



## What is Climate Change?

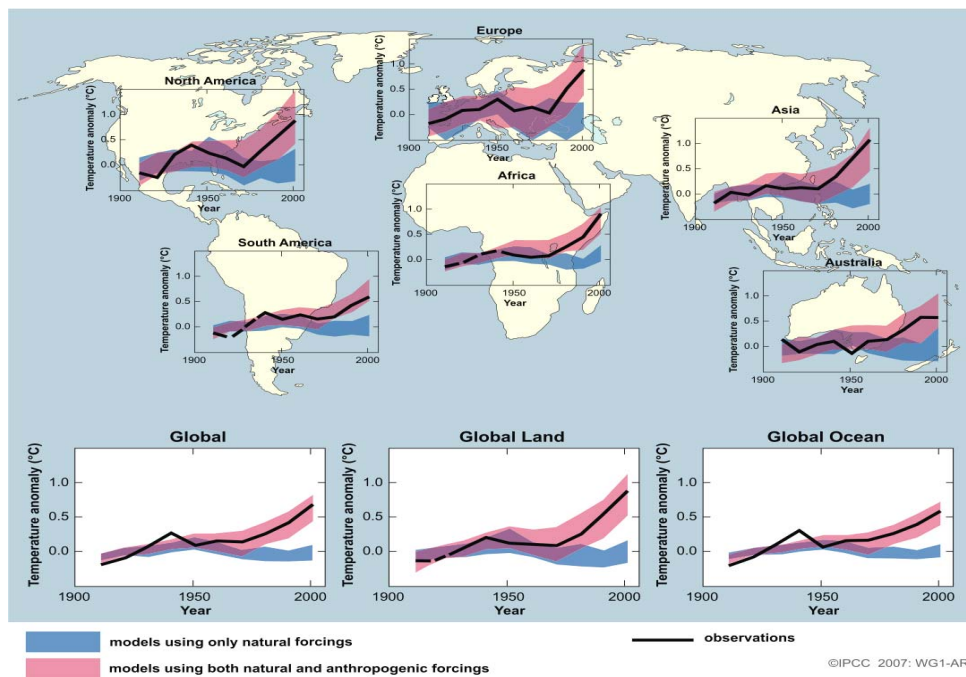
The average temperature of the earth's surface has risen by 0.74 °C since the late 1800s. It is expected to increase by another 1.8° C to 4° C by the year 2100. This is considered to be a rapid and profound change that requires urgent action.

The climate is changing because of a century and a half of industrialization, which has included the burning of **fossil fuels**, cutting of forests, and certain farming methods.

### What is a fossil fuel?

Coal, oil and natural gas are called 'fossil fuels' because they were created by the fossilization of carbon-rich organisms from another era.

These activities have increased the amount of "greenhouse gases" in the atmosphere, which are the main contributors to climate change.



Source: Intergovernmental Panel on Climate Change (IPCC) 2007.

This figure shows the observed temperature increases on a continental- and global-scale in the past century. The red band indicates human influence while the blue band indicates natural forces contributing to the changes.

Global emissions of all greenhouse gases have increased by about 70% between 1970 and 2005. Eleven of the last 12 years are the warmest on record and 1998 was the warmest year ever recorded. The recording of surface temperatures began in 1850.

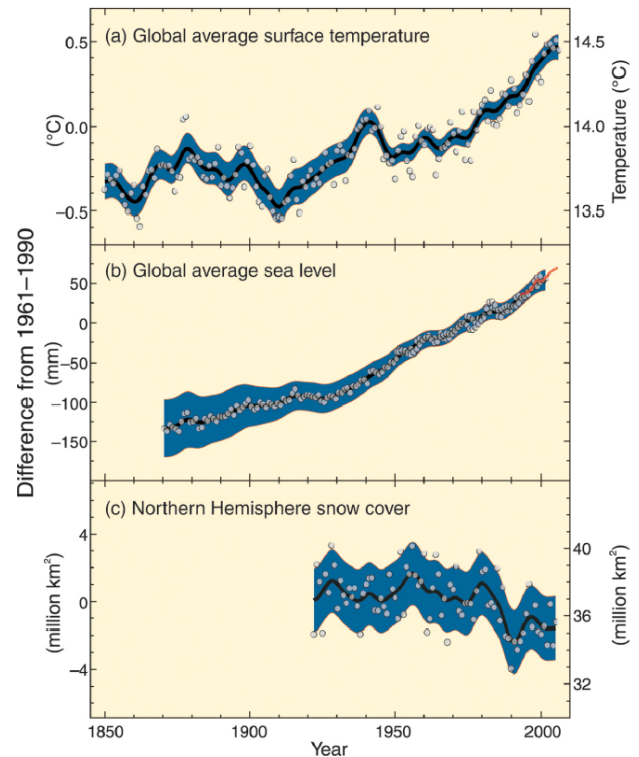
The changes in climate that have already happened as a result of global warming – and the even greater changes that are likely to occur in the future pose serious challenges for humans and all living beings on this planet.

