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Global warming, climate change and heatwave

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Humanity has prospered immensely in recent decades, but the way we have achieved this prosperity has come at a devastating cost to nature. United Nations Secretary-General Antonio Guterres, while addressing a General Assembly high-level thematic debate on climate action at UN Headquarters in New York, on October 26, 2021, said – "The climate crisis is a code red for humanity and urgent action is needed before it is too late". [1] The ongoing and upgoing emission of greenhouse gases (GHG) in the atmosphere is wreaking havoc across the world. Consequently, a relentless rise of environmental temperature or global warming is causing a major climate change throw-out the world and threatening lives, economies, health, and food.

What is global warming and climate change?

Global warming is the slow increase in the average temperature of the earth's atmosphere. This occurs when an increased amount of energy (heat) striking the earth from the sun is being trapped in the atmosphere and not radiated out into space. The earth's atmosphere has always acted like a greenhouse to capture the sun's heat, ensuring that the earth has enjoyed temperatures that permitted the emergence of life forms as we know them, including humans. Without our atmospheric greenhouse the earth would be very cold. Global warming, however, is the equivalent of a greenhouse with high efficiency reflective glass installed the wrong way around. Thus, the problem is that too much sun-heat is being trapped in our atmosphere, resulting in a rapid increase in the temperature of the earth than at any previous time in history.

Climate change refers to significant, long-term changes in the global climate. The global climate is the connected system of sun, earth and oceans, wind, rain and snow, forests, deserts and savannas, and everything people do, too.[2]

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What causes global warming?

Global warming and climate change result from human activities (are "anthropogenic"), that have increased the amount of carbon containing gases in the upper atmosphere and increased amounts of tiny black particles in the lower atmosphere. These gases are released primarily by the burning of fossil fuels and are the "greenhouse gases" (GHGs) because they act like the wrong way reflective glass in our global greenhouse. The tiny black particles, also known as 'black carbon' (soot or smoke), are produced by incomplete burning, and create a layer of black particles in the lower atmosphere that absorbs heat like a black blanket. Both eventually trap the sun's energy in the atmosphere. These heat-trapping pollutants—specifically carbon dioxide, methane, nitrous oxide, water vapor, and synthetic fluorinated gases—are greenhouse gases.

This trend of global warming started around the end of the 18th or beginning of the 19th century when coal first came into common use. This warming trend has accelerated as we have increased our use of fossil fuels to include gasoline, diesel, kerosene, and natural gas, as well as petrochemicals (plastics, pharmaceuticals, fertilizers) made from oil. The Intergovernmental Panel on Climate Change (IPCC) was set up by the World Meteorological Organization (WMO) and the United Nations Environment Programme (UNEP) to provide an objective source of scientific information on climate change. In 2013, the IPCC provided a globally peer-reviewed report about the role of human activities in climate change when it released its Fifth Assessment Report. The report was categorical in its conclusion: *climate change is real and human activities, largely the release of polluting gases from burning fossil fuel (coal, oil, gas), is the main cause.*[3]

The concentration of greenhouse gases in the earth's atmosphere is directly linked to the average global temperature on Earth. The concentration has been rising steadily, and mean global temperatures along with it, since the time of the Industrial Revolution. The most abundant greenhouse gas, accounting for about two-thirds of greenhouse gases, carbon dioxide (CO_2), is largely the product of burning fossil fuels. Methane, the primary component of natural gas, is responsible for more than 25 per cent of the warming we are experiencing today. It is a powerful pollutant with a global warming potential over 80 times greater than CO2 during the 20 years after it is released into the atmosphere.[4]

How does global warming drive climate change?

Heat is energy and when it is added to any system, changes occur. Because all systems in the global climate system are connected, adding heat energy causes the global climate to change. Earth's rising temperatures are fueling longer and hotter heat waves, more frequent droughts, heavier rainfall, and more powerful hurricanes. Much of the world is covered with ocean which heats up. When the ocean heats up, more water evaporates into clouds. Where storms like hurricanes and typhoons are forming, the result is more energy-intensive storms. A warmer atmosphere makes glaciers and mountain snowpacks and the Polar ice cap melt down. Antarctica has lost nearly four trillion metric tons of ice since the 1990s. The rate of loss could speed up if we keep burning fossil fuels at our current pace, some experts say, causing sea levels to rise several meters in the next 50 to 150 years, drowning coastal areas worldwide.[5] Changes in temperature change the great patterns of wind that bring monsoons in Asia and rain and snow around the world, making drought, wildfire, flooding and unpredictable weather more common. Extreme heat waves have caused tens of thousands of deaths around the world in recent years.

