

CLIMATE CHANGE STATION ACTIVITY

Table of Contents

Pages	Content
2	Teacher Directions
3 - 4	Student activity pages
5	Station 1: Google time lapse
6	Station 2: "Hockey Stick" graph
7	Station 3: Carbon footprint
8	Station 4: US Greenhouse gas emissions
9	Station 5: Climate refugees
10	Station 6: Ice cores YouTube clip
11 - 12	Station 7: Albedo effect
13	Station 8: Sea level rise interactive
14	Station 9: Deforestation
15	Station 10: Acid rain
16 - 17	Answer Key



TEACHER DIRECTIONS

Put students in groups and assign them to a station. Note: not all students will start at station 1. Give groups roughly 4 minutes at each station before having them rotate (you can adjust the time based on your class period length).

Station 1: Google Time Lapse

At this station students will explore <https://earthengine.google.com/timelapse/>. You will need to supply a laptop for this station.

Station 2: The Hockey Stick Graph

At this station students will analyze the famous “hockey stick” graph showing carbon dioxide emissions. No additional materials are needed.

Station 3: Carbon Footprint

For this station, students will brainstorm ways to lower their carbon footprint. No additional materials are needed.

Station 4: US Greenhouse Gas Emissions

For this station, students will analyze a pie chart showing the source of US greenhouse gas emissions. No additional materials are needed.

Station 5: Climate Refugees

At this station, students will read about climate refugees. No additional materials are needed.

Station 6: YouTube Clip

At this station, students will watch a video clip on ice cores at https://www.youtube.com/watch?v=JS2PhRd_5NA. You will need to supply a laptop for this station (video is two and a half minutes long).

Station 7: Albedo Effect

At this station, students will measure the temperature of water, light soil, and dark soil and learn about the albedo effect. You will need to supply a heat lamp (incandescent bulb), 3 petri dishes (filled with water, light soil, and dark soil), and a thermometer. Turn the lamp on a few minutes before students begin so the samples have time to heat up. If you do not have access to these supplies, an alternative sheet has been provided for students to look at albedo values.

Station 8: Interactive

For this station, students will explore rising sea levels with a NASA interactive (go.nasa.gov/3zz4wu0). You will need to supply a laptop for this station.

Station 9: Deforestation

At this station, students will read about deforestation and answer questions. No additional materials are needed.

Station 10: Acid Rain

At this station, students will test the pH of 3 liquids- tap water, simulated rain water, and simulated acid rain. You will need to supply pH paper and the water samples. (To prepare the rain water, use tap water and 1 drop of a strong acid like HCl to make a pH value of around 5 - 5.5. To prepare the acid rain, use tap water and 2 drops of a strong acid like HCl to make a pH value of around 4. Depending on the molarity you might need to keep diluting).

CLIMATE CHANGE STATIONS

Name:

Period:

Date:

Directions: You will be rotating around the room to 10 different stations. At each station, directions will be provided on what to do. You will have roughly 4 minutes to complete each station before you need to rotate.

Station 1:

1. What impact are humans having on the planet? Give 2 specific examples.

a. _____
b. _____

2. What changes would you expect to see within the next 100 years?

Station 2:

1. What does anthropogenic mean? _____
2. Why do you think there was so much resistance to the idea of rapid climate change caused by humans?

Station 3:

List 3 things you can do to lower your carbon footprint.

1. _____
2. _____
3. _____



Station 4:

1. Which economic sector releases the largest amount of greenhouse gas?

2. What could the industry (business) sector do to lower their greenhouse gas emissions?

Station 5:

1. What is a climate refugee?

2. What did the people in Cape Town, South Africa experience in 2018?

Station 6:

1. These ice cores are drilled from _____.
2. The ice cores drilled here are _____ years old.
3. Ice core layers are like _____.
4. How do they use the bubbles trapped in the ice core to measure past climate conditions?

Station 7:

1. What is the albedo effect? _____
2. Record the temperature (or albedo) of each of the following:
Water _____ Light soil _____ Dark soil _____
3. Which would heat up more during a summer day- the ocean or the sandy beach? How do you know?

Station 8:

1. Which US states shown will be impacted the most by rising sea levels?
_____ and _____.
2. What would you do if you and your family lived in an area that will be impacted by rising sea levels?

