



4-H 365.14



Climate Change

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Climate change, also called global warming, is a widely discussed environmental topic the world over. Here is some background on what it is all about.

The earth orbits the sun at an average distance of about 93 million miles. Energy comes from the sun in the form of radiation, and a portion of that energy is absorbed as heat on the surface of the earth. Most of the sun's energy, however, is reflected from earth's surface back toward space. Some of the escaping energy is captured by gases in earth's atmosphere, causing the atmosphere to heat up. This is called the **greenhouse effect**, and the gases that contribute to it are often referred to as **greenhouse gases**.

The greenhouse effect is natural. In fact, if it did not exist, the temperature on the earth would be too cold to have liquid water, which supports life as we know it. Greenhouse gases include water vapor, carbon dioxide, and methane. Since the Industrial Revolution began, around 200 years ago, humans have

burned large amounts of fossil fuels like coal, oil, and natural gas. As a result, emission of one particular greenhouse gas, carbon dioxide, has increased a great deal.

Sources and Sinks

To understand how a gas like carbon dioxide influences the atmosphere, we need to think in terms of sources and sinks. Things that put carbon dioxide into the atmosphere are called **sources**. Natural sources include decay and animal digestion. Sources related to human activity include automobile engines, electric power stations, and anything else that burns fossil fuels. Things that take carbon dioxide out of the atmosphere are called **sinks**. Growing plants like trees are very important carbon sinks, because they take in carbon dioxide and release oxygen. The oceans also have served as an important carbon sink

Plan Your Project

Use this idea starter AND publication 4-H 365 *Self-Determined Project Guide* as you plan your project. All Ohio 4-H projects, including idea starters, include project activities, learning experiences, and leadership/citizenship activities. It is all spelled out in the *Self-Determined Project Guide*, available from your county Extension office or on the web at www.ohio4h.org/selfdetermined. You may choose to do a little or a lot depending on your level of interest. Be sure to register your project with your county OSU Extension office. Good luck!



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over the past century, but whether they can continue to play this role is questionable.

So far, the carbon sinks have not been able to keep up with the sources. As a result, the concentration of carbon dioxide in the earth's atmosphere has increased—from about 280 parts per million in 1800 to about 390 parts per million in 2008.

Scientists believe that the rise in concentration of carbon dioxide in the earth's atmosphere is causing global temperatures to increase. During the twentieth century, the average temperature on the earth rose about 1.1 degrees Fahrenheit. If carbon dioxide in the atmosphere continues to increase at the current rate (about 2.5 parts per million per year) scientists estimate that the earth's average temperature will continue to rise, probably by around 3 to 7 degrees Fahrenheit by the end of the twenty-first century.

These temperature changes may not sound like a lot. After all, in many places the temperature changes 20 degrees or more from one day to the next. But a 3 to 7 degree change in the average temperature of the planet is huge. In fact, global warming is such an important topic precisely because a warmer planet in many ways means a different planet from the one we know. It will pose large challenges for the plants and animals that inhabit the earth, including humans.

Effects of Global Warming

One of the main consequences of global warming is the melting of ice in mountainous and polar regions. When ice and snow on land melt, the extra water causes sea levels to rise. Global warming also causes sea levels to rise directly, because as the oceans warm, the water expands. Higher water levels cause beach erosion and coastal flooding. A 3 to 7 degree increase

in global average temperature is expected to raise sea levels about three feet by 2100.

As temperatures warm, weather patterns also change. Global warming could cause an increase in the number of tropical cyclones (hurricanes) because these kinds of storms develop only over very warm areas of oceans and seas. Changing weather patterns also can cause drought in some areas and flooding in others.

Another area of concern is agriculture. We have an inexpensive and abundant food supply. Farmers know which kinds of crops and livestock do well under current conditions. But weather ultimately determines the amount and quality of food that can be produced. Environmental changes like global warming may mean that the agricultural activities have to change.

Plants and animals all over the world have survived by evolving, by adapting to the environment. Living things adapt more easily to gradual change than to sudden or drastic change. When change takes place quickly, over years or decades, gradual adaptation is not possible. Some animals (and even some plants) can migrate to survive. But many are not be able to do so, and will face extinction.

The Future

So, what do we do about global warming? While scientists continue to study the topic, many political and business leaders are taking action. Some countries like Norway have already cut their annual emissions of carbon dioxide. New technologies allow us to use fossil fuels more wisely. The hybrid car is one example of how technology is changing. In the future, we are likely to use a combination of more efficient engines and alternative energy sources (like solar and wind power) to meet our growing energy demand. At the same time, we need to reduce the emission of carbon dioxide and increase the number and capacity of carbon sinks.



