

MELTING ICE: A HOT TOPIC?

The Earth has warmed by approximately 0.75 °C since pre-industrial times. Eleven of the warmest years in the past 125 years occurred since 1990, with 2005 the warmest on record. There is overwhelming consensus that this is due to emissions of greenhouse gases, such as carbon dioxide (CO₂), from burning fossil fuels.

Examination of ice cores shows that there is more CO₂ in the atmosphere than at any time in the past 600,000 years. Between 1960 and 2002, annual anthropogenic global emissions of CO₂ approximately tripled. They rose by about 33 per cent since 1987 alone.

Warming in this century is projected to be between 1.4 and 5.8 °C. The impacts of climate change are already visible. Examples include: the shrinking Arctic ice cap; accelerating sea level rise; receding glaciers worldwide; thawing permafrost; earlier break-up of river and lake ice; increasing intensity and duration of tropical storms; lengthening of mid- to high-latitude growing seasons; and shifts in plant and animal ranges and behaviour.

In the Arctic, as peat bogs thaw they are releasing methane, an even more potent greenhouse gas than CO₂. Scientists are increasingly concerned about the possibility of abrupt climate change, including reductions in ocean currents, such as the Gulf Stream which warms Europe, and changed patterns of rainfall, such as the monsoon seasons, which would affect food security for billions of people.

Ask a polar bear...

The Arctic is warming twice as fast as the global average. The area of the Arctic Ocean covered by ice each summer has been shrinking, and the remaining ice is becoming less thick. Because more heat is absorbed by the sea than by ice, a feedback is created which results in further melting. Since 1980, between 20 and 30 per cent of sea ice in the European Arctic has been lost.

Polar bears depend on sea ice, where they hunt seals and use ice corridors to move from one area to another. Pregnant females build winter dens in areas with thick snow cover. They have not eaten for five to seven months when they emerge with their cubs in the spring. They need good spring sea-ice conditions for their own and their cubs' survival.

During the past two decades, the condition of adult polar bears in the Hudson Bay area in Canada has declined, with a reduction of between 15 and 26 per cent in average adult body weight and the number of cubs born between 1981 and 1998. Some climate models project that there may be an almost complete loss of summer sea-ice in the Arctic before the end of the century. If this happens, polar bears are unlikely to survive as a species.

Ask a farmer...

Although crop yields may increase in some areas due to climate change, the negative effects are likely to dominate as warming increases. Africa is especially vulnerable, and studies warn that there may be a significant increase in hunger.

Poor communities are most directly dependent for their livelihoods on a stable and hospitable climate. They often rely on rain-fed subsistence agriculture, and are deeply dependent on climatic phenomena, such as the Asian monsoons. They are also most vulnerable to extreme weather events such as droughts and tropical storms.

As glaciers melt in the world's great mountain ranges, water supplies to rivers will be affected. In Europe, eight out of nine glaciated regions show significant retreat. Between 1850 and 1980, glaciers in the European Alps lost approximately one-third of their area and one-half of their mass.

In China, highland glaciers are shrinking each year by an amount equivalent to all the water in the Yellow River. The Chinese Academy of Sciences says that 7 per cent of the country's glaciers are vanishing annually. By 2050, as many as 64 per cent of China's glaciers will have disappeared. An estimated 300 million people live in China's arid west and depend on water from glaciers for their survival.

Ask an islander...

In the past 100 years, global sea level rose between 1 and 2 millimetres a year. Since 1992 the rate has increased to about 3 millimetres a year, primarily through thermal expansion of warming oceans and freshwater flowing into the oceans from melting ice.

Melting ice is responsible for a significant portion of the observed sea level rise, with the Greenland and Antarctic ice sheets the largest contributors. The Greenland Ice Sheet is melting faster than new ice is being formed. In the Antarctic, three large sections of ice shelves in the Antarctic Peninsula have collapsed over the past 11 years, followed by a marked acceleration and thinning of glaciers that were held back by the shelves.