Station 9:

1. What is a carbon sink? _____
2. List 2 carbon sinks: _____ and _____.
3. Why are forests being cut down?

Station 10:

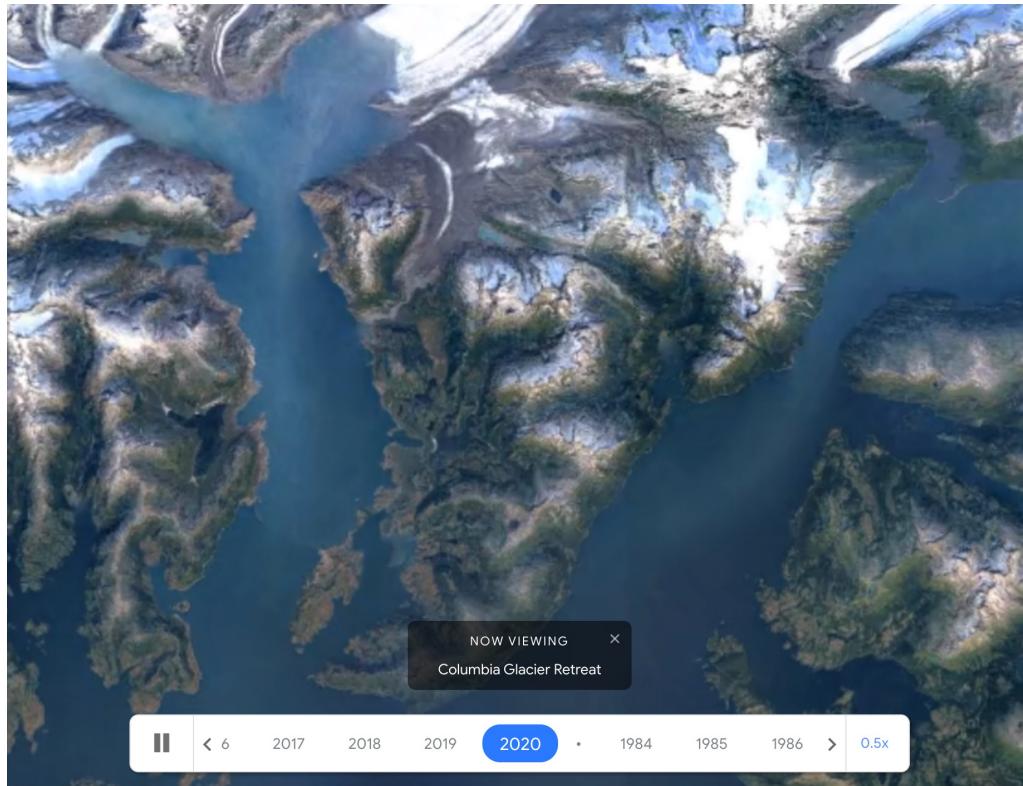
1. What was the pH of tap water? _____ Rain water? _____ Acid rain? _____
2. What impact do you think acid rain has on plants and animals? On infrastructure? (buildings and roads?)



STATION I

Directions: Head to <https://earthengine.google.com/timelapse/> and make observations of some of the changes you see around Earth over the past 30+ years.

