



CLIMATE CHANGE FACT SHEET

FACTS ABOUT CLIMATE CHANGE

1. What is climate change?

Climate change is a long-term shift in the climate of a specific location, region or planet. The shift is measured by changes in features associated with average weather, such as temperature, wind patterns and precipitation. What most people don't know is that a change in the variability of climate is also considered climate change, even if average weather conditions remain the same.

Climate change occurs when the climate of a specific area or planet is altered between two different periods of time. This usually occurs when something changes the total amount of the sun's energy absorbed by the earth's atmosphere and surface. It also happens when something changes the amount of heat energy from the earth's surface and atmosphere that escapes to space over an extended period of time.

Such changes can involve both changes in average weather conditions and changes in how much the weather varies around these averages. The changes can be caused by natural processes like volcanic eruptions, variations in the sun's intensity, or very slow changes in ocean circulation or land surfaces which occur on time scales of decades, centuries or longer.

But... humans also cause climates to change by releasing greenhouse gases and aerosols into the atmosphere, by changing land surfaces, and by depleting the stratospheric ozone layer. Both natural and human factors that can cause climate change are called 'climate forcings', since they push, or 'force' the climate to shift to new values.

2. Why “global warming” is the wrong term

Climate change refers to general shifts in climate, including temperature, precipitation, winds, and other factors. Global warming (as well as global cooling) refers specifically to any change in the global average surface temperature. Global warming is often misunderstood to imply that the world will warm uniformly. In fact, an increase in average global temperature will also cause the circulation of the atmosphere to change, resulting in some areas of the world warming more, others less. Some areas can even cool. Unfortunately, although it significantly misrepresents what really happens, the term 'global warming' is still often used by media and others to describe climate change.

3. What is the Greenhouse Effect?

A natural system known as the "greenhouse effect" regulates temperature on Earth. Just as glass in a greenhouse keeps heat in, our atmosphere traps the sun's heat near earth's surface, primarily through heat-trapping properties of certain "greenhouse gases".

Earth is heated by sunlight. Most of the sun's energy passes through the atmosphere, to warm the earth's surface, oceans and atmosphere. However, in order to keep the atmosphere's energy budget in balance, the warmed earth also emits heat energy back to space as infrared radiation.

As this energy radiates upward, most is absorbed by clouds and molecules of greenhouse gases in the lower atmosphere. These re-radiate the energy in all directions, some back towards the surface and some upward, where other molecules higher up can absorb the energy again. This process of absorption and re-emission is repeated until, finally, the energy does escape from the atmosphere to space.

However, because much of the energy has been recycled downward, surface temperatures become much warmer than if the greenhouse gases were absent from the atmosphere. This natural process is known as the greenhouse effect.

Without greenhouse gases, Earth's average temperature would be -19°C instead of $+14^{\circ}\text{C}$, **or 33°C colder.**

Over the past 10,000 years, the amount of greenhouse gases in our atmosphere has been relatively stable. Then a few centuries ago, their concentrations began to increase due to the increasing demand for energy caused by industrialization and rising populations, and due to changing land use and human settlement patterns.

4. What are the greenhouse gases?

Water vapour is the most common greenhouse gas. But others that are very important too. Some occur naturally and some come from human activity.

Carbon Dioxide or CO_2 is the most significant greenhouse gas released by human activities, mostly through the burning of fossil fuels. It is the main contributor to climate change.

Methane is produced when vegetation is burned, digested or rotted with no oxygen present. Garbage dumps, rice paddies, and grazing cows and other livestock release lots of methane

Nitrous oxide can be found naturally in the environment but human activities are increasing the amounts. Nitrous oxide is released when chemical fertilizers and manure are used in agriculture.

Halocarbons are a family of chemicals that include CFCs (which also damage the ozone layer), and other human-made chemicals that contain chlorine and fluorine.

5. Since greenhouse gases make up such a small percentage of the atmosphere, why do changes in their concentrations have such a big effect on climate?

Most greenhouse gases are extremely effective at absorbing heat escaping from the earth and keeping it trapped. In other words, it takes only small amounts of these gases to significantly change the properties of the atmosphere.

99% of the dry atmosphere consists of nitrogen and oxygen, which are relatively transparent to sunlight and infrared energy, and have little effect on the flow of sunlight and heat energy through the air. By comparison, the atmospheric greenhouse gases that cause the earth's natural greenhouse effect total less than 1% of the atmosphere. But that tiny amount increases the earth's average surface temperature from -19°C to $+14^{\circ}\text{C}$ - a difference of about 33°C . A little bit of greenhouse gas goes a long way.