Areas of Interest and Things to Do

Every self-determined project can be broken down into areas of interest. These are specific things members want to address during their project adventure. Using 4-H 365 *Self-Determined Project Guide*, identify at least three (3) areas of interest with at least three (3) activities per area to explore. Take your ideas from the list below or make up your own.

Climate vs. Weather

- Keep a weather data table for three weeks. Compare your data to the records online or from the evening weather report.
- Make a “travel brochure” that would invite tourists to sample the various climates in the United States.
- Why is the “normal” weather for a date this year different than for the same date in 1990? Use the file named “Monthly Station Normals” for Ohio at <http://cdo.ncdc.noaa.gov/cgi-bin/climatenormals/climatenormals.pl> to calculate “normals” and contrast a few locations.

History of Climate

- Describe the history of U.S. weather records—how long, what measurements, and where the oldest records are found.
- Compare the climate data summaries for the Ohio cities of Cleveland, Cincinnati, and Columbus. Use the file named “Monthly Station Normals” for Ohio at <http://cdo.ncdc.noaa.gov/cgi-bin/climatenormals/climatenormals.pl> to find out the normal monthly temperature and precipitation for a climate station near your home. Create two line graphs — one that shows the maximum and minimum temperature and another that shows precipitation.
- Estimate the percentage of the earth’s surface that is covered by ocean in the Northern Hemisphere. Use the same procedure to estimate the percentage of ocean surface in the Southern Hemisphere. Explain the procedure you used to calculate the difference, and why the land/ocean differences might be important.
- Make a timeline to show the glacial and interglacial periods in North American history. Add photos that show evidence that glaciers existed in Ohio long ago.
- Explain one of these natural processes that provide information about past temperatures: coral reefs,

tree rings, seafloor sediments, lake varves, packrat middens, or stalactites and stalagmites. Mark locations on a world map to show where these kinds of data have been gathered.

Satellite Data

- Design a display that shows what climate satellites do, when they were launched, and some examples of information they provide.
- Build a model of a satellite that is used for climate science, and explain its main features and its history.
- Select four (4) of the satellites used to gather climate data and make a poster with an illustration or picture that compares the area that each satellite can cover and the frequency with which it scans the earth.
- Create a table to compare four (4) advantages and four (4) disadvantages of using satellite data for climate and weather analysis.
- Create a poster to compare and contrast weather and climate information that Benjamin Franklin used with the satellite- and computer-based weather and climate information that is available today.

Predictions of Change

- Compare the climate change predictions for any two large regions of the United States, such as the Great Lakes area, the Gulf Coast region, the Pacific Northwest, the desert Southwest, and/or New England.
- Examine the maps and predictions for sea level rise at https://www.cresis.ku.edu/research/data/sea_level_rise/index.html. If you were the ambassador for an island nation, such as the Bahamas or Papua New Guinea, what would you say to the General Assembly of the United Nations about the predictions for storms and sea level rise in the next century?

Human Impact

- Create an illustration or a table that compares and contrasts the inputs and outputs of energy from the earth, both naturally and with human impact.
- Create a collage with photos or pictures that illustrate human activities that contribute to the “enhanced greenhouse effect.”
- Create a shopping list of appliances and other products that are ways families can reduce their impact on the environment. Include descriptions of their energy-saving features.
- Compare and contrast what other countries are doing and what NGOs (non-governmental organizations) in the United States are doing to reduce greenhouse gas emissions.

Polar Regions

- Design a zoo exhibit that shows the habitat and needs of polar bears, and compare and contrast this to the habitat and needs of penguins.
- Watch the movie *An Arctic Tale*. Make a poster that describes or illustrates the climate conditions in the winter months in the Arctic and in the Antarctic.
- Illustrate the impact of climate change on native peoples in the Arctic and sub-Arctic regions of North America.
- Find web sites that illustrate the effects of thawing permafrost on the local ecosystem and on the climate system as a whole. Select twelve (12) pictures that illustrate these changes, and write captions for each.

Related Resources

The U.S. Environmental Protection Agency
<http://www.epa.gov/climatechange/kids>

ClimateChangeEducation.org
<http://globalwarmingkids.net>

PEW Center on Global Climate Change
<http://www.pewclimate.org/global-warming-basics/kidspage.cfm>

University Corporation for Atmospheric Research
<http://eo.ucar.edu/kids/green/what1.htm>

www.ohio4h.org/selfdetermined



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