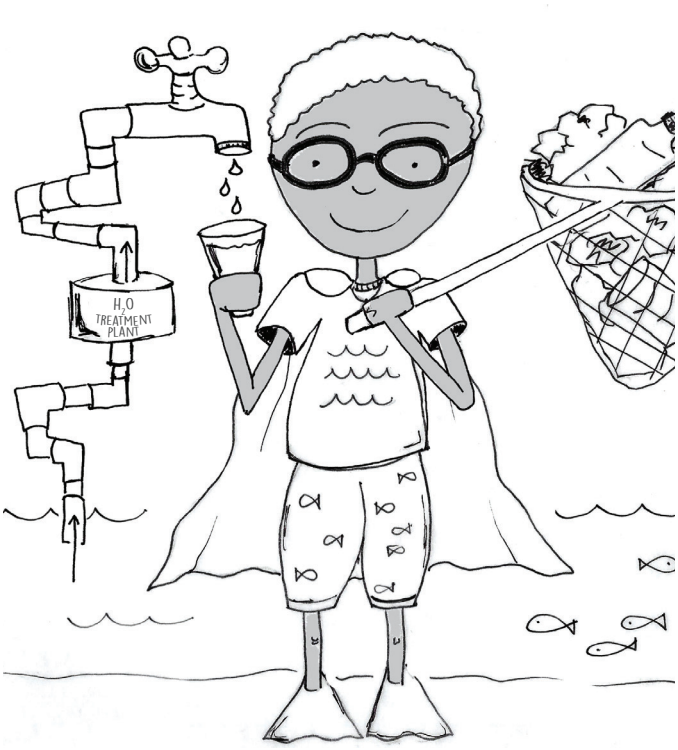
OPTIONAL DISCUSSION:

Do you and your family drink tap water? Why/why not?

Use a sheet of paper or a whiteboard to take a tally and count how many are in each column. Review the Drink Philly Tap handout, Drink Philly Tap Handout and share this resource with students.

Explain that Philly Water is safe and is tested regularly. It also has fluoride added, which is good for your teeth. Bottled water is not always tested for safety, and might not be as safe to drink. People who live in old houses might be concerned about their pipes, and the Philadelphia Water Department will help homeowners evaluate the safety of pipes inside their home.

Each single use bottle of water has to be shipped on a truck (air pollution), and the empty bottles have to be disposed of and often end up as plastic pollution in waterways (water pollution). Plastic never really decomposes, and will always remain in our environment - Plastic bottles can take 450 years to break down and it just breaks up into smaller and smaller bits of plastic until it is microscopic. But the plastic still ends up in our water, and then in the bodies of animals and humans. We should recycle plastics whenever possible. It will never really disappear from our environment.



CLEAN WATER HERO ACTIONS:

- HELP IN A GARDEN
- TAKE CARE OF A TREE
- MAKE SURE YOUR TRASH GOES INTO A TRASH CAN
- PICK UP TRASH OFF THE GROUND BEFORE IT GOES DOWN THE DRAIN
- CLEAN UP AFTER YOUR PET IF HE/SHE POOPS OUTSIDE
- CLEAN YOUR SIDEWALKS WITH A BROOM, NOT A HOSE. AND DON'T SWEEP THE TRASH INTO THE STORM DRAINS.
- DON'T USE CHEMICAL FERTILIZERS OR PESTICIDES AROUND YOUR HOUSE. THEY CAN WASH INTO STORM DRAINS AND END UP IN A STREAM.
- DON'T FLUSH MEDICINE, CHEMICALS OR TRASH DOWN THE TOILET.
- NEVER PUT SOMETHING DOWN A STORM DRAIN THAT MAY HURT A FISH.
- DRINK PHILLY WATER — LESS PLASTIC MEANS LESS WASTE.

RESOURCES:

Soak it Up Adoption Grants
Rain Check Program (Rain Barrel)
Drink Philly Tap (multiple languages)

CLEAN EARTH HERO

LESSON 4

REDUCE, REUSE, RECYCLE & COMPOST!

BE A CLEAN EARTH HERO

THEME: LOWERING OUR CARBON FOOTPRINT
GRADE LEVEL: 1–6
SETTING: INDOOR/OUTDOOR

TIME:

15 minutes - 2 hours.
Use these ideas to fit your time-frame & group.

OBJECTIVES:

- Youth will be able to identify which materials can be recycled in Philadelphia.
- Youth will be able to define compost as the healthy decomposition of things that were once alive.
- Youth will be able to identify which items can go into compost.
- Youth will be able to explain how reducing and reusing can help with climate change.
- Youth will be able to explain how composting and recycling can help with climate change.

TAKE AWAY:

Nature has ways of "recycling" nutrients, however humans have created many materials like plastics that do not break down naturally. As stewards of this planet, we can rethink our choices, refuse single use materials, reduce consumption, reuse everything, refurbish old stuff, and repurpose/upcycle (be creative). Lastly, we can recycle.

ESSENTIAL QUESTIONS:

- Where does trash go when we throw it away?
- How does nature recycle & reuse?
- What are some creative ways to use less?
- What can be recycled?
- What can be composted?
- What is biodegradable?
- What are some actions we can do to waste less and be a Reduce, Reuse & Recycle Hero?
- What are some actions we can take to be a Clean Air Hero?

MATERIALS:

Bucket full of active compost

Hand lenses

Chopsticks, plastic spoons

5-10 small containers
(plastic take-out containers work well)

Laminated copies of "soil life" handout and "compost critters info sheet"

Optional - bug boxes
(lid has magnification)

3 buckets or small trash cans

Variety of different materials
(cotton fabric, paper, leaves, sticks, rocks, aluminum cans, glass bottles, plastic, batteries, juice box, fruits/ vegetables, food packaging)

Optional - gloves

KEY WORDS TO USE:

Compost
Waste
Natural
Decay
Fungus
Bacteria
Insects
Decompose
Trash
Landfill
Biodegradable

BACKGROUND/CONTEXT:

Nature recycles by bio-degrading and recycling nutrients. How can we connect these lessons from the garden into our day to day practices. Reducing our waste has a big impact on the earth and on climate change.

When you throw something away - where do you think it goes? If you throw it on the sidewalk or street it may go down the storm drain. If you dispose of it in a trash can it will be processed either to a landfill where it is it is either buried (which can pollute the water,) or incinerated (burned) which can generate some energy but also pollutes the air. If you put it in a recycling bin properly, it will be recycled. Throwing something "away" means it just goes somewhere else - and since many things we use once don't decompose, or bio-degrade, they may be there for a very, very long time!

SOME FACTS FROM THE PHILADELPHIA STREETS DEPARTMENT:

IN THE U.S. 350,000 NEW CANS ARE PRODUCED EVERY MINUTE.

A CAN THAT IS THROWN AWAY WILL STILL BE A CAN 500 YEARS FROM NOW.

Every month we throw out enough glass jars to fill up Philadelphia's Municipal Services Building.

AMERICANS USE 85,000,000 TONS OF PAPER A YEAR, ABOUT 680 POUNDS PER PERSON.

