Understanding Climate Change

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1 Climate change is one of the most pressing issues facing our planet today. From social media and product advertisements to political debates, climate change is a topic that is on the minds of people across the globe. But what exactly does this term mean? Climate change refers to significant alterations in global temperatures and weather patterns over time. According to the United Nations, a diplomatic and political international organization, "Climate change refers to long-term shifts in temperatures and weather patterns."

Climate change is happening. Fast

2 Though Earth's climate has changed naturally throughout its history—due to factors like volcanic eruptions and changes in solar energy—today's climate change is occurring at an unprecedented rate. There are undeniable signs all around us that climate change is here, including rising temperatures, extreme weather events, and rising sea levels.

Global Warming

3 According to the Copernicus Climate Change Service (C3S)'s research, conducted on behalf of the European Commission and European Union, global warming has exceeded 1.5°C, or 2.7°F, from February 2023 to January 2024. The report goes on to say that, "The global mean temperature for the past twelve months (Feb 2023–Jan 2024) is the highest on record, at 0.64°C above the 1991–2020 average and 1.52°C above the 1850–1900 pre-industrial average" (C3S, 2024). Though many who stand to gain from climate change and its related calamities, such as oil corporations, assert that this increase is small, it has significant implications for weather patterns, sea levels, and ecosystems worldwide. In January 2024, the average global sea surface temperature (SST) reached 20.97°C [69.75°F], or 0.26°C [32.47°F] warmer than the previous warmest January in 2016 (C3S, 2024). Warmer sea surface temperatures can fuel more intense hurricanes, increase the amount of carbon dioxide absorbed by the ocean, and affect the distribution and abundance of plankton, the foundation of the marine food web.

4 As we experience these changes, some remain skeptical about the causes and consequences of climate change. However, the visual evidence—melting glaciers, shifting wildlife patterns, and erratic weather—provides a compelling argument for the reality of this urgent issue.

How do weather and climate differ?

Think of weather as a person's mood and climate as their personality. Similar to how a person's mood can change from elated to enraged in a matter of minutes, the weather can shift from sunny to stormy in the blink of an eye. Conversely, someone's personality is a collection of moods and behaviors over a long period, giving others an idea of who they are overall. The American Geosciences Institute notes key differences between weather and climate:

Weather refers to the short-term atmospheric conditions in a specific place at a specific time. This includes factors like temperature, humidity, precipitation, wind speed, and visibility. For example, a rainy day or a sunny afternoon are descriptions of weather.

Climate, on the other hand, is the long-term average of weather patterns over an extended period—typically 30 years or more—for a particular region. It encompasses the expected range of temperatures, precipitation, and seasonal variations. For instance, a region might have a climate classified as tropical, arid, or temperate.

Extreme Weather

5 Extreme weather events are increasingly common, with droughts, floods, and wildfires intensifying in frequency and severity. According to a 2021 report from the Intergovernmental Panel on Climate Change (IPCC), the United Nations body for assessing the science related to climate change, the probability of extreme weather events has increased, leading to devastating impacts on communities and ecosystems. Examples of extreme weather events include:

6 - **Hurricanes**: Hurricanes in the Atlantic Ocean affect coastal regions of the United States, the Caribbean, and Central America. Warmer water temperatures have been associated with increased intensity and frequency of hurricanes, as warmer water provides more energy for storms, leading to higher winds and rainfall.

7 - **Droughts:** In sub-Saharan Africa, countries such as Zimbabwe, Malawi, and Zambia face droughts that devastate agriculture, leading to food shortages, and water scarcity. Rising temperatures and changing precipitation patterns have led to more prolonged, severe droughts in recent years.

8 - **Floods**: In countries such as India, Bangladesh, and Nepal, monsoon seasons have become more unpredictable and intense, leading to severe flooding in parts of Asia. Increased moisture in the air has resulted in heavier rainfall, causing rivers to overflow. Damage to homes and infrastructure has led to the displacement of millions of people.

Rising Sea Levels

9 Climate change is not just a distant threat; the evidence is visible and tangible, with profound impacts on our environment. One striking example is the shrinking of ice sheets and glaciers worldwide. According to the National Snow and Ice Data Center, since satellite-based measurements began in the late 1970s, the amount of ice that survives the summer melt season has shrunk by 13% each decade from the 1980s to the 2010s. In total, NASA estimates that sea levels rise by three millimeters each year. This alters ecosystems, which threatens coastal communities around the globe.

