NATIONAL GEOGRAPHIC

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UNIT

# Climate Change Challenge

Students examine key causes and impacts of climate change on Earth's atmosphere and oceans, as well as mitigation and adaptation strategies. They analyze data from long-term observations of climate in the air and under water, using graphs to convince community members to sign a Climate Change Challenge Pledge of their design.

**GRADES**

6 - 8

**SUBJECTS**

*Biology, Ecology, Conservation, Earth Science, Climatology, Meteorology, Oceanography, Engineering, Geography, Human Geography*

**CONTENTS**

4 Lesson plans

For the complete unit with media resources, visit:
http://www.nationalgeographic.org/unit/climate-change-challenge/

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# UNIT OVERVIEW

Climate change has far-reaching effects on our planet, from increasing the frequency and intensity of many extreme weather events, including flooding and drought, to changing sea temperature, ocean acidity, and sea level. In this unit, students apply concepts such as the greenhouse effect, weather variables, and thermohaline circulation to model how climate change impacts the atmosphere, the oceans, and human communities.

For each major effect of climate change studied in this unit, students examine related, long-term primary datasets. They collaborate to organize variables into tables, calculate summary statistics, and create graphical representations of climatic trends. They move from performing these key skills by hand to digitally, as they gain mathematical and technical fluency.

After organizing, analyzing, and visualizing climate data, students perform research to create a Climate Change Challenge Pledge with three relevant strategies for mitigation of personal contributions to climate change. They present their work to the school community using explanations of their data representations and justifications of the pledge to convince others to shrink their carbon footprints.

Use this unit at a glance to explore a brief outline of the materials included in this resource.

***Unit Driving Question: How can we communicate evidence of climate change to convince our community to act?***

## LESSON 1: CARBON CONCERNS | 5 HRS

Students explore climate change and global warming with multimedia. They create a model of the greenhouse effect and then refine their findings using a demonstration and interactive. Next, students research and diagram carbon sources and sinks. Finally, they organize and analyze data to draw evidence-based conclusions regarding atmospheric carbon concentrations and local emissions. This lesson is part of the *Climate Change Challenge* unit.

## LESSON 2: EXTREME WEATHER | 5 HRS

Students examine the causes and effects of extreme weather events and read to contrast weather and climate. Next, they create and revise models of an extreme weather event using knowledge of weather variables. Finally, students link extreme weather events and climate change. Students use an interactive graph and long-term datasets, as well as create their own graphical representations of weather data. This lesson is part of the *Climate Change Challenge* unit.

## LESSON 3: SHIFTING SEAS | 4 HRS 35 MINS

Students make and evaluate predictions related to climate change's effects on the oceans, using evidence from videos, articles, and demonstrations. Next, they examine, analyze, and graph data on ocean acidification, sea surface temperature, and changes in sea level. Finally, students use these data and their visualizations to make evidence-based predictions and examine adaptation technologies. This lesson is part of the *Climate Change Challenge* unit.

## LESSON 4: OUR CHANGE TO MAKE! | 5 HRS

Students explore the human effects of climate change and global strategies for mitigation and adaptation. Next, they track their own carbon footprint and interview school community members to identify key carbon-emitting behaviors. Finally, students design and present a Climate Change Challenge Pledge to help others in the school community commit to reducing their climate impact. This lesson is part of the *Climate Change Challenge* unit.

## BACKGROUND & VOCABULARY

# Vocabulary

| Term | Part of Speech | Definition |
|---|---|---|
| **adaptation** | *noun* | a modification of an organism or its parts that makes it more fit for existence. An adaptation is passed from generation to generation. |
| **atmosphere** | *noun* | layers of gases surrounding a planet or other celestial body. |