A GLASS BOTTLE TAKES ABOUT 4,000 YEARS TO DECOMPOSE, MAYBE NEVER IN A LANDFILL.

Each ton of recycled paper can save 7,000 gallons of water.

PAPER PRODUCTS THAT SHOULD BE RECYCLED MAKE UP THE GREATEST PORTION OF OUR TRASH — ABOUT 60%.

THE AMOUNT OF WOOD AND PAPER WE THROW AWAY ANNUALLY IS ENOUGH TO HEAT 50,000,000 HOMES FOR 20 YEARS.

The energy saved from recycling one glass jar can run a 100-watt light bulb for 4 hours!

OUTDOOR ACTIVITY
(CAN BE DONE INDOORS IF NEEDED)
COMPOST ORGANISMS (15 MINUTES)

MATERIALS:
- Bucket of active compost
- Chopsticks, plastic spoons (for searching the compost)
- 5-10 small containers (plastic take-out containers work well)
- Hand lenses
- Copy of the handout "Soil Food Web"

PROCEDURE:
NOTE: You might be able to get active compost from a community garden, farm, or through the Philadelphia Community Compost Network. In a pinch, really good topsoil with lots of worms and other decomposers will work.

Intro: Tell students that today we will be learning about trash, recycling and compost. Show students the bucket of compost and ask students to make observations about what they see. Has anyone heard of compost before? What is compost? Everything in the bucket was once "trash" but instead it became soil that we can use. Explain that compost is biodegradable material like food or plants that have been decomposed by the FBI (fungus, bacteria, insects).

Students will work with a partner. Educator will put a shovel full of compost into a container. Students will be able to examine the contents with their hands, or they can use small tools (chop sticks, plastic spoons).

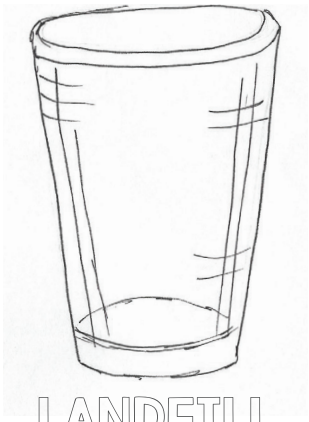
Students will look through the compost and see what they find. Hand lenses and bug boxes can also be provided. Encourage students to treat worms and other critters with care.

DEBRIEF: Educator should go over the handout with the soil food web. Decomposition generally starts with bacteria, which cannot be seen without a microscope. These are good bacteria! Many people think all bacteria are bad, but they are not. In soil, microorganisms eat the bacteria, and so on up the food chain. All life on earth depends on soil, and soil depends on the FBI (fungus, bacteria, insects). Without soil, there would be no plants, and without plants, there would be no animals, including humans.

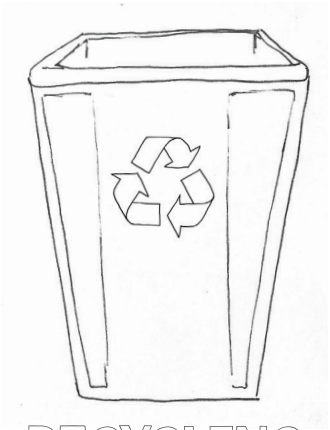
NOTE: We also have lots of good bacteria in our bodies and in our gut. In our bodies there are about the same number of human cells as bacteria cells (National Geographic. Greshko, Michael. January 13, 2016).

"IT'S REALLY EASY TO FORGET THAT WE LIVE IN A MICROBIAL WORLD. THEY'RE EMPERORS OF OUR PLANET." - Carolyn Hovde Bohach.

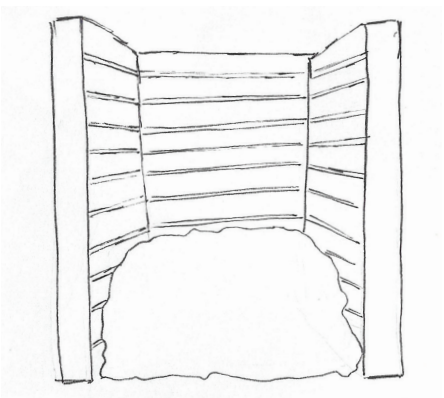
Learning how to compost properly is not difficult, and there are lots of groups ready to assist you. Our resource page can help you find help. Compost helps the soil, helps the planet, and is a normal part of the ecosystem in a forest or natural environment.



LANDFILL



RECYCLING



COMPOST

INDOOR OR OUTDOOR ACTIVITY:
SORTING OUR WASTE RELAY (20 MINUTES)

MATERIALS:
For this activity you will need a "waste pile" with an assortment of different materials (cotton fabric, paper, leaves, sticks, rocks, aluminum cans, glass bottles, plastic, batteries, juice box, fruits/vegetables, food packaging, foil). These can come from a trash or recycling bin at your facility, but it might be best to sort first and make sure materials are clean. Kids can also get gloves. You will also need 3 different bins marked "Landfill", "Recycling", "Compost".

PROCEDURE:
Ask students which objects are biodegradable? Definition of biodegradable: capable of being decomposed by bacteria or other living organisms.

What does it mean to be recyclable? Reusable? Go through all the items in your waste pile and help students to decide where each one belongs: in the compost bin, recycling, or landfill. After we have gone through, dump everything out again. Tell students that we will sort the materials again, but this time it is going to be a race!

You can divide students into teams, or just tell them that as a group we will see how fast we can all do it together and you will use a stopwatch to keep time. Set it up as a relay race with the buckets running distance from the waste pile.

DEBRIEF after the race, and see if we correctly placed items in the compost, recycling, or landfill buckets. Go through each bucket and take out items that don't belong. Ask participants why we might want to recycle and compost? How can we reduce the amount of waste that CANNOT be recycled or composted? If any of the following answers are missing, make sure to discuss these.

CREATING LESS TRASH IS BETTER FOR OUR PLANET.

WHEN YOU BUY FOOD, TRY TO BUY THINGS THAT ARE NOT INDIVIDUALLY WRAPPED SINCE THIS PRODUCES MORE TRASH. ALSO LOOK FOR PACKAGING THAT CAN BE REUSED OR RECYCLED.

BY COMPOSTING AT HOME, WE CAN PUT LESS IN THE LANDFILL. WHEN FOOD WASTE GOES TO THE LANDFILL, IT UNDERGOES ANAEROBIC DECAY AND PRODUCES METHANE GAS – A VERY POTENT GREENHOUSE GAS.

17% OF GREENHOUSE GASES IN THE USA COME FROM LANDFILLS. BY RETURNING BIODEGRADABLE MATERIAL TO THE SOIL, WE ARE CARING FOR THE ENVIRONMENT.

ADDING COMPOST TO A GARDEN IMPROVES THE HEALTH OF THE PLANTS AND SOIL, WHICH REDUCES THE NEED FOR CHEMICAL FERTILIZERS AND PESTICIDES.

