

4-H Environmental Project Week 5: How Hot Has it Got?



Lesson Goal: Youth will understand the relationships that exist in our environment for the production of air, temperature control and the greenhouse effect.

Lesson Objectives:

Youth will be to identify 3 gases that makeup air.

Youth will be to describe how photosynthesis supports the environment.

Youth will be able to define the role plants play in our environment.

Youth will be able to identify how humans may contribute to global warming.

Youth will be able to describe some factors that affect increased global warming.



Background Knowledge:

Air is a natural resource composed mainly of 78.09% nitrogen. It's made up of 20.95 percent oxygen with 1% consisting of 0.93% argon. There's 0.03% carbon dioxide and water vapor. Only about 0.003% consists of other trace gases such as ozone. Water vapor amounts in the air vary.

Air is a mixture of gasses that compose the atmosphere. When the earth was forming, air as we know it today did not exist. In the beginning of the earth's formation, gravity drew in materials that were orbiting around the sun. This included gases.

As the earth cooled, the solid inner core and liquid outer core produced the magnet field. When the heat of the early earth dissipated out into space, water began to condense, and surface water accumulated. Algae made oxygen, the same way plants make it today. Early oxygen levels were at around 1 to 2 percent of what they are today. Ozone formed after oxygen levels were sufficient for it to form to protect the earth from ultraviolet light.

North Dakota Summers

According to North Dakota State Climate Office, summer days are usually warm or even hot on occasion. The average number of days per year with maximum temperatures of 90° F or more range from 10 in the northeast to 24 in the west and south. Temperatures of 100° F are most prevalent in the drier southwest and southcentral regions where they average about 2 days per year. In the northeast regions 100° F occurs only about 1 day every 4 or 5 years. The highest temperature ever recorded was 121° F at Steele ND on July 6, 1936

Photosynthesis in the Environment

In the process of photosynthesis, (means: making things with light) phytoplankton release oxygen into the water. Half of the world's oxygen is produced via phytoplankton photosynthesis. The other half is produced via photosynthesis on land by trees, shrubs, grasses, and other plants.

On Land

The process of photosynthesis is one process that is a very vital and basic link to sustaining life on earth. On land, plants (Producers) capture energy from the sun, carbon dioxide from the air, and nutrients

from the soil to live. Plants provide oxygen, food and shelter for insects, birds and animals. Predatory birds and animals (consumers) eat the small animals and insects and deposit droppings on the soil. Plants and animals die and decomposers work to turn the droppings and dead animals back into soil nutrients for the plants. This is a continuous renewing cycle as long as conditions remain the same.



In the Ocean

In the ocean, phytoplankton (producer) is the plant life of the ocean that drives the food chain. Phytoplankton functions much like the plants on land. The tiny plants use sunlight, carbon dioxide and nutrients from the water to grow. Zooplankton (consumer) are tiny animals that feed on the plant life and provide food for small fish and whales. The small fish (consumers) are prey species for the larger fish (consumers), sharks, seals, and whales. The plant life, fish and animals deposit droppings, die and the decomposers turn them back into nutrients for the plankton.

Why is it important to have plants that use carbon dioxide?

Carbon dioxide is a greenhouse gas, meaning that it is among a family of gases including water vapor, ozone, and nitrous oxide. Together, these gases make the Earth habitable, by increasing heat efficiency and keeping the temperature of the planet stable. The issue with carbon dioxide in particular is that there is currently more of it in the atmosphere than there should be, and it is starting to trap too much heat as a result. The extra heat trapped by the growing number of greenhouse gases is leading to a phenomenon called global warming.

The atmosphere that exists on earth that supports life is a delicate balance of factors that current life is adapted to survive. If those conditions change, species must begin to immediately adapt or they will no longer thrive and survive. If a drastic long-term change occurs before the species can make an adaptation, the species will go extinct.

Why do we care if the Earth's temperature is rising?

The five warmest years in the 1880–2019 record have all occurred since 2015, while nine of the 10 warmest years have occurred since 2005. According to the 2019 Global Summit Summary, the combined land and ocean temperature has increased at an average rate of 0.07°C (0.13°F) per decade since 1880; however, the average rate of increase since 1981 (0.18°C / 0.32°F) is more than twice as great.