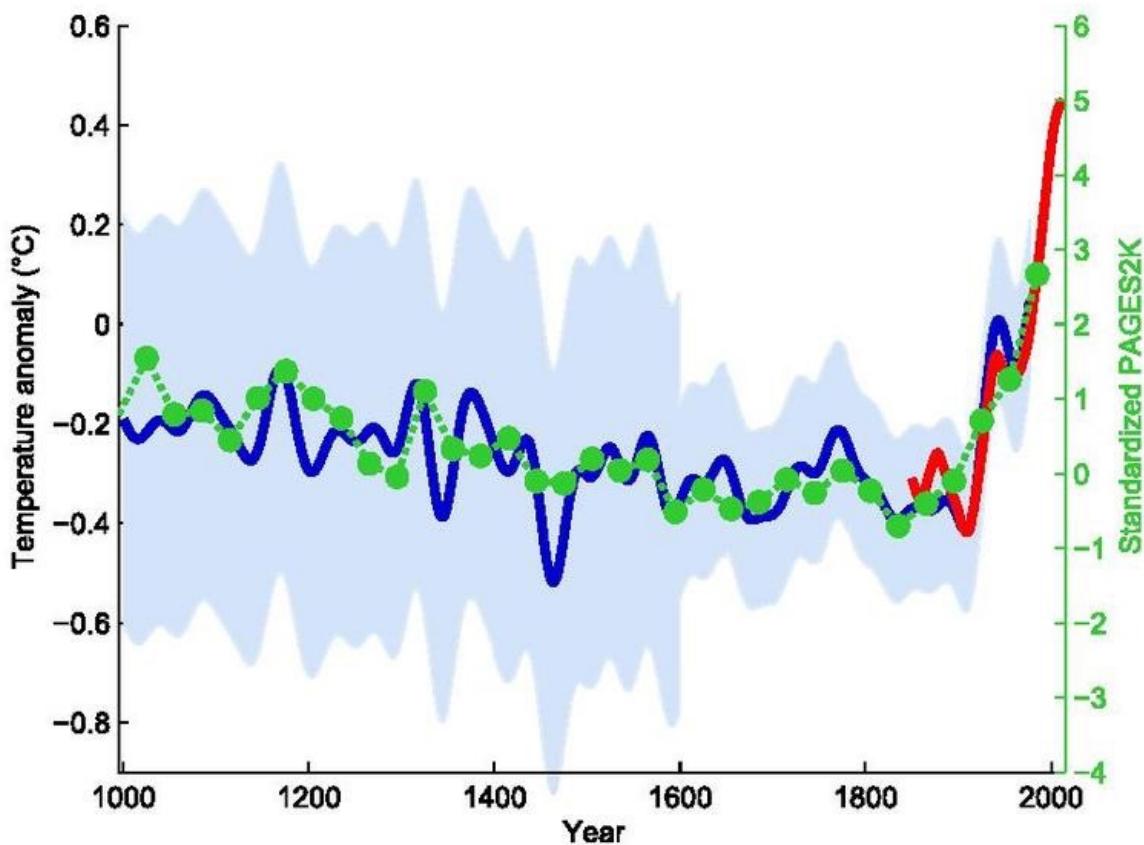
What impact are humans having on our planet? Based on the trends you saw, what changes do you expect to see within the next 100 years?



STATION 2

In 1998, a group of scientists published a paper in the scientific journal *Nature*, showing a reconstruction of the planet's past temperatures going back 1000 years. They showed that current temperatures have risen due to anthropogenic (human caused) climate change. It came to be known as the "hockey stick" graph due to its shape.

Once the article was published there was tremendous pushback, especially from corporations who produce the most pollution such as energy companies. Even congress got involved. But in the nearly 25 years since the hockey stick publication, independent studies have repeatedly reaffirmed the findings and conclusion that recent warming is unprecedented over the past millennium.



Blue = original hockey stick prediction, Red = data record,
Green = "Pages2K" temperature reconstruction

STATION 3

Your carbon footprint is the total amount of greenhouse gases generated by your actions. Everything you do and every product you use has a carbon footprint.

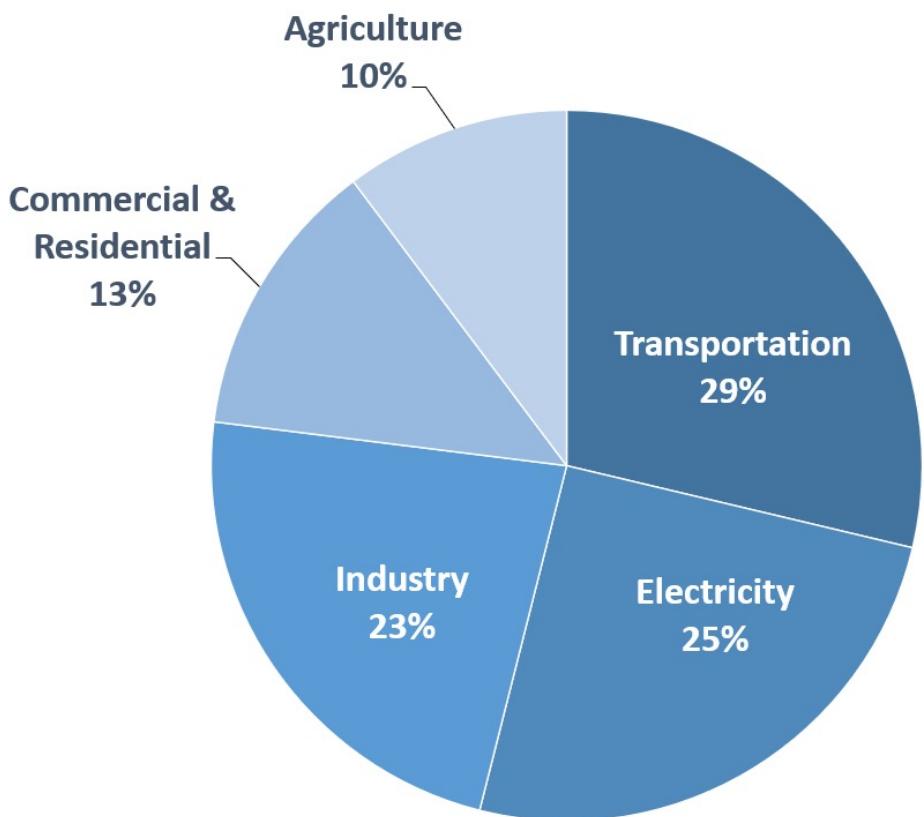
Directions: On your lab paper, list 3 things **you** can do to lower your carbon footprint. (List actionable ideas. Don't say buy solar panels if your family doesn't have the ability to do so).