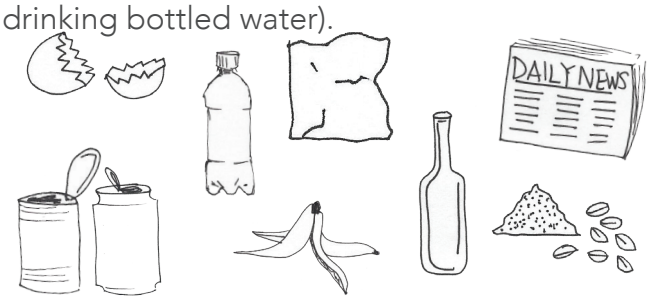
CHEMICAL FERTILIZERS AND PESTICIDES CAN BE DAMAGING TO THE ENVIRONMENT.

INDOOR OR OUTDOOR ACTIVITY:
HOW LONG DOES IS TAKE? (5–10 MINUTES)

MATERIALS:
- Copy of Handout:
  How long does it take to break down
- Optional - a whiteboard or large sheet of paper
- Optional - various pieces of trash, compost, and recycling. These can be the same as what was used in the "waste relay".

PROCEDURE:
For a small group, you can use the "how long does it take to break down" fact sheet and cover up the side with the answers (you can just use another sheet of paper). Have students guess how long all the various items will take to break down in the environment. As they guess, you can uncover the correct answers. With a large group, it may be better to write the items down on a whiteboard or poster first, and then fill in the answers as they guess.

DEBRIEF: Which materials decompose quickly and which take the longest? Make sure students understand that while plastics "break down", they never truly disappear. They just break down into smaller and smaller bits of plastic until it is microscopic. Every year about 8 million pounds of plastic waste ends up in the oceans, and microplastics have been found in the bodies of numerous marine species. Microplastics can also now be found in the water that people drink and the air we breathe - a new study from the journal Environmental Science and Technology found that people may be drinking and breathing tens of thousands of microparticles of plastic a year. (NOTE - if you drink tap water, you will be drinking less microparticles of plastic than drinking bottled water).

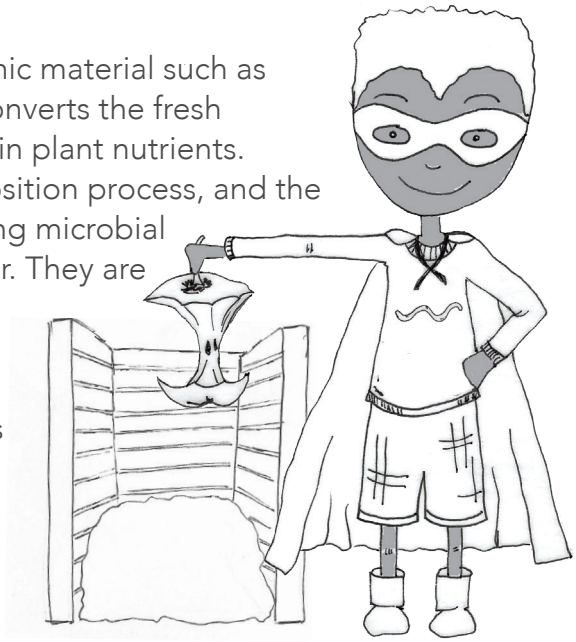


CLEAN EARTH HERO ACTIONS

- HELP SORT THE RECYCLING AT YOUR REC CENTER
- HELP TO RECYCLE AT HOME – USING WHAT YOU'VE LEARNED TO DO IT RIGHT! RECYCLE YOUR PAPER, METAL, AND PLASTIC.
- PICK UP TRASH OR RECYCLING FROM THE GROUND AND PUT IT WHERE IT BELONGS.
- CREATE OR HANG POSTERS TO EDUCATE OTHERS
- FIND A WAY TO COMPOST SOMETHING
- LEAVE THE LEAVES – RAKING LEAVES OFF OF GARDENS MEANS THAT INSECTS LIVING UNDER THE LEAVES, AND THE ORGANISMS THAT NEED LEAVES FOR FOOD WON'T HAVE THEM.

RESOURCES:
Resources from Streets Department on Recycling
Clean PHL compost info
Drink Philly Tap

BACKGROUND INFORMATION ON COMPOST



In nature, soil organisms called decomposers digest organic material such as leaves, dead plants and animals. The digestion process converts the fresh material into humus, a dark brown component of soil rich in plant nutrients. Composting is simply a matter of managing the decomposition process, and the end product is called compost. A compost pile is a teeming microbial farm. Bacteria start the process of decaying organic matter. They are the most numerous of the decomposer organisms - one tablespoon of soil contains billions of bacteria! Fungi and protozoans soon join the bacteria and, somewhat later in the cycle, earthworms, centipedes, millipedes and beetles do their parts. Each organism has a role in the food web of the compost pile. Successful composting is simply a matter of providing the conditions in which the decomposer organisms will flourish. Like us, they need food, air, water and a habitable temperature.

If this subject interests you - and your students - you can make connections back to the food web and energy transfer activities from Lesson One - which is mirrored by the processes that occur during composting and underground in healthy soil. Learn more here:

FIRST LEVEL DECOMPOSERS: Bacteria do the majority of the work and are the primary decomposer organisms of a compost pile. There are three types of aerobic (oxygen-requiring) bacteria.
1) Psychrophilic bacteria (thrive in lowest temperature range - 55 degrees F or less) give off a small amount of heat as a by-product, causing a rise in the pile's air temperature.
2) Mesophilic bacteria (thrive at 70-90 degrees F) do most of the work and also generate heat as a by-product, raising the pile temperature even more.
3) Thermophiles (thrive at 104-200 degrees F) work fast and last only 3-5 days.

Actinomycetes (higher form of bacteria similar to fungi and molds) liberate carbon, nitrogen and ammonia, making nutrients available for plants. They take over during the final stages of decomposition, often producing antibiotics that destroy bacterial growth.

Fungi also take over during the final stages of composting when the organic material has been changed to a more digestible form.

SECOND LEVEL DECOMPOSERS include protozoa, rotifera, nematodes (roundworms), earthworms, millipedes, sow bugs, land snails and slugs, springtails, feather-winged beetles, mold mites and beetle mites. They consume the first level decomposers. Some second level decomposers, such as earthworms, also consume the organic residue, so they can also be considered first level decomposers.

THIRD LEVEL DECOMPOSERS include ground beetles, centipedes, pseudoscorpions and ants (ants are usually not found in a compost pile that contains adequate moisture - they are a sign that the pile is too dry). They feed upon first and second level decomposers. Some may also consume organic residue.

NOTE: There are many places in the city that compost, and will accept or pick up household compostibles.

HEALTHY HABITAT HERO

LESSON 5
NURTURE NATURE
BE A HEALTHY HABITAT HERO

THEME: THE IMPORTANCE OF HABITAT
GRADE LEVEL: 1–6
SETTING: INDOOR/OUTDOOR

TIME:
15 minutes - 2 hours.
Use these ideas to fit your time-frame & group.

OBJECTIVES:
- Youth will learn about indicator species (canary in the coal mine) and why they are important.
- Youth will be able to describe and define a habitat.
- Youth will learn about the habitat requirements of specific insects, birds, and other urban wildlife and show us that there is habitat (places for them to live).
- Youth will be able to draw connections between healthy air, clean water, and reduced trash with healthy habitats.
- Youth will understand that butterflies and other insects, worms, squirrels, birds, certain fish, etc. are indicators that the air, water and soil are healthy habitats.
- Youth will have opportunities to create and support a specific healthy habitat.