Vehicles driving through a flooded street in Kolkata, India.

It's true. Human activity is driving climate change.

10 Though the evidence for climate change is vast, it all leads to the same conclusion: humans are responsible for rising temperatures and are the largest contributors to climate change.

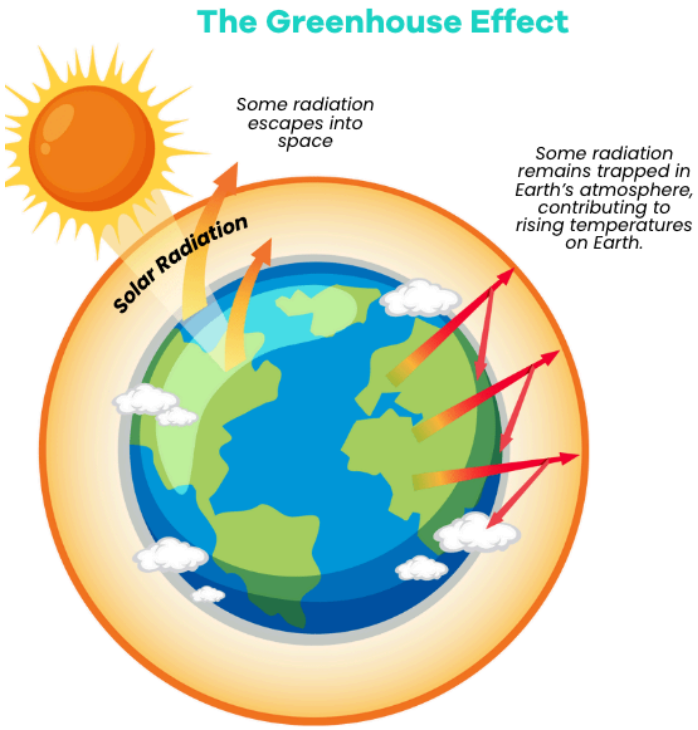
11 This overwhelming agreement is not just a matter of opinion—it is based on extensive research and data analysis. Major scientific organizations, including the Intergovernmental Panel on Climate Change (IPCC) and the National Aeronautics and Space Administration (NASA), continue to emphasize that climate change is a pressing global issue requiring immediate action. A 2014 NASA report polled the 120,000 members of the American Association for the Advancement of Science and concluded that over 97% of climate scientists agree that climate change is happening and that human activities are a significant contributing factor. And

although scientists differ slightly on exactly how much temperatures have increased, there is overwhelming agreement in the scientific community that the world is in its warmest period on record—and potentially even longer than that.

Greenhouse Gases: A Natural Cause of Climate Change

12 A 2009 report by the American Association for the Advancement of Science, an international nonprofit with the stated mission of promoting cooperation among scientists, reiterated concerns about a leading threat: greenhouse gases. "Observations throughout the world make it clear that climate change is occurring," the AAAS's statement pleaded, "and rigorous scientific research demonstrates that the greenhouse gases emitted by human activities are the primary driver" (AAAS, 2009).

13 The greenhouse gas effect—an essential natural process—warms the Earth's surface. When the Sun's energy reaches the Earth, some of it is reflected back into space, while the rest is absorbed, warming the planet. Earth then emits this absorbed energy as infrared radiation, and greenhouse gases in the atmosphere—including carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), and water vapor (H_2O)—trap some of this infrared radiation, preventing it from escaping back into space. This trapped heat helps to maintain the Earth's temperature at a level conducive to life; however, human activities—particularly the burning of fossil fuels, deforestation, and industrial processes—have increased the concentrations of these greenhouse gases, thereby enhancing the natural greenhouse effect. According to NASA, "These natural causes are still in play today, but their influence is too small or they occur too slowly to explain the rapid warming seen in recent decades."



Burning fossil fuels

14 Fossil fuels are natural resources that have formed over millions of years from the remains of dead plants and animals. They are called "fossil" fuels because they are derived from the fossilized remains of ancient organisms found in Earth's crust.

15 Fossil fuels—while a major source of energy for modern society—are also a leading cause of environmental pollution and climate change, as they release carbon dioxide and other greenhouse gases into the atmosphere when burned. Fossil fuels are burned to release energy that can be used for various purposes, such as generating electricity, powering vehicles, and heating homes. When burned, fossil fuels like coal, oil, and natural gas release large amounts of energy in the form of heat, which is then converted into mechanical or electrical energy.