The Federal Environmental Protection Agency is charged with oversight of our environmental safety. According to the Federal Environmental Protection Agency, many things generate carbon dioxide naturally. However, human activities have released large amounts of carbon dioxide and other greenhouse gases into the atmosphere in the last century. The majority of greenhouse gases come from burning fossil fuels to produce energy, although deforestation, industrial processes, and some agricultural practices also emit gases into the atmosphere. Greenhouse gases act like a blanket around Earth, trapping energy in the atmosphere and causing it to warm. This phenomenon is called the greenhouse effect and is natural and necessary to support life on Earth.

However, two things are contributing to the rise of carbon dioxide levels. The first is the generation of large amounts of the compound through the burning of fossil fuels like gasoline. The second issue is a decline in organisms that would normally process this compound. This is a problem caused by the activities of humans such as widespread deforestation and ocean pollution are interfering with the earth's oxygen generator.

Rising levels of carbon dioxide in the atmosphere appear to be clearly linked with the rise in global temperature. These scientists believe that global warming is being accelerated by human activity, and that our growing emissions need to be checked before it is too late.

Scientists have only examined a small fraction of the estimated 8 million species on Earth. The International Union for Conservation of Nature calculated in March 2019 that 27,159 species are threatened, endangered or extinct in the wild out of nearly 100,000 species biologists examined in depth. That includes 1,223 mammal species, 1,492 bird species and 2,341 fish species. Nearly half the threatened species are plants.

Use Background Information to Discuss:

1. **What is air and where does it come from?** Air is a gas and is a by-product of photosynthesis on land and in the ocean. Animals need it to survive. A person breathes about 11,000 liters of air per day.
2. **Who oversees our environment and air quality for us?** Environmental Protection Agency.
 - a. Air quality index – a government scale (EPA) from 0- 500. Zero is perfect. 300 is hazardous. North Dakota Winter is 30-32 PPB – in the good range <50 PPB.
 - b. North Dakota Department of Health – identifies air quality policies, works to safeguard the air quality in North Dakota. Provide inspections and permitting.
3. **What is happening to the earth that is changing our environment?**

Ozone and greenhouse gases. The issue with carbon dioxide in particular is that there is currently more of it in the atmosphere than there should be, and it is starting to trap too much heat as a result. The extra heat trapped by the growing number of greenhouse gases is leading to a phenomenon called global warming.

Explain how global warming begins to change the planet. If those conditions change, species must begin to immediately adapt or they will no longer thrive and survive. If a drastic long-term change occurs before the species can make an adaptation, the species will go extinct.

Resources and References:

<https://www.climate.gov/news-features/understanding-climate/climate-change-global-temperature>

<https://www.ncdc.noaa.gov/sotc/global/201913>

<https://www.cbsnews.com/news/report-1-million-animals-plant-species-face-extinction-due-climate-change-human-activity-population/>

<https://www.ndsu.edu/ndsco/#:~:text=Mission,and%20extension%20and%20information%20services.>



www.ag.ndsu.edu/extension

NDSU Extension does not endorse commercial products or companies even though reference may be made to tradenames, trademarks or service names. NDSU encourages you to use and share this content, but please do so under the conditions of our Creative Commons license. You may copy, distribute, transmit and adapt this work as long as you give full attribution, don't use the work for commercial purposes and share your resulting work similarly. For more information, visit www.ag.ndsu.edu/agcomm/creative-commons.

County commissions, North Dakota State University and U.S. Department of Agriculture cooperating. NDSU does not discriminate in its programs and activities on the basis of age, color, gender expression/identity, genetic information, marital status, national origin, participation in lawful off-campus activity, physical or mental disability, pregnancy, public assistance status, race, religion, sex, sexual orientation, spousal relationship to current employee, or veteran status, as applicable. Direct inquiries to Vice Provost for Title IX/ADA Coordinator, Old Main 201, NDSU Main Campus, 701-231-7708. ndsu.eoaa@ndsu.edu. This publication will be made available in alternative formats for people with disabilities upon request, 701-231-7881.