STATION 4

Directions: Examine the pie chart below that shows greenhouse gas emissions in the United States as of 2019. What sectors release the largest amount of greenhouse gasses? Answer the questions on your lab worksheet.

Total U.S. Greenhouse Gas Emissions
by Economic Sector in 2019



U.S. Environmental Protection Agency (2021). Inventory of U.S.
Greenhouse Gas Emissions and Sinks: 1990-2019

STATION 5

The term “climate refugee” describes large scale migrations and cross-border mass movements of people due to weather-related disasters.

A changing climate can make natural disasters more common, cause sea levels to rise and displace people that live near the coast, and food and water shortages due to drought. Read the article below about what people experienced in Cape Town, South Africa in 2018.



The warnings begin even before you arrive. "Cape Town is suffering through an extreme water crisis," the pilot explains on approach, urging tourists and travelers to save water. Hotel televisions blare out messages to guests: "90 second showers only!" Bathroom taps are shut in restaurants and bars, and "If it is yellow, let it mellow" signs are plastered across bathroom stalls. "Unwashed hair is now a sign of social responsibility," resident Darryn Ten told CNN.

For months, Cape Town, a city of four million people, has been facing the doomsday scenario of the taps running dry. They're calling it "Day Zero." With dam levels drastically low, life-altering emergency water restrictions have been implemented in a desperate attempt to prevent the catastrophe.

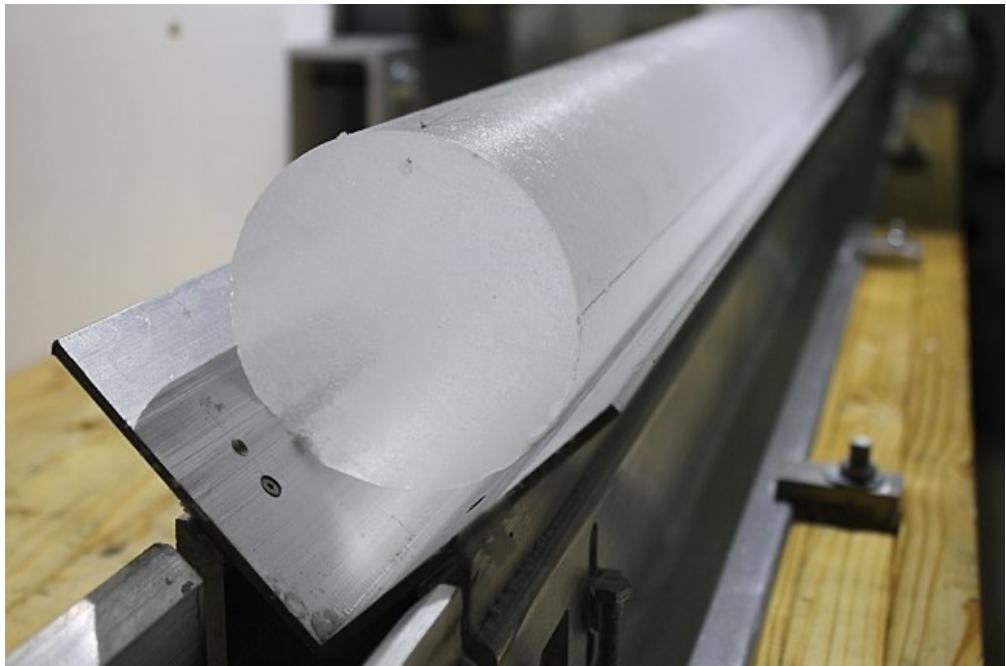
Residents have been living off a daily allowance of just 50 liters (a little over 13 gallons) a day. Anxious residents have been stockpiling water and installing tanks. For many, the day now starts standing in line at a natural spring to collect water for the family.