| Term | Part of Speech | Definition |
|---|---|---|
| **atmospheric pressure** | *noun* | force per unit area exerted by the mass of the atmosphere as gravity pulls it to Earth. |
| **carbon cycle** | *noun* | series of processes in which carbon (C) atoms circulate through Earth's land, ocean, atmosphere, and interior. |
| **carbon dioxide** | *noun* | greenhouse gas produced by animals during respiration and used by plants during photosynthesis. Carbon dioxide is also the byproduct of burning fossil fuels. |
| **carbon emission** | *noun* | carbon compound (such as carbon dioxide) released into the atmosphere, often through human activity such as the burning of fossil fuels such as coal or gas. |
| **carbon footprint** | *noun* | total sets of greenhouse gas emissions caused by an organization, event, product or individual over a set period of time. |
| **carbon sink** | *noun* | area or ecosystem that absorbs more carbon dioxide than it releases. |
| **carbon source** | *noun* | process, area, or ecosystem that releases more carbon dioxide than it absorbs. |
| **climate** | *noun* | all weather conditions for a given location over a period of time. |
| **climate change** | *noun* | gradual changes in all the interconnected weather elements on our planet. |
| **climate refugee** | *noun* | person forced to leave his or her home and community because of climate change. |
| **cloud cover** | *noun* | amount of sky covered with clouds. |
| **density** | *noun* | number of things of one kind in a given area. |
| **drought** | *noun* | period of greatly reduced precipitation. |
| **environmental refugee** | *noun* | person who has been forced to flee his home and community due to changes in the environment, such as drought. |
| **extreme weather** | *noun* | rare and severe events in the Earth's atmosphere, such as heat waves or powerful cyclones. |
| **fossil fuel** | *noun* | coal, oil, or natural gas. Fossil fuels formed from the remains of ancient plants and animals. |
| **global warming** | *noun* | increase in the average temperature of the Earth's air and oceans. |
| **greenhouse gas** | *noun* | gas in the atmosphere, such as carbon dioxide, methane, water vapor, and ozone, that absorbs solar heat reflected by the surface of the Earth, warming the atmosphere. |
| **heat** | *noun* | energy that causes a rise in temperature. |

| Term | Part of Speech | Definition |
|---|---|---|
| **humidity** | *noun* | amount of water vapor in the air. |
| **hurricane** | *noun* | tropical storm with wind speeds of at least 119 kilometers (74 miles) per hour. Hurricanes are the same thing as typhoons, but usually located in the Atlantic Ocean region. |
| **Keeling curve** | *adjective* | graph illustrating the amount of carbon dioxide ($CO_2$) in Earth's atmosphere as measured at the Mauna Loa Observatory in Hawaii. |
| **mean** | *noun* | mathematical value between the two extremes of a set of numbers. Also called the average. |
| **median** | *adjective* | situated in the middle. |
| **mitigation** | *noun* | process of becoming or making something milder and less severe. |
| **ocean acidification** | *noun* | decrease in the ocean's pH levels, caused primarily by increased carbon dioxide. Ocean acidification threatens corals and shellfish. |
| **ocean conveyor belt** | *noun* | system in which water moves between the cold depths and warm surface in oceans throughout the world. Also called thermohaline circulation. |
| **pH** | *noun* | measure of a substance's acid or basic composition. Distilled water is neutral, a 7 on the pH scale. Acids are below 7, and bases are above. |
| **pledge** | *verb* | to guarantee or promise. |
| **precipitation** | *noun* | all forms in which water falls to Earth from the atmosphere. |
| **range** | *noun* | difference between the smallest and largest value in a set of numbers. |
| **reservoir** | *noun* | large, concentrated supply or reserve. |
| **salinity** | *noun* | saltiness. |
| **sea level** | *noun* | base level for measuring elevations. Sea level is determined by measurements taken over a 19-year cycle. |
| **sea level rise** | *noun* | increase in the average reach of the ocean. The current sea level rise is 1.8 millimeters (.07 inch) per year. |
| **slope** | *noun* | slant, either upward or downward, from a straight or flat path. |
| **sunlight** | *noun* | visible radiation from the sun. |
| **temperature** | *noun* | degree of hotness or coldness measured by a thermometer with a numerical scale. |
| **thermohaline circulation** | *noun* | ocean conveyor belt system in which water moves between the cold depths and warm surface in oceans throughout the world. |
| **tornado** | *noun* | a violently rotating column of air that forms at the bottom of a cloud and touches the ground. |

| Term | Part of Speech | Definition |
| --- | --- | --- |
| **weather** | *noun* | state of the atmosphere, including temperature, atmospheric pressure, wind, humidity, precipitation, and cloudiness. |
| **wildfire** | *noun* | uncontrolled fire that happens in a rural or sparsely populated area. |
| **wind** | *noun* | movement of air (from a high pressure zone to a low pressure zone) caused by the uneven heating of the Earth by the sun. |