Because the concentration of greenhouse gases in the atmosphere is so low, human emissions can have a significant effect. For example, human emissions of carbon dioxide (CO_2) currently amount to roughly 28 billion tonnes per year. Over the next century human emissions will increase the concentration of carbon dioxide in the atmosphere from about 0.03% today to almost certainly 0.06% (a doubling), and possibly to 0.09% (a tripling).

6. What causes climate change?

Earth's climate changes naturally. Changes in the intensity of sunlight reaching the earth cause cycles of warming and cooling that have been a regular feature of the Earth's climatic history. Some of these solar cycles - like the four glacial-interglacial swings during the past 400,000 years - extend over very long time scales and can have large amplitudes of 5 to 6°C . For the past 10,000 years, the earth has been in the warm interglacial phase of such a cycle. Other solar cycles are much shorter, with the shortest being the 11 year sunspot cycle.

Other natural causes of climate change include variations in ocean currents (which can alter the distribution of heat and precipitation) and large eruptions of volcanoes (which can sporadically increase the concentration of atmospheric particles, blocking out more sunlight).

Still, for thousands of years, the Earth's atmosphere has changed very little. Temperature and the balance of heat-trapping greenhouse gases have remained just right for humans, animals and plants to survive. But today we're having problems keeping this balance.

Because we burn fossil fuels to heat our homes, run our cars, produce electricity, and manufacture all sorts of products, we're adding more greenhouse gases to the atmosphere. By increasing the amount of these gases, we've enhanced the warming capability of the natural greenhouse effect.

It's the human-induced enhanced greenhouse effect that causes environmental concern, because it has the potential to warm the planet at a rate that has never been experienced in human history.

7. So this is real?

An international scientific consensus has emerged that our world is getting warmer. Abundant data demonstrate that global climate was warmed during the past 150 years. The increase in temperature was not constant, but rather consisted of warming and cooling cycles at intervals of several decades. Nonetheless, the long term trend is one of net global warming.

Corresponding with this warming, alpine glaciers have been retreating, sea levels have risen, and climatic zones are shifting. The 1980s and 1990s were the warmest decades on record. The 10 warmest years in global meteorological history have all occurred in the past 15 years and the 20th century has been the warmest globally in the last 600 years.

8. What could happen if the climate changes?

Climate change is more than a warming trend (which is why the term “global warming” is an inaccurate description of the phenomenon). Increasing temperatures will lead to changes in many aspects of weather, such as wind patterns, the amount and type of precipitation, and the types and frequency of severe weather events. Such climate change could have far-reaching and/or unpredictable environmental, social and economic consequences.

The global sea level could rise due to several factors including melting ice and glaciers. Rising sea levels could damage coastal regions through flooding and erosion. The climate of various regions could change too quickly for many plant and animal species to adjust. Harsh weather conditions, such as heat waves and droughts, could also happen more often and more severely.

Climate change could also affect health and well-being. Many larger cities could experience a significant rise in the number of very hot days. Air pollution problems would increase, placing children, the elderly and people suffering from respiratory problems at greatest risk of health effects. Increases in molds and pollens due to warmer temperatures could also cause respiratory problems such as asthma for some people.

9. What is being done around the world?

Climate change affects the entire globe. Developed and developing countries are working together to find solutions to climate change. In June 1992, the United Nations Framework Convention on Climate Change (UNFCCC) was signed by 154 countries that agreed to stabilize the amount of greenhouse gases in the atmosphere at levels that won't cause harm. In December 1997, in Kyoto, Japan, Canada and 160 industrialized nations committed to reduce their greenhouse gas emissions, as part of an international agreement on climate change called the Kyoto Protocol.

10. What can we do about climate change?

Canada and the world will continue to warm, but there are many variables that can affect the speed and magnitude of the changes. Staying informed about climate change, and supporting efforts to slow its progress are things everyone can do.

Taking action on climate change can also make our economy more internationally competitive by creating growth and jobs while producing less waste, pollution and greenhouse gases.

Our climate may already be changing because of the existing buildup of greenhouse gases in the atmosphere, and we must be prepared to adapt to those changes. While action now to reduce emissions is critical, the existing build-up of GHG concentrations means that some climate change in the coming decades is inevitable and planning must start now on adapting our economy and society to these changes.

Adaptation involves taking action to minimize the negative impacts of climate change and taking advantage of new opportunities that may arise. The types of adaptation measures adopted will depend on the impact of climate change on particular regions and economic sectors. Increasing our capacity to adapt reduces our vulnerability to the effects of climate change. However, we must start planning our adaptive responses now; by doing so, we may help to lessen some of the environmental, economic and social costs of climate change.