TAKE AWAY:
Wildlife is everywhere. Wildlife matters. Butterflies, birds, and other creatures co-exist with us, even in the city, and the presence of certain species, tells us our ecosystem is healthy. Gardening matters to wildlife. Our parks and gardens are improving our ecosystem and making life in the city better. These spaces are welcoming to people and wildlife, and support **indicator species** such as the monarch butterfly.

ESSENTIAL QUESTIONS:
- Why are green spaces in cities important?
- How can people help support healthy habitats for themselves and other species?
- How do indicator species let us know about habitat health?

MATERIALS:
Paper, pencils, markers, crayons

OR

Assortment of craft materials (bonus if you reuse things) like paper towel rolls, cotton balls, toothpicks, feathers, etc.

Seeds

KEY WORDS TO USE:
Indicator Species
Habitat
Wildlife
Ecosystem
Diversity
Species
Home
Environment
Adapt
Food
Water
Shelter

BACKGROUND/CONTEXT:

We share the world with millions of other species. Choices we make in our day to day lives, in and around our homes, and in our care of outdoor spaces can play a part to keep the planet healthy for all the beneficial insects and local wildlife. Certain insects, birds, plants, and fish are very sensitive to changes in their environment, and will disappear, or be fewer in number, if the environment is disturbed by pollution.

In the early 1900's, coal miners who went very deep underground to dig coal would bring a little yellow bird, called a canary, in a cage down below ground with them. There was a very scary risk of dying from lack of oxygen, because underground in the mines there could be poisonous gases that were colorless and odorless. The canary was very sensitive to these gases and if the canary stopped chirping, people knew they had to hurry up and get to the surface before there was enough gas to kill people. Because the canary was so sensitive, it could indicate danger to the miners and saved many lives.

Butterflies, as well as many other insects, can tell us about the health of habitats. They reproduce quickly, and share food and habitat needs with other species and this gives them a sensitive response to subtle habitat or climatic changes. They can be considered representative of the diversity and responses of other wildlife in an area. If they are missing, or few in number, we have an indication that something is not right with the air, water, soil or temperature.

OPTIONAL:

Discuss IPM (integrated pest management).
IPM for kids

Share info about Opossums (babies not rabies).
National Wildlife Federation info about Opossums

OUTDOOR ACTIVITY:
BE A NATURALIST (20–30 MINUTES)

Before heading outside, ask youth to hypothesize (guess) what wildlife they might see. Clarify that cats and dogs - while animals - are not "wild." Depending on the size of the group, and adult supervision, you can stay together or break into small groups. Invite youth to observe and record what they see. Look for holes in leaves. Who do you think made those holes (insects). Where do ants live (in the soil). Look for places where we can find ants. What do bees like to eat (nectar from flowers). Are there any places where a bee could get food? Where do birds live? What do birds eat (seeds and insects). Flip over some logs or rocks to see what animals live underneath.

Each season will offer a different opportunity to see creatures. If it is a particularly barren winter day don't forget to look up, and in any shrubbery, for birds. Take the opportunity to wonder where the wildlife might be (hibernating, flying south, etc.). Have youth tally total insect and animal count.

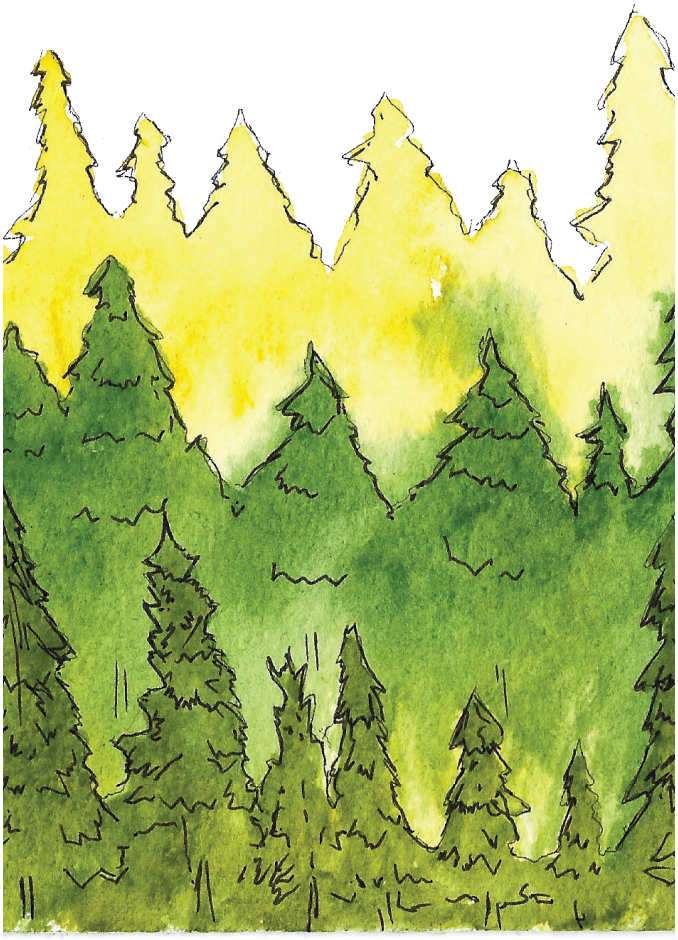
If you have multiple groups you could break into teams. One for birds, another for four legged creatures (squirrels), another could look in a grassy spot, another could look on garden plants etc.).

Regroup and have a report back. Some questions you might pose:

- What do you think each species are/were eating?
- What do the numbers indicate? (Are there a lot of a particular species? Why?)
- Were there any surprise sightings?
- Did you expect to see something you didn't?
- What other animals have you seen in the city? (opposum, racoons, fox, hawks, deer)
- Were the guesses on target? If not, what does the group think happened?

Spend time working in the garden, cleaning up the garden, observing habitats that animals might have. Look for ant holes in the ground, or holes that insects have eaten on leaves. Also look in trees for squirrel nests (balls of leaves in outer tree branches-easier to see in winter), and flip some rocks to look underneath.

Consider whether you have a space at your site to create some simple habitats (a brush pile or a bird house or plant some milkweed seeds - which need to be stratified by the cold, so can be planted in the winter and left outside).



INDOOR OR OUTDOOR ACTIVITY:
CREATE YOUR OWN SPECIES (20 MINUTES)

MATERIALS:
Paper, pencils, markers, crayons
OR
Assortment of craft materials (bonus if you reuse things) like paper towel rolls, cotton balls, toothpicks, feathers, etc.

PROCEDURE:
Tell students that each person will create their own plant or animal (real or imaginary) that is adapted to the environment we just saw outside. In other words, your outdoor space is their habitat. You can choose whether students draw their species on a sheet of paper, or create something using craft materials.

NOTE: If you were unable to go outside to make observations, the instructor can pick a habitat like a meadow or a forest. Since you were not outside in this location to make observations, you should spend some time talking to students about what this habitat is like.