The shortage is forcing some residents to get creative. Anne Verbist recycles her tap water to tend to her plants. "We catch all water from the tap to wash hands and dishes and use it for the plants," she said. But creativity is also creating problems. "People are buying anything that can hold water," said resident Richard Stubbs. "No buckets, no gas cans or drums are in stock. So people are buying bins, vases and large storage boxes." If the rains don't come soon, "Day Zero" will force many residents out of the town. Then the question will be- where will they go?

(Adapted from CNN articles)

STATION 6

Directions: Head to <https://bit.ly/3ELdxnO> and watch the YouTube clip on ice cores. How do ice cores help us learn about what the climate was like thousands of years ago?
(link is case sensitive)

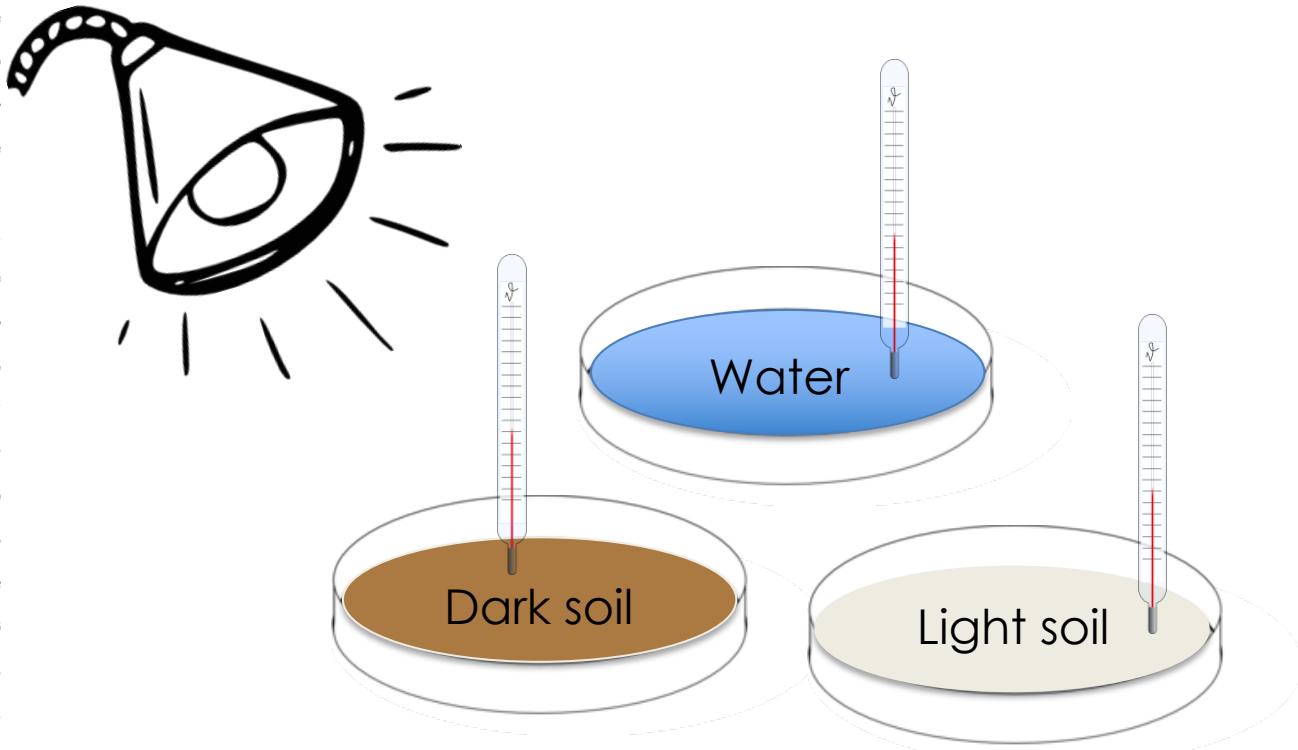


STATION 7

The **Albedo Effect** is the ability of surfaces to reflect sunlight. Lighter surfaces (such as snow) reflect more light than darker surfaces (such as soil).