Lesson Materials: Greenhouse Activity

- 4 -glass jars (quart sized)
- 4 -one gallon Ziploc or clear plastic bags
- 3-5 ice cubes for 2 jars
- 2 -shallow pans for glacier ice and two teaspoons soil
- 4 thermometers and two sticks or pegs
- Observation Sheets



Greenhouse Activity

In demonstrations and experiments, it is always good to have youth make predictions and discover how well they prove true. At the end of the activity, reflect on the activity to process what they have learned. In this activity, youth will be able to simulate and monitor an experiment for the influence of the greenhouse effect on the temperature of our environment.

1. Take two glass jars and fill one third with cold water. (quart jar)
2. Let stand until both are same temperature (overnight)
3. Add 5 ice cubes to each jar.
4. A thermometer is fastened to a stick, landscape peg, or object to keep it above the water in the jar. A thermometer is placed in each jar.
5. Wrap one jar in the clear plastic sack and the other with no cover.
6. Put both jars in the sun near window for two hours. Youth can monitor the temperature rise of each jar and record results on the activity sheet.



More Greenhouse Fun!

1. Take four glass jars and place a layer of soil one inch deep in each jar. One with sand, one with black soil, one with soil covered with material like lawn clippings, and the last one with a cup of water. (do a comparison to the jar with water with each jar of soil if only two thermometers)
2. Place a thermometer in each jar and wrap each jar with a clear plastic bag.
3. Place the jars in the sun near a window and monitor temperature of the jars every 30 minutes for two hours of time.
4. Record the temperatures on your activity sheet.

Glacier Melt

The world's glaciers are part of the mechanism to moderate the world's temperature. This experiment is to discover how pollution on glacier ice can affect its melting rate and influence the earth's temperature. With premature melting, the ability of the glacier to cool is changed and so is the overall climate.



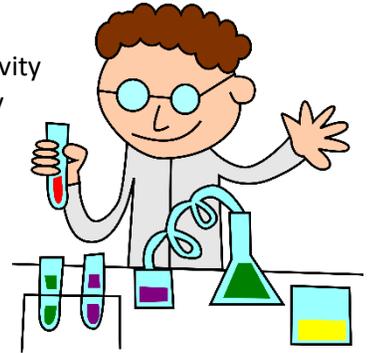
1. Two pans are filled with one quart of water. One pan is filled with clean water and the other is filled with water with one teaspoon of soil mixed in it and one sprinkled over the top once frozen. The soil simulates dust from pollution that settles on the glacier.
2. Next, remove the ice glaciers from the pans and place them in the sun on a clear sheet of plastic or they can be left in the pan indoors near a sunny window.
3. Monitor every 15 minutes until the time of the melting of each glacier.
4. Record the times on the activity sheet.

4-H Environmental Activity Record

Please remember it is not required for the five projects completed to do every activity provided in the weekly project. They are provided so youth can do as much as they want or can be adapted for younger ages.

Greenhouse Activity

Be sure that both jars are same temperature to start before adding ice cubes. After putting the ice cubes in the jar and placing the thermometer inside, what happened at:



30 minutes: Jar in the plastic sack temperature is _____

Jar without the plastic sack temperature is _____

45 minutes: Jar in the plastic sack temperature is _____

Jar without the plastic sack temperature is _____

One hour: Jar in the plastic sack temperature is _____

Jar without the plastic sack temperature is _____

Two hours later: Jar in the plastic sack temperature is _____

Jar without the plastic sack temperature is _____

Greenhouse Effect on our Landscape

Temperature	<u>Jar 1</u>	<u>Jar 2</u>	<u>Jar 3</u>	<u>Jar 4</u>
-------------	--------------	--------------	--------------	--------------

30 minutes

One hour

90 minutes

2 hours

Glacier Melt Activity

	<u>Glacier One</u>		<u>Glacier Two</u>	
30 minutes		% melted		% melted

One hour

90 minutes