Once everyone is done, have a show-and-tell where everyone describes their species. Since all species need food, water, shelter, and space, students should be prepared to talk about what their species needs are. If you have a large group and there is not time for everyone to share, students can share with a partner or in a smaller group.

Explain that due to climate change, the habitat where these plants/animals live is changing. You can tell students that you are taking something away from their habitat like a food source, or water due to drought.

Which species would survive and which would not? In real life, would all species be able to adapt?

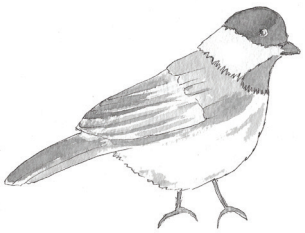
DEBRIEF: While this was a game, climate change really is altering environments and ecosystems. Sometimes plants and animals can move and sometimes they cannot. Plants are not able to pick up and move like an animal could, but they can "move" to a move favorable location over time. Can students figure out how? (seeds may be carried by the wind, or by animals who ate the fruit or nut from the tree and carried the seeds in their bellies. And yes, the seeds are pooped out!). Ask students what would happen if a plant or animal can't move to a new habitat fast enough? Or if there is no other habitat for them? This might be a depressing discussion, so make sure to include ways that we as individuals can help to reduce climate change.

INDOOR OR OUTDOOR GAME
GARDEN SIMON SAYS (5 MINUTES)

PROCEDURE:
NOTE- this may be best suited for younger kids. This is just like a regular game of Simon Says, but using things from a garden or from nature.

Here are some examples, but feel free to use your own, or let the kids come up with some! You don't need to know what it would "look like" to act these out, since kids can use their own imagination.

SIMON SAYS TO BE:



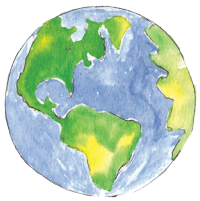
..... A BIRD
..... A BEE
..... AN ANT
..... A FLOWER
..... A TREE
..... A LADYBUG
..... A SPIDER
..... A GRASSHOPPER
..... A WORM
..... A BEETLE
..... A SEED
..... A TOMATO
..... A CARROT
..... A LEAF
..... A STEM

INDOORS OR OUTDOORS

Plant some seeds that kids can care for. If you plant them indoors, make sure to have a nice sunny window and a plan to water regularly.

HEALTHY HABITAT HERO ACTIONS

- HELP MULCH THE GARDEN OR BUILD/ MAINTAIN A HABITAT OR PLANT MILKWEED SEEDS.
- DON'T KILL RANDOM INSECTS OUTSIDE... WHAT'S ALIVE STAYS ALIVE..
- KEEP CAT INSIDE (DON'T KILL BIRDS)
- DON'T SPRAY CHEMICALS TO KILL WEEDS – TRY VINEGAR INSTEAD
- EAT SOMETHING THAT WAS GROWN IN OUR GARDEN, YOUR GARDEN, A FRIENDS GARDEN OR PURCHASED AT A FARMERS MARKET.



CLIMATE HERO

LESSON 6

CONNECTING TO CLIMATE ACTION

BE A CLIMATE HERO

THEME: ENVIRONMENTAL STEWARDSHIP, UPCYCLING, FOOD MILES
GRADE LEVEL: 1–6
SETTING: INDOOR/OUTDOOR

TIME:

15 minutes - 2 hours.
Use these ideas to fit your time-frame & group.

OBJECTIVES:

- Youth will be able to connect our learning to actions.
- Youth will gain exposure to the concept of Carbon/Water Footprint & Food Miles
- Youth will connect the impact of daily food choices on air, water & energy on climate change.
- Youth will commit to continue and go deeper with Climate Hero pledge.

TAKE AWAY:

Human actions have caused climate change, and human actions can help our environment heal. Our choices and our actions matter. Small changes make a difference. You make a difference. Together we can do more than working alone.

ESSENTIAL QUESTIONS:

- What did you learn about taking care of our planet?
- Where does the food you eat come from?
- What is a Carbon Footprint?
- How can we reduce Carbon Footprint by reducing food miles?
- What do you still wonder?
- How can we all work together to be Climate Heroes?

MATERIALS:

1 old t-shirt per student (students can bring one in from home, or you can purchase a lot of them very cheaply from a thrift store).

Scissors

Globe or large world map

Ruler / measuring tape

String

Large paper or whiteboard

Markers or crayons

Optional - book: *"How to Make an Apple Pie and See the World"* by Priceman, Marjorie. (Available from the Free Library of Philadelphia)

KEY WORDS TO USE:

Reusable

Carbon Footprint

Upcycle

Repurpose

Landfill

Greenhouse gas

BACKGROUND/CONTEXT:

We can compare the choices we make of what we are consuming by the amount of greenhouse gases each choice requires. The total amount of greenhouse gases needed for your choices is called your carbon footprint. Do you drive or walk? Use CFL light bulbs or incandescent? Grow most of your food, or eat meat every day? Eating beans has a much smaller carbon footprint than eating beef. Driving a SUV has a much bigger carbon footprint than riding a bicycle. Calculating a carbon footprint is not an exact measure, though there is great data on how much carbon is used for many activities and purchases, but is an idea to help people who want to make choices to reduce their impact on climate change. The smaller our carbon footprint, the less carbon we are adding to the environment. Sometimes choices are easier to make when you know the real impact of your choice.

WHAT WE EAT HAS AN EFFECT ON CLIMATE CHANGE.

The world's food system is responsible for at least a quarter of the planet warming gases that humans generate each year. The food system includes everything from raising and harvesting all the plants and animals that we eat — beef, chicken, fish, milk, lentils, kale, corn etc.— and all the processing, packaging and shipping food to the markets and stores . Since you eat food, you're part of this system. Food miles are the miles your food travels to get to your market or store. If you grow food at home your food miles are zero. If you shop at a farmer's market your food miles might be 50-75 miles. Much of the food at the supermarkets comes from California or Arizona -2000- 3000 food miles away! As we have discussed in earlier lessons, non-organic agricultural practices can pollute the water with chemical fertilizers and pesticides. Watersheds are also polluted with animal waste from the factories that raise and process meat. Choosing to help grow food, shopping at farmers markets, buying organic foods, eating less meat, are all ways to reduce your carbon footprint.

To review more about these ideas see the articles linked below:

NY Times Article about Food & Climate Change
Science magazine - background info

DOES WHAT I EAT HAVE AN EFFECT ON CLIMATE CHANGE?

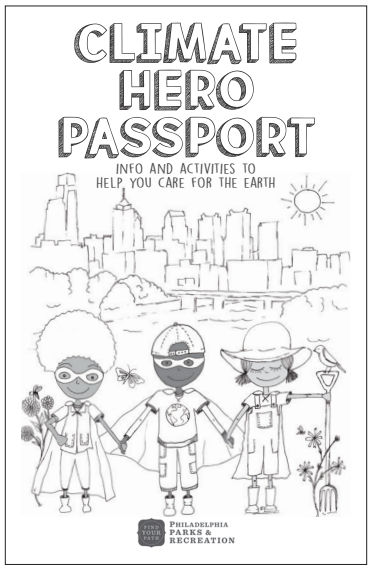
Yes. The world's food system is responsible for about one-quarter of the planet-warming greenhouse gases that humans generate each year. That includes raising and harvesting all the plants, animals and animal products we eat — beef, chicken, fish, milk, lentils, kale, corn and more — as well as processing, packaging and shipping food to markets all over the world. If you eat food, you're part of this system

Review—Ask Questions—Discuss
(students can answer in teams if larger group.)