This graph shows the impact of worldwide temperature increase on global sea levels and snow covers, which leads to more extreme weather patterns and storms and species' loss and endangerment (i.e. polar bears).

## Greenhouse Effect

After heat from the sun (solar radiation) is absorbed and reradiated (reflected back) by the earth's surface, gases such as **CO<sub>2</sub> (carbon dioxide)**, **CH<sub>4</sub> (methane)** and **N<sub>2</sub>O (nitrous oxide)** prevent the heat from escaping back into space. Under **natural circumstances** this is what keeps the earth warm enough to support life.

But **current conditions** are far from natural. Due to the burning of fossil fuels on an extraordinary scale, greenhouse gases have steadily been piling up in the atmosphere. As their concentrations in the atmosphere are now higher than at any time in the past 420,000 years, more and more heat is being trapped in the atmosphere, leading to an **enhanced greenhouse effect**.

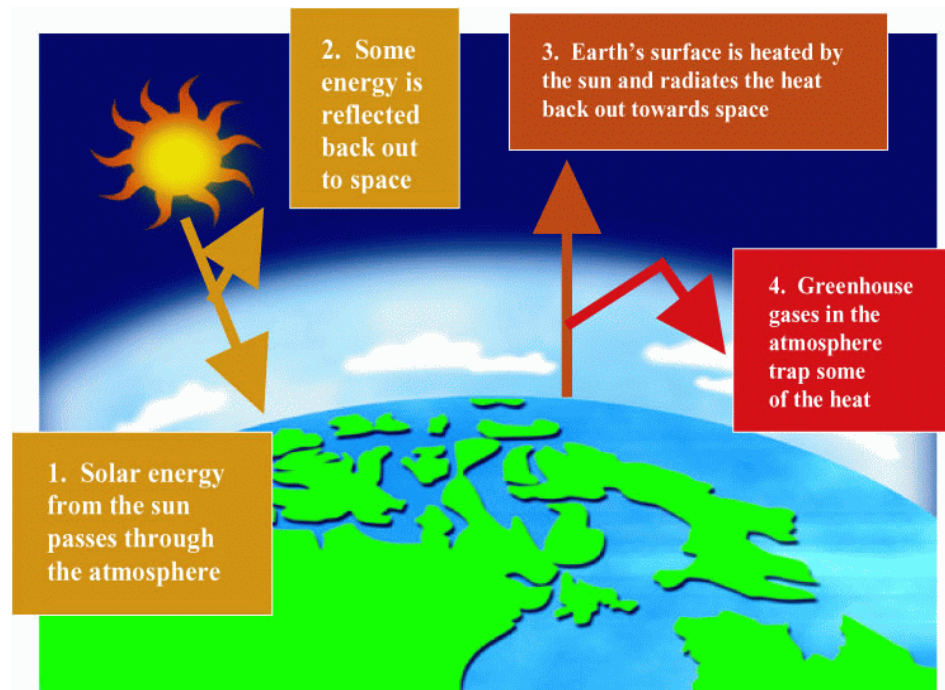


Source: [Intergovernmental Panel on Climate Change \(IPCC\) Fourth Assessment Report](#).

## The GHGs (a.k.a. greenhouse gases)

There are many different greenhouse gases responsible for climate change. However, **only three** – CO<sub>2</sub> (carbon dioxide), CH<sub>4</sub> (methane) and N<sub>2</sub>O (nitrous oxide) – **account for almost 99%** of all of the greenhouse gases in our atmosphere. **Knowing where these gases come from tells us how we can reduce them.**

The principal greenhouse gas generated from human activities is **carbon dioxide or CO<sub>2</sub>**. It accounts for about 75% of all the 'greenhouse gas emissions' in the world.