The albedo effect has a significant impact on our climate. We are seeing shifts in our climate due to albedo; as ice caps melt and bedrock below is exposed, the amount of sunlight reflected back to space changes.

Directions: Three materials have been placed under a heat lamp, which represents the Sun. Record the temperature of each material and answer the questions on your lab worksheet.



STATION 7

The **Albedo Effect** is the ability of surfaces to reflect sunlight. Lighter surfaces (such as snow) reflect more light than darker surfaces (such as soil).

The albedo effect has a significant impact on our climate.

We are seeing shifts in our climate due to albedo; as ice caps melt and bedrock below is exposed, the amount of sunlight reflected back to space changes.

Directions: Observe the albedo chart below and answer the questions on your lab paper.

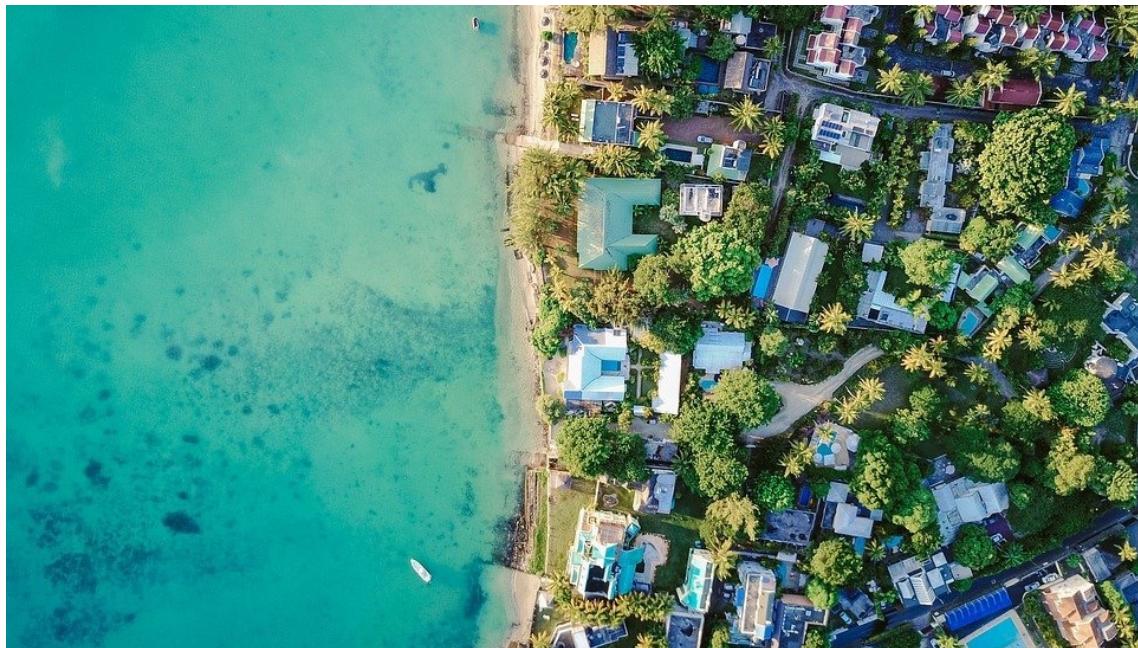


Material	Percent reflected
Fresh snow	80-95
Thick cloud	70-80
Old snow	50-60
Light soil	24-45
Thin cloud	20-30
Deciduous forest	15-20
Crops	10-25
Dark soil	5-15
Asphalt	5-10
Water	3-5

STATION 8

Directions: Head to go.nasa.gov/3zz4wu0 and click on “sea level” within the interactive.

As ice sheets melt due to global warming, we will see ocean levels rise. As you push play in the interactive, you will see a prediction of what areas of land will be underwater due to sea level rise. What impact will this have on people who leave near the coast?



STATION 9

A **carbon sink** is a natural environment that has the ability to absorb large amounts of carbon dioxide from the atmosphere. (This is good! We want to keep CO₂ out of the atmosphere to minimize the greenhouse effect). Two main carbon sinks are forests and oceans.

Trees take in carbon dioxide from the atmosphere during photosynthesis, and store it as mass within their leaves and wood. Cutting down forests not only releases carbon dioxide, but also removes the ability for trees to absorb carbon dioxide from the atmosphere.

