

Lesson 5 Climate and Our Lives

Weather's Hand in History

Throughout human history, inventions and technological advances have allowed people to track, adapt to, and even control the weather. Around 1602, Galileo first conceptualized a thermometer that could measure temperature. The air conditioner made its first appearance in 1902. In 1946, researchers succeeded in producing rain clouds over the sky of Massachusetts. But far more often than we control the weather, the weather controls us. The weather—or more broadly, the climate—has caused significant events throughout human history, from forced migration or the course of a war to even the creation of famous artworks.

Earth Cools and Warms Before Human History

The earth was formed about 4.5 billion years ago—that is a very long time ago! It is hard to say exactly what the weather was like in any particular place on any particular day thousands or millions of years ago. But we know a lot about what the earth's climate was like way back then, thanks to clues that remain in rocks, ice, trees, and fossils. Were it not for these natural records of the past, we would be in the dark as to the climate of the long past.

About 55-56 million years ago, the global mean temperature appears to have been as high as 23 °C, while today's global average is just shy of 19 °C. During much of this hot period, the North and South Poles were free of ice caps, and palm trees and crocodiles lived above the Arctic Circle.

While our planet has been hotter—sometimes much hotter—than it is today for much of its history, it has also been colder at times. When deep freezes occurred between 750 and 600 million years ago, ice covered the entire surface of the earth, making it look like an enormous snowball.

Climate Change Drives Humans out of Africa

There is no greater decider of human history than climate change, due to its long-term effect on living conditions. Scientists have discovered that humanity's earliest move out of Africa and into other reaches of the planet was most likely due to climate change. Homo sapiens is believed to have evolved in eastern Africa sometime over 200,000 years ago. For a long time, the climate of eastern Africa was relatively wet, meaning conditions were favorable for them with plenty of food and water available.

From 125,000 years ago, however, the climate gradually became drier in eastern Africa. This long-term drying trend was occasionally interrupted by climate shifts that lasted a few thousand years. In particular, the wet period that occurred 62,000 to 60,000 years ago throughout the Arabian and Sinai peninsulas created clear migration paths by providing sufficient food and water resources. If it had not been for the climate shifts, the humans of that time might not have spread outside of Africa.

Drought Spells the End for the Mayan Civilization

During its peak around 800 A.D., the Mayan civilization was responsible for astonishing stone temples, highly advanced astronomical observatories, and advances in mathematics that were far ahead of its time. The Mayans also practiced slash-and-burn agriculture, which involves cutting down a forest, burning the entire area, farming on the rich soil for a couple of years, and then moving onto a new plot. This method led to extreme deforestation in the Yucatán Peninsula, a region that depended on underground root systems to maintain water resources because rain was its chief water source.

Researchers found that, over 200 years, rainfall in the Yucatán Peninsula dropped by as much as 70%. The drought, combined with wars and other conflicts, seems to have triggered the end of the Mayan civilization. The Mayans themselves left behind a clue of how desperate things had become. Among the ruins that attract thousands of tourists each year are many carved stones in the shape of Chaac, the rain god of the Mayan culture.

Fog Saves the American Revolution

By the summer of 1776, Britain had increased its troop strength to more than 30,000 in a battle against General George Washington's 19,000-man army for control of New York City. Washington moved the revolutionaries out to Brooklyn and Queens, where British soldiers began their attack. Americans secretly made their way across the East River, totally undetected by the British soldiers just a few hundred meters away because of a dense fog cover. Historians widely agree that Washington would have surely been captured and punished as a traitor by the British government, had it not been for that fog. Instead, the American Revolution ended in victory for the new colonies, which made the United States an independent nation.

A Weather Phenomenon Inspires a Famous Painting

One of the most famous pieces of art in the world may have been inspired by an unusual weather event. A study suggests that the sky depicted in Edvard Munch's *The Scream* may actually be an accurate representation of a weather phenomenon known as "Mother of Pearl Clouds," a rare phenomenon that may have a big impact on anyone who sees it for the first time. The typical colors in this rare weather event are the same as the colors in Munch's painting, and the circumstances under which these rare clouds form match Munch's environment at the time he conceived *The Scream*.

Air Pollution Brings the Hazy, Dreamy Impressionist Skies

A recent study analyzed the changes in style and color of nearly 100 paintings by impressionists William Turner and Claude Monet, who lived during Europe's Industrial Revolution in the 18th and 19th centuries. The study found that over time, as industrial air pollution increased throughout Turner's and Monet's careers, the skies in their paintings became hazier, too. The Industrial Revolution transformed the skies of London and Paris, the painters' hometowns, in unprecedented ways. Many artists draw inspiration from surrounding environmental changes, and impressionist artists like Turner and Monet must have been more keenly aware of the atmospheric changes of their time. While impressionism is often contrasted with realism, the study pointed out that Turner's and Monet's works had captured a certain reality rather accurately, a reality of environmental changes.

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Climate by Design

While there have been generations of efforts to adjust weather in our favor, most of them were more theatrical than effective. However, some scientists began seriously considering ways to influence the climate system itself in an emerging field, most widely known today as "climate engineering" or "climate intervention" efforts.

There have been two main approaches aimed at preventing undesired warming. One centers on slowing down global warming by reflecting some of the sun's rays back into space before they can warm the earth. On the ground level, it may involve making the earth's surface brighter by painting the roof tops white or even adding highly reflective coverings across large areas of desert. On the atmospheric level, it works by making the atmosphere more reflective so that the sun's light is scattered before it reaches the earth's surface. To achieve this, bright, reflective particles would be fired into clouds using airplanes or balloons flying high in the sky.

The other approach is focused on capturing carbon dioxide from the atmosphere and storing it underground, or breaking down CO₂ molecules and locking the carbon in stable materials. For example, iron dust is scattered from ships in order to fertilize ocean planktons. As these organisms grow, they consume carbon dioxide from the atmosphere, and sink to the ocean floor while taking some of the carbon with them. On the ocean floor, the carbon can stay for hundreds of years.

There are, however, a host of issues too, ranging from technical to ethical to diplomatic. Perhaps the biggest issue is simply the scale of emissions—the enormous amount of CO₂ emitted into the atmosphere every year. Against such reality, could the climate engineering efforts make a difference? A recent study found that after taking into account the energy used to capture and isolate CO₂, the carbon capture efforts would reduce the total global emissions by at most 10%. Still, some believe that we need to pursue multiple routes to slow climate change. Even if there is no 100% solution, they say, we need a lot of 10% and 20% solutions.