Questions to ask and discuss
(and review and re-review as needed):

- What is the difference between climate and weather?
- What are some ways we can help keep our air clean?
- What are some ways we can help keep our water clean?
- What are some habitats you have noticed in your neighborhood?
- How do you think we can work together to lower our carbon footprint and keep our planet healthy?

Hand out passport
Give students a chance to complete activities and exercises in the passport.



Indoor or Outdoor Activity:
Do an upcycle craft! (20—25 minutes)
The craft you choose is up to you, but here is one example:

Reusing is one of the three R's (reduce, reuse, recycle), and repurposing old shirts is a great way to not only make something new out of something old, but is also a way to replace single use plastic bags. We will use the old shirts to make a cloth tote bag that can be taken to the grocery store for shopping, or any other place you may need a bag. Since plastic bags are such a problem in our oceans and also on land, we are doing something good for the planet when we bring a reusable cloth bag instead.

DIY Reusable Bags
For step by step illustrations visit:
https://snapguide.com/guides/make-a-tote-bag-from-an-old-t-shirt-no-sewing/

Materials:
- One old t-shirt for each student (students can bring one in from home, or you can pur chase a lot of them very cheaply from a thrift store).
- Scissors

Procedure:
Depending on the age of the youth, you will likely need to do most of the cutting preparation for your students. This can be done ahead, but bring a few uncut t-shirts to show the process.

Step 1: Cut off the sleeves- this area becomes the bags handles. You can fold the t-shirt in half and cut both sleeves at once so that they are identical. Or, if your material is too thick to cut them both at once, you can cut one, then fold it in half and use the cut side as a guide for the next sleeve.

Step 2: Cut away the neckline area – this area becomes the opening to the bag. Again it can be helpful to fold the shirt in half, or poke a hole with scissors for each student and let them cut off the neck seam.

Step 3: Determine how deep you want the bag to be. Turn the t-shirt inside out. Decide where you want the bottom of the bag to be and trace a line across. Depending on the fabric used, the tote may stretch and become longer when it's filled with stuff. The thicker the t-shirt the bigger the bag can be without stretching too much.

Step 4: Cut fringe
Now grab your scissors and cut slits from the bottom of the shirt up to the line marking the bottom of your bag. You'll want to cut both the front and back layers together because they need to match up for the next step. I cut my slits about 3/4 of an inch apart. Fringe should be about 1- 1 ½ inches long.

Step 5: Tie the Fringe
Tie pairs of fringe that are next to each other together. This makes the bottom of the bag. Because you are not sewing there will be small gaps. This is fine for carrying all but very small objects. Turn your t-shirt right side out and you are done.

VARIATIONS . .

Turn the bag right side out when tying the fringe – and the fringe will be decorative at the bottom. Also - you can try lining the sleeve handles together in different orientations before tying the fringe for "hobo" style bag, rather than "classic" tote.

There are many other ideas that can reinforce and support the idea of reducing and reusing items. Anything that we reuse, means we don't have to buy something new which is the whole idea of reduce. Try using cardboard from toilet paper rolls as little planters to plant seeds in (just crimp one end to hold soil and place on a waterproof tray - such as a take out container or lid).

Here are some other DIY reuse or Upcycling ideas Kids Can Upcycle Craft Ideas

INDOOR OR OUTDOOR ACTIVITY:
FOOD MILES (20 MINUTES)

MATERIALS:

- Globe or a large world map
- Ruler / measuring tape
- String
- Large paper or whiteboard
- Markers or crayons
- Optional - book: ***"How to Make an Apple Pie and See the World"*** by Priceman, Marjorie. (Available from the Free Library of Philadelphia)

PROCEDURE:

Ask students where our food comes from? Without soil, there would be no food. All of our food originates from a plant, and the plants can be eaten by an animal, or decomposed by mushrooms. Our food is generally grown or raised on a farm or garden (if it doesn't start out this way, is it really food?)

Tell students that you are going to prove to them that all food starts with soil. Allow students to pick a food or meal that everyone is familiar with, and you will trace it back to the soil. Some examples include pizza or hamburgers, but you can allow students to pick whatever they want. Once they have picked their food or meal, draw a quick sketch of it on your paper or white board (don't worry too much about your drawing skills!). You will then ask students if they can name each ingredient. Point to things in your picture if kids need to be reminded of other ingredients.
See Examples below:

HAMBURGER & FRIES

The meat comes from a cow. The cow eats grass.The bun comes from wheat, which is a plant. The wheat seeds are a grain which is ground up into flour.
Some people put lettuce, tomato, pickles, or onions on their burgers. These are all plants which came from a farm.
If you put cheese on your burger, the cheese came from milk from a cow.
French fries come from potatoes which grew in the soil on a farm.

PIZZA

Pizza dough is made with wheat flour. When wheat seeds are ground up it is called wheat flour.
The red sauce comes from tomatoes. You can also put basil or oregano in your pizza sauce (these are all plants).
The cheese came from milk from a cow.
Pepperoni came from a pig, which lived on a farm and ate a variety of plants in its diet.
Toppings like peppers and onions are plants and came from a farm and once grew in the soil.
Mushrooms are a fungi, which decompose plants that were once alive.

READ THE STORY: *"How to Make an Apple Pie and See the World"* by Marjorie Priceman.

Tell students that ALL of our food came from a farm and can be traced back to the soil, but how does this food get to us? Allow students time to answer, and explain that our food travels from the farms by truck, boat, and occasionally airplanes. This takes a lot of fossil fuels. The farther the food travels, the more gas the truck or boat needs to burn. This is called "Food Miles". When the food travels a shorter distance to get to us, it is better for the environment.

Look at your globe or world map. Use your string or ruler/measuring tape and compare the distances between different places on the globe. You can use a string to measure the difference between food coming from China or New Zealand vs. grown on farms in Pennsylvania or New Jersey. If you read the book, How to Make an Apple Pie and See the World, you can find the places mentioned in the book and measure how far away they are. Sometimes we really need things like vanilla for a recipe, but in general, the closer to home we get our food, the less air pollution we make because the trucks and boats don't need to travel as far. Having a healthy environment is one reason why some people in the city grow their own food in a garden.

OPTIONAL:

Food or produce from the grocery store will say on its label where it came from. You could bring in a few items and have students look for the place of origin. Use a long measuring tape or string and pretend that each foot is 100 miles. Use sticky notes and write, 100 miles, 200 miles, 500 miles, 1000 miles, 5000 miles, etc. Have students figure out where each food item should go. Make sure you have some things that are really close by like produce from PA or NJ, and something from really far away like garlic from China.

CELEBRATION SNACK:

From local food if possible to connect the food miles. If not local food, figure out the food miles. Maybe even from your garden.