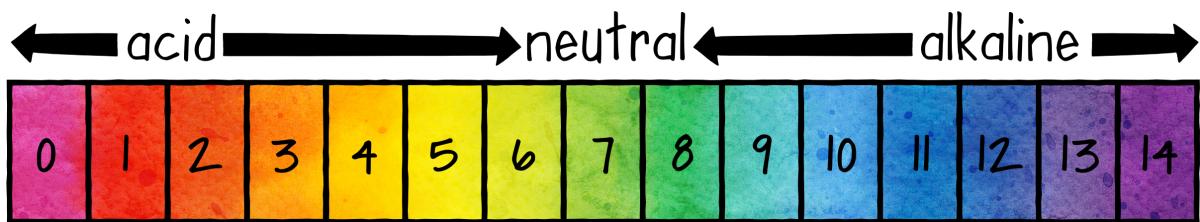
Trees are important! But we are losing forests at an alarming rate. Between 1990 and 2016, the world lost 502,000 square miles (1.3 million square kilometers) of forest- an area larger than South Africa.

So why are forests getting cut down? There are a variety of reasons. Your first guess may be logging- we use the wood to produce paper products. Urbanization is also a factor. But the surprising reason we are losing thousands of acres per year? We need the space for livestock. The demand for beef is so high that cattle ranchers need the space to raise them. Is that steak really worth more than the carbon the forest stores and the oxygen it produces?

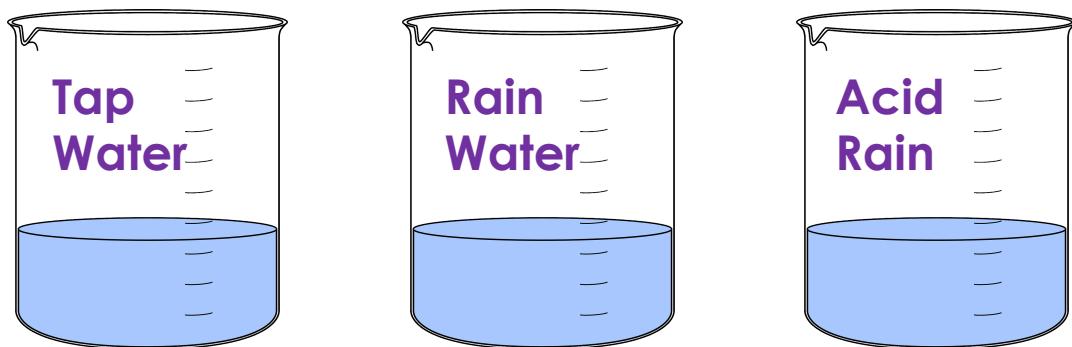


STATION 10

Acid rain is rainfall that is made slightly acidic due to atmospheric pollution. Greenhouse gases including carbon dioxide, sulfur oxide, and nitrogen oxide are acidic. When they mix with water vapor in the air they form acid rain.



Directions: At this station you will test the pH of tap water, the pH of typical rainwater, and the pH of acid rain. What impact do you think acid rain has on wildlife?



CLIMATE CHANGE STATIONS

Name: ANSWER KEY

Period:

Date:

Directions: You will be rotating around the room to 10 different stations. At each station, directions will be provided on what to do. You will have roughly 4 minutes to complete each station before you need to rotate.

Station 1:

1. What impact are humans having on the planet? Give 2 specific examples.
 - a. STUDENT ANSWERS WILL VARY. THEY WILL SEE THINGS LIKE MELTING GLACIERS,
 - b. DEFORESTATION, URBANIZATION, AND MINING.
2. What changes would you expect to see within the next 100 years? STUDENT ANSWERS WILL VARY BUT CAN INCLUDE- IF WE CONTINUE AT THIS RATE WE WILL SEE EXTINCTION OF SPECIES, RISING SEA LEVELS, AND HIGHER CO₂ EMISSIONS.

Station 2:

1. What does anthropogenic mean? HUMAN CAUSED
2. Why do you think there was so much resistance to the idea of rapid climate change caused by humans? PEOPLE DON'T LIKE THE IDEA THAT WE ARE CHANGING THE CLIMATE IN WAYS THAT HAVE NEVER OCCURRED BEFORE. HUMANS ALSO DON'T LIKE CHANGE-SO HAVING TO CHANGE OUR LIFESTYLE (IE: USING LESS ENERGY, SWITCHING TO RENEWABLES) IS INCONVENIENT.