Source: Government of Canada, Climate Change Web site

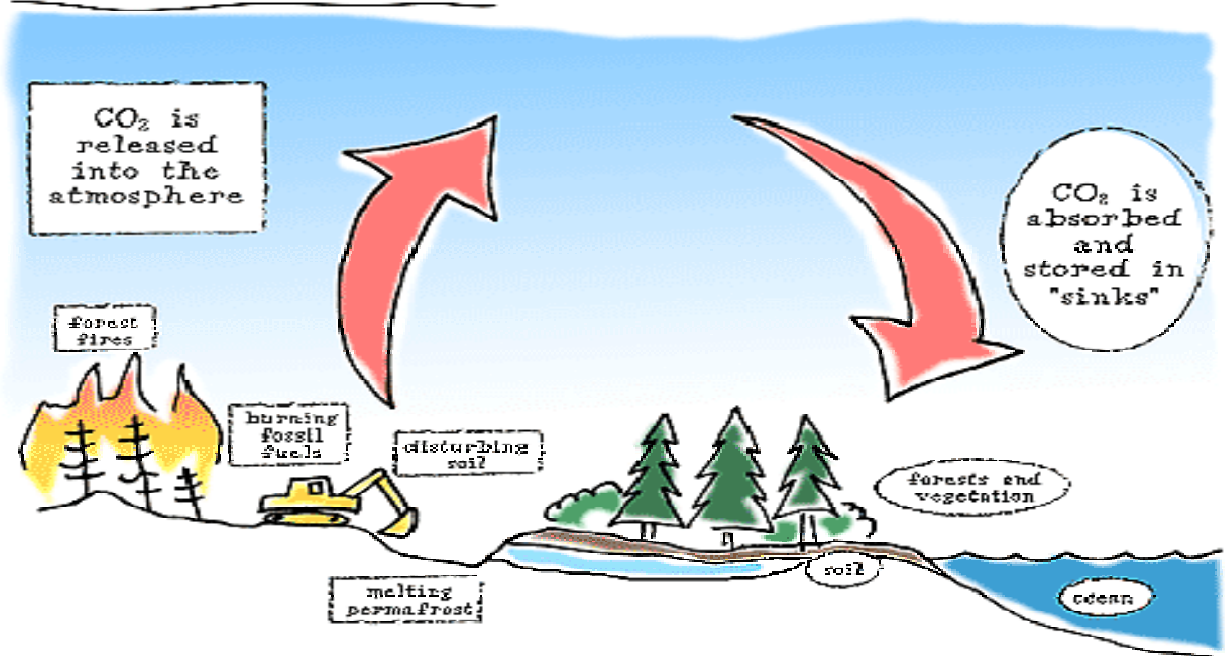
CO<sub>2</sub> is released when fossil fuels (coal, oil, natural gas), which are the most-used sources, are burned. They are burned to produce electricity and heat and are also used as fuel for vehicles, ships and planes.

**What do you mean by greenhouse gas (GHG) emissions?** GHG emissions describe all GHGs emitted (released) into the atmosphere in the form of smoke, steam, fumes from exhaust pipes, chimneys, fires and other sources.

Another source of CO<sub>2</sub> relates to land-use change: through photosynthesis, plants absorb CO<sub>2</sub>, thereby acting as a '**carbon sink**' and balancing emissions. The concept of a carbon sink is based on the natural ability of trees, other plants and the soil to soak up carbon dioxide and temporarily store the carbon in wood, roots, leaves and the soil, just the way a kitchen sink can temporarily store water without allowing it to spill on to the floor.

When forests are destroyed and replaced by other land uses such as creation of cities or deforestation, these 'sinks' are removed, leading to an increase in emissions as they "spill" into the atmosphere. **Currently, about 2,000 trees in the Amazon are cut down every minute!**

### The Carbon Cycle:



Source: Climate Change North Canada, Basics of Climate Change

Another greenhouse gas released through human activity is **methane or CH<sub>4</sub>**. Methane is actually more harmful than CO<sub>2</sub>, but is much less common. One of its sources is agriculture, particularly livestock such as cattle or sheep. Methane is also emitted in the retrieval, processing and distribution of fossil fuels (such as in the mining of coal or use of natural gas in industrial production). Lastly, methane is emitted as a 'landfill gas', from decomposing waste or organic garbage.