16 Prior to the Industrial Revolution (1760–1840), transportation had little to no impact on Earth's climate. However, with the advent of steam engines and later, internal combustion engines, the landscape of transportation—and its environmental footprint—changed dramatically. Today, transportation, including cars, airplanes, buses, and trains, generates about a fourth of global carbon dioxide emissions, second only to the electric power sector (NASA, 2024).

17 Most cars, trucks, ships, and planes run on fossil fuels, which makes transportation a major contributor of greenhouse gases, especially carbon dioxide emissions. According to a 2024 report on carbon pollution by the Environmental Protection Agency (EPA), "Greenhouse gas (GHG) emissions from transportation account for about 28 percent of total U.S. greenhouse gas emissions, making it the largest contributor of U.S. GHG emissions. Between 1990 and 2022, GHG emissions in the transportation sector increased more in absolute terms than any other sector" (2024).

18 While transportation is a large contributor to climate change, other industries have a big impact as well, and in different ways. Not only are humans adding to the amount of greenhouse gases in the atmosphere, they are taking away Earth's ability to absorb them.

Climate Misinformation

Climate misinformation refers to the spread of false or misleading information regarding climate change. This can take various forms. Some sources may outright deny that climate change is occurring. They may claim that the Earth's climate is not changing or that any changes are part of natural cycles. Another common tactic is to misrepresent the level of agreement among scientists about climate change. While the vast majority of climate scientists agree that climate change is happening and is largely driven by human activities, misinformation campaigns often portray the scientific community as deeply divided. Some misinformation campaigns allege that climate change is a hoax orchestrated by governments, scientists, or other groups for various nefarious purposes.

The spread of climate misinformation can have serious consequences. It can delay the implementation of effective policies to combat climate shange, mislead the public, and undermine trust in scientific institutions. For example, climate misinformation helps the fossil fuel industry by making people doubt the reality of climate change. When people are unsure if climate change is real or caused by humans, they are less likely to support policies that limit fossil fuel use. This allows the industry to continue profiting from oil, coal, and gas without having to invest in cleaner, more sustainable energy sources. Addressing this issue requires promoting scientific literacy, critical thinking, and reliable sources of information.

Manufacturing and the Fashion Industry

19 Factories contribute to climate change primarily through the burning of fossil fuels to power machinery and production processes. According to a February 2024 report, the manufacturing sector contributes significantly to greenhouse gas emissions. In 2021, the CBO estimated that the manufacturing industry was responsible for 12% of greenhouse gas emissions, with 25% of these emissions originating from industrial processes that convert materials into finished products. Throughout the 21st century, the fashion industry has become a top contributor and example of the ways demand and mass production contribute to our climate crisis. ARUP, a global collective dedicated to sustainable development, stated in a 2019 report that the fashion industry is responsible for an estimated 2–8% of global emissions—which is more than air travel and shipping combined.

20 The fashion industry, renowned for its rapid production cycles and ever-changing trends, is a significant contributor to environmental degradation. One of the primary ways it impacts climate change is through its reliance on fossil fuels. From the production of synthetic fibers like polyester to the transportation of goods across the globe, fossil fuels are an integral part of the fashion supply chain. Synthetic fibers like polyester are derived from petroleum, a non-renewable fossil fuel. Every year, over 70 million barrels of oil are used to manufacture polyester. The production of polyester involves energy-intensive processes and the release of greenhouse gases, contributing to climate change. The polyester garments produced also shed microplastics when washed, which eventually make their way into oceans, harming marine life and entering the food chain.

Factory in Euharlee, GA

Agriculture and Deforestation

21 Deforestation and agriculture are two significant human activities that have profound impacts on climate change. Deforestation, the deliberate clearing of forested land, primarily for timber

extraction and agricultural expansion, disrupts the carbon cycle and exacerbates global warming. Forests act as carbon sinks, absorbing approximately 2.6 billion metric tons of carbon dioxide annually. However, when these forests are cleared, not only is this capacity to store carbon lost, but any carbon that had been stored is then released back into the atmosphere. This considerable release of carbon dioxide and other greenhouse gases accelerates the greenhouse effect and contributes to around 10% of global greenhouse gas emissions.