Station 3:

List 3 things you can do to lower your carbon footprint.

1. UNPLUG THINGS NOT IN USE
2. CARPOOL OR TAKE PUBLIC TRANSPORTATION
3. RECYCLE



Station 4:

1. Which economic sector releases the largest amount of greenhouse gas? TRANSPORTATION
2. What could the industry (business) sector do to lower their greenhouse gas emissions? STUDENT ANSWERS WILL VARY- BUT THEY MIGHT SUGGEST USING SOLAR PANELS, PURCHASE ENERGY EFFICIENT LIGHTING, OR EVEN ALLOW EMPLOYEES TO WORK FROM HOME.

Station 5:

1. What is a climate refugee? A PERSON WHO HAS MOVED DUE TO WEATHER-RELATED DISASTERS IN THEIR HOMETOWN.
2. What did the people in Cape Town, South Africa experience in 2018? THE PEOPLE WERE EXPERIENCING A SEVERE WATER SHORTAGE. THEY HAD A DAILY ALLOWANCE OF WATER AND MANY HAD TO STAND IN LINE TO COLLECT WATER FOR THEIR FAMILY.

Station 6:

1. These ice cores are drilled from **ANTARCTICA**.
2. The ice cores drilled here are **70,000** years old.
3. Ice core layers are like **TREE RINGS**.
4. How do they use the bubbles trapped in the ice core to measure past climate conditions? **THEY MELT THE ICE AND ANALYZE THE GASSES TRAPPED IN THE BUBBLES TO DETERMINE WHAT THE ATMOSPHERE WAS LIKE DURING THAT TIME PERIOD.**

Station 7:

1. What is the albedo effect? **THE ABILITY OF SURFACES TO REFLECT SUNLIGHT.**
2. Record the temperature (or albedo) of each of the following: **(STUDENTS WILL RECORD TEMPERATURES IF YOU SET UP THE LAB, OR ALBEDO VALUES IF YOU CHOSE TO USE THE ALBEDO CHART)** Water _____ Light soil _____ Dark soil _____
3. Which would heat up more during a summer day- the ocean or the sandy beach? How do you know? **THE BEACH- THE SAND GOT HOTTER THAN THE WATER IN THIS EXPERIMENT.**

Station 8:

1. Which US states shown will be impacted the most by rising sea levels? **FLORIDA** and **LOUISIANA**.
2. What would you do if you and your family lived in an area that will be impacted by rising sea levels? **MANY FAMILIES WILL HAVE TO MOVE, AND BE FACED WITH LOSING THEIR HOME VALUES AND NOT HAVING THE FUNDS TO RELOCATE.**

Station 9:

1. What is a carbon sink? **A NATURAL ENVIRONMENT THAT IS ABLE TO ABSORB LARGE AMOUNTS OF CARBON DIOXIDE FROM THE ATMOSPHERE.**
2. List 2 carbon sinks: **FORESTS** and **OCEANS**.
3. Why are forests being cut down? **URBANIZATION, NEED FOR LUMBER, NEED LAND FOR AGRICULTURE AND LIVESTOCK.**

Station 10:

1. What was the pH of tap water? ~7 Rain water? ~5 Acid rain? ~4
2. What impact do you think acid rain has on plants and animals? On infrastructure? (buildings and roads?) **ACID RAIN CAN KILL TREES OVER TIME AS THEY ABSORB ACIDIC WATER. IT CAN AFFECT MARINE LIFE SUCH AS PHYTOPLANKTON AND FISH. OVER TIME IT CAN CAUSE WEATHERING AND EROSION OF BUILDINGS.**



SCIENCE LESSONS THAT ROCK!



Thank you for purchasing one of my products!



I hope you enjoy the product! If so, I would love if you would leave positive feedback! If you are not happy with the product, please let me know how I can improve it.



© Science Lessons That Rock
TERMS OF USE
YOU MAY:

- Use this product year after year for your own students
- Place this file in a password protected class page (Canvas, Google Classroom, Microsoft Teams, etc.)

YOU MAY NOT:

- Upload this file to a public website where resources can be shared without permission
- Make copies for or email this resource to teachers within your grade level or organization



Failure to comply with these terms of use is a copyright infringement.



Due to copyright, products with clipart cannot be provided in an editable format. Thanks for your understanding!

Thanks to Jena Hudson at Sew Much Music for clipart and Kimberly Geswein fonts