The third most potent greenhouse gas is **nitrous oxide or N<sub>2</sub>O**. Natural emissions of nitrous oxide from the soil have increased through the use of fertilizers and other chemicals commonly used in large-scale agricultural production. Combustion engines that burn fossil fuels, such as those used in automobiles, other vehicles, and industrial production, are also a major source of nitrous oxide (as well as carbon dioxide, as described above).

Three other GHGs exist: **Hydrofluorocarbons (HFCs), Perfluorocarbons (PFCs) and Sulphur hexafluoride (SF<sub>6</sub>)**. These gases are also referred to as **high global warming potential gases** (high GWPs). They are extremely powerful and often have a very long lifespan. Fortunately, they are emitted in small quantities and

easy to reduce. They are emitted in the manufacturing of semi-conductors (an important material in the production of computers), aluminum production (especially PFCs) and replacement of ozone-depleting substances with HFCs.

**The main GHGs and their sources vary significantly from one country to another.** You can check where your country's emissions are coming from and find ways on what you can do to reduce them. **How?** You can find the emission profiles from the United Nations Framework Convention on Climate Change (UNFCCC) Web site: [http://unfccc.int/ghg\\_emissions\\_data/items/3800.php](http://unfccc.int/ghg_emissions_data/items/3800.php). The national environment agency of many countries also has this information.

## Effects of Climate Change

Greenhouse gases are clogging up our atmosphere and warming it. As much as most of us like warmer weather, there is more to climate change than just temperature increase. In fact, while the average temperature of the earth's surface is rising, the effects of this change on the climate in different regions of the world are very different – and warmer weather is not always the result. Climate change impacts ecosystems and communities all over the world.

What exactly is happening and what else can happen due to climate change? Here are some examples:

### Extreme weather changes

- Numerous long-term changes in the climate have been observed, including extreme weather such as droughts, heavy precipitation, heat waves and the intensity of hurricanes, tsunamis and tropical cyclones.
- Trends toward more powerful storms and hotter, longer dry periods have been observed and are assessed in the Intergovernmental Panel on Climate Change's (IPCCs) Fourth Assessment Report. Dry regions are apt to lose still more moisture if the weather is hotter; this exacerbates droughts and desertification.
- A future of more severe storms and floods along the world's increasingly crowded coastlines is likely. These conditions will be a bad combination even if only the least damaging scenarios forecast are to occur. Furthermore, the paths of storms outside the tropical regions are projected to move towards the North and South Poles, leading to further changes in wind, precipitation, and temperature patterns, continuing the pattern observed over the last half century.
- In Africa's large catchment basins (areas in which groundwater is collected) of Niger, Lake Chad, and Senegal, total available water has decreased by 40 to 60 per cent. Desertification has worsened through the lower average annual rainfall, runoff, and soil moisture, especially in southern, northern, and western Africa.
- The Rhine floods of 1996 and 1997, the Chinese floods of 1998, the East European floods of 1998 and 2002, the Mozambique and European floods of 2000, and the monsoon-based flooding of 2004 in Bangladesh (which left 60 per cent of the country under water), are examples of more powerful storms.

### Decline of winter

- Average Arctic temperatures increased at almost twice the global rate in the past 100 years. Temperatures at the top of the permafrost layer (permanently frozen ground essential to the ecosystems of Arctic regions) have generally increased since the 1980s by up to 3°C. In the Russian Arctic, buildings are collapsing because permafrost under their foundations has melted. As permafrost melts, it releases greenhouse gases it has stored as a sink.
- New data evaluated by the IPCC shows that losses from the ice sheets of Greenland and Antarctica have very likely contributed to the 1993-2003 sea level rise. The average global sea level rose at an average rate of 1.8 mm per year between 1961 and 2003, and between 1993 and 2003, rose by 3.1 mm per year.

### Shifts in the natural world

- In Europe, mating and egg-laying of some bird species has occurred earlier in the season - in the United Kingdom, for example, egg-laying by 20 of 65 species, including long-distance migrants, occurred earlier in the season by an average of eight days between 1971 and 1995.