22 Agriculture, while essential for food production, also plays a significant role in climate change. Agricultural practices, particularly livestock farming and rice production, are major sources of methane, a potent greenhouse gas with a global warming potential approximately 28 times greater than that of carbon dioxide over a 100-year period, according to the EPA.

23 Moreover, the conversion of forests and grasslands to agricultural land further exacerbates climate change by altering Earth's reflectivity, meaning forests and natural vegetation typically absorb more sunlight and retain heat. When these areas are maintained as forests, the trees reflect more sunlight away from the Earth's surface, leading to a cooling effect.

As reported by NASA, methane is a potent greenhouse gas and ranks as the second-largest contributor to climate warming, following carbon dioxide. Cattle, including dairy and beef cows, produce methane as a byproduct of their digestive process. Microorganisms in the cow's stomach decompose cellulose from plant material, releasing methane gas, which the cows then expel primarily through belching. In 2015, livestock accounted for 10% of methane emissions in the United States.

Small ways to make a big impact.

24 Climate change often feels like an insurmountable problem, especially when considering the significant contributions made by large corporations. However, individuals can still play a crucial role in combating climate change by making conscious choices in their daily lives. By thinking

critically about our consumption habits, travel methods, and energy use, each of us can contribute to a healthier planet. Here are some actionable steps individuals can take to make a difference.

Be an Activist

Beyond personal habits, advocating for systemic change is a key component of combating climate change. By addressing larger structures and policies, we can create environments that support healthier, more sustainable choices for everyone.

- **Support Climate Policies:** Vote for and support politicians and policies that prioritize climate action. Participate in local government meetings and advocate for sustainable practices in your community.
- **Raise Awareness:** Educate yourself and others about climate change. Share information with your friends and family and encourage them to make sustainable choices.
- **Join Environmental Groups:** Get involved with organizations that work on climate issues. Volunteering your time or donating to these groups can amplify your impact.

Sustainable Eating Habits

The food industry is a major contributor to climate change due to deforestation, methane emissions from livestock, and energy-intensive farming practices. To combat this, many are advocating for a transition towards more sustainable practices.

- **Plant-Based Diets:** Research shows that vegan and plant-based diets resulted in 75% less climate-heating emissions, water pollution, and land use than diets that include 100g of meat a day. Even reducing your meat and dairy consumption can significantly lower your carbon footprint, for instance, by observing "Meatless Mondays"—choosing one day per week to abstain from consuming animal products.
- **Local and Seasonal Foods:** Choose to buy locally sourced, seasonal produce as a way to lower the miles food has to travel from where it was grown to your table. This not only lowers carbon emissions linked to long-distance food transport but also supports local farmers.

Mindful Consumption

One of the most important and impactful changes individuals can make is to think critically about the products we buy. The production, transportation, and disposal of goods contributes significantly to greenhouse gas emissions.

- **Buy Less, Shop Smart:** Before making a purchase, consider, "Do I really need this item?" If so, opt for high-quality products that are durable and can be repaired when needed, compared to disposable items that may contribute to waste in landfills.

- **Shop Sustainable Brands:** Research companies that prioritize sustainability in their production process. Look for certifications such as Fair Trade or B Corps on products to help identify eco-friendly products.

- **Shop Second-Hand:** Thrift and consignment stores, either online or brick-and-mortar, are excellent places to source things such as electronics, clothing, furniture, and home essentials. This reduces the demand for manufacturers to produce more goods and minimizes waste.

Daily Habits and Routines

Take inventory of your daily habits and routines, including how you get to school or work, which lights you use when reading or playing video games, or how long you leave the water running when brushing your teeth each day. Changes in daily habits and routines can contribute to reducing emissions.

- **Smart Thermostats and LED Bulbs:** When possible, use smart thermostats to regulate heating and cooling efficiently, and replace incandescent bulbs with LED ones, which use up to 75% less energy and last longer.

- **Getting Around:** Use public transportation or carpool with others whenever possible. This reduces the number of vehicles on the road and the overall emissions. For shorter distances, consider biking or walking. These modes of transport are not only eco-friendly but also beneficial for your health.

- **Energy Consumption:** Actions such as turning lights or video game consoles off when not in use or unplugging electronics can save energy and lower emissions.

- **Conserving Water:** Habits like taking shorter showers, fixing leaks, and using water-efficient fixtures can conserve water and the energy required to process and heat it.

Understanding climate change is essential for our future, as it empowers us to make informed decisions and take meaningful actions to protect our planet for generations to come.