Climate Change Causes

» Essential Question: How have scientists investigated climate change?

» Materials: ice cubes, printouts of graphic organizers (such as those available at scholastic.com/teachers/lesson-plan/graphic-organizers-reading-comprehension), pencils, paper, Internet/library access for student research

» Activity Sheet: Why Is the Climate Changing? Lexile 1140L  » Time Required: 40 minutes, plus homework time

» Background Resource: Think Like a Scientist epa.gov/climatestudents/scientists/index.html

LEARNING OUTCOMES
Students will be able to:
1. Explain the investigative processes scientists have used to document and monitor climate change.
2. Explain why scientists believe human activity is the main driver of climate change.
3. Identify the main ideas in a nonfiction passage about climate change.

INTRODUCE THE CONCEPT
Pass around ice cubes and ask students to observe the bubbles inside them. Explain that air can become trapped inside ice. By studying samples of ancient air trapped inside ice from Greenland and Antarctica, scientists have learned how Earth’s atmosphere has changed over thousands of years.

EXPLORE THE SCIENCE
Scientists have collected data on climate changes going back hundreds of thousands of years by examining clues preserved in nature. Besides studying ancient air trapped in ice, they’ve also analyzed chemicals in tree rings, ocean sediments, and even ancient bits of pollen.

By analyzing data, scientists have determined that there is more carbon dioxide in the atmosphere now than there has been at any point in the past 800,000 years.

Although not every scientist agrees on each component of climate change, a large body of scientific evidence leads many scientists to conclude that—in addition to Earth’s natural cycles—greenhouse gases from human activities are the most significant driver of observed climate change. For a close look at climate-change clues and to see some of the scientific data, visit epa.gov/climatechange/kids/scientists/ and epa.gov/climatechange/science/causes.html.

APPLICATION THE KNOWLEDGE
Scientific evidence has led many scientists to conclude that recent global warming is caused, in large part, by human activities. The research has also led scientists to explore such important questions as, How warm will Earth get? How will climate change affect different places?

Ask students to consider whether they have noticed any evidence of climate change in their everyday lives. You may choose to share examples from epa.gov/climatechange/science/indicators/index.html.

If time permits, separate students into groups and ask them to create a comic strip or a storyboard that projects how they think climate change could impact children’s lives if temperatures were permanently warmer all year long. For templates, visit printablepaper.net/category/storyboard.

Make sure students consider the types of activities children enjoy (e.g., playing basketball, running track, gardening, ice skating, or skiing), making a personal connection to the types of food they like to eat and the places they like to travel to.

Family Connection: Assign students to read a newspaper together with their family members, identifying at least one article that relates to climate change in some way. Encourage students to discuss the article and its connection to the global and regional climate.

ADDITIONAL RESOURCES
- Do Climates Change?: priweb.org/globalchange/climatechange/globalwarming/gw_01.html
- Why Do Small Changes in Earth’s Temperature Have a Big Impact?: science.howstuffworks.com/environmental/green-science/changes-earth-temperature-impact.htm
- Intergovernmental Panel on Climate Change: ipcc-wg2.gov
- What We Know: whatweknow.aaas.org
Why Is the Climate Changing?

The climate is changing. But what, exactly, does that mean?

The word *climate* describes the long-term average of the weather over a period of time. While the weather—the state of the atmosphere at a specific moment—influences what clothes you wear on a given day, the climate determines what you include in the entire wardrobe you own. When scientists talk about the global climate, they're talking about the average climate of the whole Earth. And—as demonstrated by the data collected around the world—it's warming rapidly.

**Earth's average temperature has climbed by about 1.4°F over the last 135 years.** That may not sound like much, and if we were just talking about the weather on a given day, it wouldn't be significant. But that increase creates a big change in our climate. As Earth warms, droughts, heat waves, and wild storms are becoming more common. These climate shifts influence all life-forms that depend on the environment to survive, including humans.

**What’s behind the warm-up?**

It's not the first time the planet has gotten hotter. In the 4.5 billion years since Earth first formed, its global climate has bounced between frosty ice ages and toasty warm periods. Scientists point to several reasons for those changes.

Earth's orbit around the sun changes naturally, but these changes happen over very long periods of time. Planetary cycles, which unfold over tens to hundreds of thousands of years, impact how much solar energy reaches Earth. Slight shifts in Earth's axis, the degree to which it is tilted toward the sun, and how circular or oval Earth's path is as it orbits the sun all influence Earth's temperature.

Within shorter time frames, the sun goes through cycles too. At times, the sun gives off a bit more energy than usual, making things warmer on Earth. Events on Earth also affect climate. Volcanoes, changes in the amount of vegetation, and natural releases of greenhouse gases like methane can make Earth cooler or warmer.

Scientists trace the rapid increase back to events that happened around the year 1750. People started burning huge amounts of fossil fuels to power homes, vehicles, and factories. The burning of fossil fuels releases carbon dioxide and other greenhouse gases into the atmosphere, and it has added billions of tons of greenhouse gases to the atmosphere since the 18th century. Only by factoring in the effects of human activity along with natural causes have climatologists been able to explain the accelerated increase in Earth's temperatures.

Those are just some of the natural factors that can influence Earth's complex climate system. But climatologists—scientists who study climate—say natural factors alone can't explain the sharp rise in Earth's temperature over the last two centuries or so. Earth has warmed up much more than scientists expect from natural causes alone.