- Higher temperatures are expected to expand the range of some dangerous "vector-borne" diseases that affect people living in very warm regions, such as malaria, which already kills 1 million people annually, most of which are children.

## Next Steps

As we now know, climate change is largely caused by our emission of greenhouse gases. What can be done about this? **REDUCE THEM!** This approach is called climate change **mitigation**. While we cannot completely eliminate the problem, we need to take steps to make global warming more manageable and less severe. We need to ensure that we manage our **carbon footprint** and reduce it while there is still time.

### What is a carbon footprint?

It is the total set of GHG emissions caused directly and indirectly by an individual, event, organization, or product.

Scientific evidence of climate change, as contained in the fourth assessment report of the Intergovernmental Panel on Climate Change (IPCC), puts **human activity as the leading cause of global warming**. Therefore, it is **up to us** to make changes.

The Earth's surface temperature is rising, thereby changing the Earth's climate. **It is real and it is happening.** Even if every factory, power plant and vehicle shut off completely, we would still experience warming of additional 0.6°C this century. We will have to find ways to adapt to the adverse effects of climate change. **Adaptation** is about finding and implementing ways of adjusting to climate change. It focuses on how impacts can be reduced for communities often already struggling with poverty and vulnerability to natural disasters. These communities are often the most vulnerable, yet are likely to be those least responsible for causing climate change and have the fewest resources to adapt.

### What is climate justice?

Climate justice focuses on the inequality facet of climate change. While an island in the South Pacific is considered most vulnerable to sea-level rise resulting from climate change, it is responsible for few of the greenhouse gases in the atmosphere in comparison to the GHGs emitted by industrialized and emerging economies.

Emissions produced from high rates of consumption and energy production in industrialized countries have the greatest negative effect for the developing and least developed countries, which have the fewest resources to adapt. During extreme weather events such as floods, hurricanes and tsunamis, people without insurance or means to escape are the most affected.

We must be aware of these inequalities to ensure that everybody and our future generations can live in a healthy and just world, respecting the ecological limits of the planet.

## Climate Change Resources

Bet Campaign

[www.thebet.de](http://www.thebet.de), [www.inforse.dk/europe/schools/program\\_Bet.htm](http://www.inforse.dk/europe/schools/program_Bet.htm)

Climate Change Science, Fourth Assessment Report, Intergovernmental Panel on Climate Change (IPCC)

<http://www.ipcc.ch/>

Climate Change Youth Guide to Action, Taking It Global

<http://www.takingitglobal.org/action/guide/>

Carbon Sinks, FERN

<http://www.fern.org/pages/climate/carbon.html>

Carbon Footprint, Carbon Trust UK

[http://www.carbontrust.co.uk/solutions/CarbonFootprinting/what\\_is\\_a\\_carbon\\_footprint.htm](http://www.carbontrust.co.uk/solutions/CarbonFootprinting/what_is_a_carbon_footprint.htm)

Climate Justice, Friends of the Earth

<http://www.foei.org/en/media/archive/2007/climate-justice-for-all/>

An Educational Resource for Northerners, Climate Change North

[http://www.climatechangenorth.ca/section-BG/BG\\_HS\\_03\\_O\\_E.html](http://www.climatechangenorth.ca/section-BG/BG_HS_03_O_E.html)

European Union Climate Change Campaign Youth

[http://ec.europa.eu/environment/climat/campaign/pdf/climate\\_change\\_youth\\_en.pdf](http://ec.europa.eu/environment/climat/campaign/pdf/climate_change_youth_en.pdf)

Greenpeace Solar Generation

<http://www.greenpeace.org/international/news/the-solar-generation>

High Global Warming Potential Gases, U.S. Environmental Protection Agency

<http://www.epa.gov/highgwp/sources.html>

Kyoto Protocol

[http://unfccc.int/kyoto\\_protocol/items/2830.php](http://unfccc.int/kyoto_protocol/items/2830.php)

United Nations Framework Convention on Climate Change (UNFCCC)

[http://unfccc.int/essential\\_background/feeling\\_the\\_heat/items/2917.php](http://unfccc.int/essential_background/feeling_the_heat/items/2917.php)

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