RETHINK
YOUR CHOICES.
REFUSE
SINGLE USE.
REDUCE
CONSUMPTION.
REUSE
EVERYTHING.
REFURBISH
OLD STUFF.
REPAIR
BEFORE YOU REPLACE.
REPURPOSE
BE CREATIVE, REINVENT.
RECYCLE
LAST OPTION.

CLIMATE HERO ACTIONS:

- BRING A REUSABLE BAG TO THE GROCERY STORE
- PARTICIPATE IN DISCUSSION – ASK AND ANSWER QUESTIONS
- REVIEW AND COMPLETE YOUR PASSPORT
- DECIDE WHAT THINGS YOU WANT TO PLEDGE TO DO

AT HOME TO REDUCE THE EFFECTS OF CLIMATE CHANGE YOU CAN:

- TRAVEL BY FOOT, BIKE, OR SKATEBOARD INSTEAD OF CAR.
- REPLACE YOUR OLD LIGHT BULBS WITH COMPACT FLUORESCENT LIGHTS (CFLS) THAT USE LESS ENERGY.

GLOSSARY

Air Quality - The degree to which the ambient air is pollution-free, assessed by measuring a number of indicators of pollution.

Atmosphere - The envelope of gases surrounding the earth made up of Nitrogen, Oxygen, Argon, Carbon Dioxide and a few other trace gases.

Beneficial Insects - Any number of species of insects that perform valued services like pollination and pest control.

Biodegradable - Capable of being decomposed by bacteria or other living organisms. Anything that was once alive can decompose. Plastic can not.

Carbon - The chemical element occurring as diamonds, graphite, coal, petroleum, as well as in plant and animal bodies.

Carbon Based Life Forms - All lving things contain and are strucutred around carbon atoms. All things that are alive, and all things that were once living and are now dead also have carbon stored in their cells.

Carbon Dioxide - A heavy and colorless gas that is formed by burning fuels, breaking down organic matter, or from breathing.

Carbon Footprint - A way of counting the carbon dioxide and other carbon compounds emitted due to a person or businesses consumption of fossil fuels. A way to compare choices.

Chrysalli/Cacoon - Pupa and chrysalis (and cacoon) have the same meaning: the stage between the larva (caterpiller) and the adult. While pupa can refer to this naked stage in either a butterfly or moth, chrysalis is strictly used for the butterfly pupa. A cocoon is the silk casing that a moth caterpillar spins around it before it turns into a pupa.

Climate - The weather conditions prevailing in an area in general or over a long period.

Compost - Compost is usually made by gathering plant material, such as leaves, grass clippings, and vegetable peels, into a pile or bin and letting it decompose as a result of the action of aerobic bacteria, fungi, and other organisms.The Decayed organic material used as a plant fertilizer.

Consumers - An organism that feeds on plants or other animals for energy. They are either plant eaters, meat eaters, plant and animal eaters, or decomposers.

Decompose - Decomposition is the process of organic materials are broken down into smaller organic matter - either on the forrest floor or in a compost pile. The is how nature recycles nutrients and is essential for recycling.

Downstream - Situated or moving in the direction in which a stream or river flows - where stuff goes when you put it in a body of water. We all live downstream of somewhere.

Drain- A channel or pipe carrying off surplus liquid, especially rainwater or liquid waste.

Earth - The planet on which we live; the world.

Ecosystem - A biological community ofinteracting organisms and their physical environment.

Emissions - The production and discharge of something usually from an industrial process. This can be particulate odor filled smoke or colorless odorless but dangerous radiation.

Energy - Energy is the ability to do work. Energy comes in different forms: Heat (thermal) Light (radiant) Motion (kinetic).

Energy Transfer - The conversion of one form of energy into another. An example might be when you peddle your bike you tranfer the energy you got from eating food through the pedals to the wheels to move. Food energy to you, your energy to the pedal, pedal energy to the wheels.

Exhaust - Most often seen coming out of the tailpipe of a car or truck. Waste gases or air expelled from an engine, turbine, or other machine in the course of its operation.

Food Chain/Food Web - Food chain, in ecology, the sequence of transfers of matter and energy in the form of food from organism to organism. Food chains intertwine locally into a food web because most organisms consume more than one type of animal or plant.

Food Miles - The distance over which a food item is transported during the journey from where it is grown to where it is eaten.

Food Web - A way of describing the connections between organisms exchanging energy ultimated sourced from photosynthesis into a network of the insects and animals that eat and are eaten.

Fossil Fuels - A fuel such as coal or gas, formed over millions of years, hundreds of millions of years ago, from the remains of dead organisms: coal was formed from dead trees and other plant material. crude oil and gas were formed from dead marine organisms. Because these fuels were made so long ago, and take so long to make, once they are used they will no longer be available which is why they are called “non-renewable” fuels.

Gas - A substance in a state where it will expand freely to fill the whole of a container having to fixed shape or volume.

Greenhouse Effect - The greenhouse effect is a process that occurs when gases in Earth’s atmosphere trap the Sun’s heat. This process makes Earth much warmer than it would be without an atmosphere. The greenhouse effect is one of the things that makes Earth a comfortable place to live.

Greenhouse Gas - A gas that contributes to the greenhouse effect by absorbing the infrared radiation. The primary greenhouse gases in Earth’s atmosphere are water vapor, carbon dioxide, methane, nitrous oxide and ozone.

Habitat - The natural home or environment of an animal, plant, or other organism.

GLOSSARY

Heat Island - An urban or metropolitan area that is significantly warmer than its surrounding rural areas due to the buildings and paved surfaces that absorb heat, and the lack of trees and grass that naturally cools the air.

Impervious Surface - A surface that water can not penetrate, such as asphalt or concrete, which water then runs off.

Infrared radiation - The type of energy that is invisible to the human eye but that we can feel as heat.

Insect - Insects are the largest and most diverse group of organisms on Earth. They have three body parts and can have wings.

Larvae - The active immature form of an insect, especially one that differs greatly from the adult.

Leaf Mulch - Leaves that have decomposed and can be used to protect or nourish soil and plants.

Microbes - Microbes are orgnisms that are too small to be seen with the naked eye, and require a microscope to view.

Monarch - A large orange and back butterfly that occurs mainly in North America. The caterpillar feeds on milkweed, using the toxins in the plant to render both itself and the adult undesirable to predators.

Mulch Material - Used to spread around the base of a tree or other plant to conserve moisture or protect the soil.

Naturalist - Someone who learns about nature, and/or spends time observing the natural world.

Pervious Surfaces - A surface such as soil, grass, or gravel, that allows water to pass through to be absorbed in the ground.

Photosynthesis - The process by which green plants and other organisms use sunlight to synthesize foods from carbon dioxide and water. All life on earth depends on photosynthesis for energy, food, oxygen.

Producers - An organism (either a green plant or bacterium) which transforms sun energy into carbohydrates through photosynthesis. This is part of the first level of a food chain.

Rain Garden - A garden of native shrubs, perennials, and flowers planted in a small depression which is generally formed on a natural slope. It temporarily holds rain water runoff flowing from roofs, driveways, patios or lawns.