As sea levels rise, inhabitants of low-lying islands and coastal cities face inundation. In December 2005, a small community living in the Pacific island chain of Vanuatu became perhaps the first to be formally moved as a result of climate change.

Climate change also threatens marine habitats and the livelihoods of the people who depend on them. The oceans have absorbed approximately half of the CO₂ produced in the past 200 years, producing carbonic acid and lowering the pH of surface seawater. This could affect the process of calcification by which animals such as corals and molluscs make their shells from calcium carbonate.

Ask an insurer...

In 2005 the Munich Re Foundation estimated economic losses due to weather-linked disasters, such as tropical storms and forest fires, at more than US\$ 200 billion, with

insured losses at more than US\$ 70 billion. This compares with 2004, the previous most costly year, when economic losses totalled around US\$ 145 billion and insured losses reached some US\$ 45 billion.

Continued global warming is expected to cause shifts in the geographic range (latitude and altitude) and seasonality of certain infectious diseases, including vector-borne infections such as malaria and dengue fever, and food-borne infections, such as salmonellosis, which peak in the warmer months.

Some health impacts may be beneficial. For example, milder winters may reduce the seasonal winter-time peak in deaths in temperate countries. However, many of the same countries are seeing hotter summers. In 2003, France experienced an estimated extra 15,000 deaths due to a heat wave that claimed as many as 35,000 people across Europe. Overall it is likely that the negative health impacts of climate change will far outweigh the positive effects.

Ask an indigenous person...

Arctic communities, including indigenous people striving to maintain and adapt traditional lifestyles, are particularly vulnerable to environmental change. The Arctic is home to some 4 million people, of whom roughly 10 per cent (400,000) are indigenous. Concentrations vary, from the Inuit, who comprise 85 per cent of the population of the Nunavut territory in Canada, to the Sámi, who account for 2.5 per cent of the population in northern Scandinavia and the Kola Peninsula.

Widespread melting of permafrost in Alaska and Siberia is causing serious damage to buildings, pipelines, roads and other infrastructure. Climate change means shorter ice seasons for traveling on winter roads, and warmer and less predictable weather, causing more forest fires in some regions.

Agriculture in the Arctic is severely limited. Subsistence economic activities are therefore mainly hunting and fishing, reindeer herding, trapping and gathering. Warming throughout the Arctic is a problem for reindeer herders and hunters who travel on frozen rivers and through snow. More melting and freezing of snow also makes food less accessible to caribou and reindeer, affecting the economies and cultural integrity of herders and hunters.

Sea-ice changes and related increased coastal erosion are also causing damage, necessitating the relocation of some coastal communities (such as in Shishmaref, Alaska), and affecting indigenous marine hunters and fishers.

Ask yourself...

There are many options available to avoid catastrophic climate change. These include worldwide improvements in energy efficiency and a shift to low-carbon and renewable resources such as solar and wind power, bio-energy and geothermal energy. There is also potential for capturing and storing CO₂, while a number of analysts consider that nuclear power could play a significant role

In 1995, installed global wind power capacity was 4,800 megawatts of electricity. At the end of 2005 the figure had increased twelve-fold to more than 59,000 megawatts. The Global Wind Energy Council estimates that over a third of the world's electricity could be generated by wind by 2050.

A low-greenhouse gas future will also need to include social changes. Millions of households now use the sun to heat water, with an increasing number also harnessing solar energy for electricity. In Iceland, abundant hydropower and geothermal energy is being channelled into developing hydrogen from water as a major energy source to replace fossil fuels. In Brazil, ethanol made from sugar cane has replaced about 40 per cent of the country's need for petrol.

From Vietnam to Australia, Kenya to Mexico, people are banding together to plant trees, many of them as part of the UNEP Plant For The Planet: Billion Tree Campaign. Trees can slow climate change by absorbing carbon dioxide as they grow. They also help to reduce pollution, keep cities cool, protect water catchments and reduce soil erosion.

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