Recycle - To convert already used products into reusable materials -such as using plastic bottles to make building supplies, or old paper to make new paper.

Reduce - A smaller or lesser amount or size. Buy less.

Reuse - To use again or more than once.

Rivers - A large natural stream of water flowing in a channel to the sea, a lake or another such stream.

Runoff - The draining away of water (or substances carried in it) from the surface of an area of land, a building or structure, etc.

Spider - An eight-legged predatory arachnid with an unsegmented body consisting of a fused head and thorax and a rounded abdomen.

Solar - Relating to or denoting energy derived from the sun's rays.

Steward - A person who carries out responsible use and protection of the natural environment through conservation and sustainable practices.

Storm Water - Stormwater is water that comes from precipitation and ice/snow melt – it either soaks into exposed soil or remains on top of impervious surfaces, like pavement or rooftops.

Sun - The star around which the earth orbit, and where all light and energy used on earth originates. The Sun's energy drives the climate system. The sun warms the planet, drives the hydrologic cycle, and makes life on Earth possible.

"There is no away" - The idea that when you throw trash "away" it just goes someplace else - into a nearby landfill, or sent to another state or country. Anything that can't biodegrade is still on our planet somewhere.

Upcycle - To reuse something (turn a t-shirt into a cloth bag) in a creative way and makes the item useful or more useful.

Upstream - In the opposite direction from that in which a stream or rover flows; nearer to the source. What does in upstream heads downstream to others.

Vermicomposting - A method to to convert organic waste into fertilizer using worms. Is a form of composting that is often done indoors.

Water Footprint - The amount of freshwater utilized in the production or supply of the goods and services used by a particular person or group.

Watershed - We all live in a watershed. Your watershed describes the area of land where water flows above and underground when it rains and combines with other watersheds to form a network of rivers and streams that progressively drain into larger water areas. Most Philadelphians live in the Delaware River Watershed.

Weather - The atmospheric conditions at a place and time in regards to heat, dryness, sunshine, wind, rain, etc.

RESOURCE LINKS

AIR

How to get a street tree or yard tree

https://www.youtube.com/watch?v=3v-w8Cyfoq8

https://climate.nasa.gov/news/2491/10-interesting-things-about-air/

Air & Water Connection Cards

WATER

Soak it Up Adoption Grants
Rain Check Program (Rain Barrel)
Drink Philly Tap
Air & Water Connection Cards

https://pmm.nasa.gov/education/water-cycle/hydrologic-cycle

https://blog.nationalgeographic.org/2014/03/19/the-urban-water-cycle-sustaining-our-modern-cities/

https://marinedebris.noaa.gov/discover-issue/trash-talk

"How Long Does it Take to Break Down?"

REDUCE/REUSE/RECYCLE/COMPOST

Clean PHL https://cleanphl.org/

Philadelphia Streets Department Resources

Composting In Philadelphia
https://cleanphl.org/composting/

Backyard Composting/ Community Composting Program

HABITAT

Habitat Photos

BLOCK CAPTAINS

How to Sign Up? Online sign up
Resources for block captains
cleanphl

FOOD & CLIMATE CHANGE

https://www.ecoliteracy.org/download/understanding-food-and-climate-change-interactive-guide

https://www.epa.gov/recycle/reducing-wasted-food-home

https://www.nytimes.com/interactive/2019/04/30/dining/climate-change-food-eating-habits.html?smid=nytcore-ios-share

Kids Can Upcycle Craft Ideas

CLIMATE HEROES

Real People Doing Work on this issue - especially young people:

https://climateheroes.org/

https://citiesspeak.org/2019/04/18/climate-change-could-devastate-your-community-but-it-doesnt-have-to/

Lot's of stories about Greta Thunberg:
https://en.wikipedia.org/wiki/Greta_Thunberg

Other youth leaders:
https://www.nytimes.com/2019/09/20/climate/climate-strikes-protests.html

LINKS TO CURRICULUM MATERIALS

Connection Cards
https://drive.google.com/open?id=1U0z8A1s22nMRRb51kfN-tayNInlwCgHbG

Air & Water Connection Cards
https://docs.google.com/presentation/d/1lcc4WIHvfrl-1genXS7vPfkBESIDUOtAY58zooeyCqZk/edit#slide=id.g707d811179_0_6

Habitat Photos
https://docs.google.com/presentation/d/1Vx9QMcdpUa89lNjj9C-4M4rEpbcPPNSuWirGAd0P1IgY/edit?usp=sharing

Climate Story
https://drive.google.com/open?id=15YxagCcXIjQytC38SOR-DIv0Tv6dWzCt3

Climate Hero Passport
https://drive.google.com/open?id=1Kfzk4uuGJP3P1jzZ6Wstb-fYdzDz7jLhL

Climate Hero Badges
https://drive.google.com/open?id=1SOmrSPa544IK-wH9_9A8pxNoSVUNFb_pC

Avery Label 94107
https://www.avery.com/blank/labels/94107

I Spy Activity
https://drive.google.com/file/d/1NCJuHpFnH3RWQQXV9hNc-BOFISZsCktuL/view?usp=sharing

BOOK LIST

★ Available at the Free Library of Philadelphia

LESSON 1 — MAKING CONNECTIONS

★ My Light by Bang, Molly.
★ The Lorax by Dr. Seuss
How Did That Get in My Lunchbox?: The Story of Food (Exploring the Everyday)
by Chris Butterworth (Author), Lucia Gaggiotti (Illustrator)
Where Did My Clothes Come From? (Exploring the Everyday) by Christine Butterworth

LESSON 2 — AIR

★ The Trouble with Dragons by Gliori, Debi.
★ The Berenstain Bears Don't Pollute (Anymore)
★ The Busy Tree by Ward, Jennifer
★ Because of an Acorn by Schaefer, Lola M.

LESSON 3 — WATER

★ River by Atwell, Debby.
All the Water in the World by Lyon, George Ella
A Drop Around The World by Barbara McKinney and Michael S. Maydak
You Wouldn't Want to Live Without Clean Water! by Roger Canavan (Author),
David Antram (Illustrator)

LESSON 4 — RRR & COMPOST

The Adventures of a Plastic Bottle: A Story About Recycling by Alison Inches and Pete Whitehead
★ What happens to our trash? by Ward, D. J.
★ Diary of a Worm by Doreen Cronin
★ Where Does the Garbage Go? by Paul Showers (Author), Randy Chewning (Illustrator)
Compost Stew: An A to Z Recipe for the Earth by Mary McKenna Siddals and Ashley Wolff

LESSON 5 — HEALTHY HABITAT

★ Curious George Plants A Tree by H. A. Rey
★ Many: The Diversity of Life on Earth by Nicola Davies, Emily Sutton
★ Insect Detective by Voake, Steve.
★ Whose Garden is it? by Hoberman, Mary Ann.

LESSON 6 — EARTH CARE

★ Heroes of the Environment: True Stories of People Who Are Helping to Protect Our Planet -
Rohmer, Harriet
★ All that trash: The Story of the 1987 Garbage Barge and our Problem with Stuff
by McCarthy, Meghan
★The Great Kapok Tree : A Tale of the Amazon Rain Forest by Cherry, Lynne.