Heatwave and heat related illness (HRI)

Heatwave is an important effect as well as manifestation of global warming and climate change. The IPCC defines a heatwave as 'a period of abnormally hot weather, often defined with reference to a relative temperature threshold, lasting from two days to months. With increasing hot environment, our body tries to adjust by redistributing blood flow towards the skin (vasodilation) to improve heat transfer from muscles to skin and subsequently to the environment and by secreting sweat onto the skin, which subsequently evaporates and removes body heat (Heat acclimatization). When the environmental temperature reaches 36°C, the human body stops cooling itself. This is the threshold for heatwave. Bangladesh Meteorological Department (BMD) has classified heatwaves into four categories based on maximum temperature – Mild heatwave (temperature 36-38^{0}C), moderate heatwave (temperature 38-40^{0}C), severe heatwave (temperature 40-42^{0}C) and Extreme heatwave (temperature > 42^{0}C).

With sustained heatwave, human body becomes stressed (Heat stress); with continued heat exposure various heat related illnesses (HRI) occur - Heat edema, Heat rash (also known as prickly heat and miliaria), Heat cramps, Heat tetany, Heat syncope, Heat exhaustion and Heat stroke. Heat stroke is the most serious heat-related illness. It occurs when the body can no longer control its temperature: the body's temperature rises rapidly, the sweating mechanism fails, and the body is unable to cool down. When heat stroke occurs, the body temperature can rise to 106°F or higher within 10 to 15 minutes. Heat stroke can cause permanent disability or death if the person does not receive emergency treatment. The affected person should be moved to a cool environment. Rapid cooling with cold water or ice water immersion and immediate rehydration with IV fluid is necessary. If there is no response to treatment in 30 minutes, then aggressively cool the patient to the core temperature of 39°C.

Rising global ambient temperatures affect all populations. However, some populations are more exposed to, or more physiologically or socio-economically vulnerable to physiological stress, exacerbated illness, and an increased risk of death from exposure to excess heat. These include the elderly, infants and children, pregnant women, outdoor and manual workers, athletes, and the poor. Patients with various co-morbidities like cardiac, renal disease and on certain medications like diuretics, vasodilators, beta-blockers etc. are also at increased risk.

To prevent HRI, some general preventive measures should be adopted, like keeping living spaces cool with fans, air conditioning and misting, decreasing/

rescheduling the exercises or strenuous activities for cooler parts of the day, wearing clothing that is light colored and loose fitting, increasing carbohydrate intake and decreasing protein intake to decrease endogenous heat production, drinking plenty of electrolyte rich ûuids, even when not thirsty, avoiding alcoholic beverages because they promote dehydration, avoiding direct exposure to the sun, rest in shade at regular interval during work usually 15 minutes in every 2 hours activity, etc.

Actions needed to limit global warming and climate change

The Sustainable Development Goals (SDG) spell out how we can protect our environment and slow climate change, from forests to oceans to everywhere in between. In 2015, world leaders signed a major treaty called the Paris agreement to put these solutions into practice.[2] Core to all climate change solutions is reducing greenhouse gas emissions, which must get to zero as soon as possible. Only then we can prevent global warming beyond 1.5°C. Changing our main energy sources to clean and renewable energy is the best way to stop using fossil fuels. These include technologies like solar, wind, wave, tidal and geothermal power. Reducing car use, switching to electric vehicles, and minimizing plane travel will not only help stop climate change, but also reduce air pollution too. Forests are crucial in the fight against climate change and protecting them is an important climate solution. Conserving and restoring natural spaces, both on land and in the water, is essential for limiting carbon emissions providing one-third of the mitigation effort needed in the next decade.[6,7]

Bangladesh scenario

Bangladesh is among the countries that is most susceptible as well as affected by extremes of climate changes including heatwaves due to global warming. In the 2020 edition of Germanwatch's Climate Risk Index, Bangladesh ranked 7th in the list of countries most affected by climate calamities during the period 1999–2018.[8] The combination of frequent natural disasters, high population density and low resilience to economic shocks, make Bangladesh very vulnerable to climate and environmental hazards. The unbridled rise in population, ill planned urbanization, continuous deforestation, and air thick with noxious pollutants makes way for conditions where heat is trapped. Studies showed that between 1989 and 2011, the country experienced 22 percent higher mortality rates on heatwave days and between 2003 and 2007, heat effects increased all-cause mortality by 1–3 percent.[9] According to the World Bank Group, temperatures in Bangladesh ranged from 15 to 35 degrees Celsius on average between 1901 and 2020. Sea levels in Bangladesh are predicted to rise by up to 0.30 meters by 2050, resulting in the displacement of 0.9 million people, and by up to 0.74 meters by 2100, resulting in the displacement of 2.1 million people. So, urgent actions are needed both globally and nationally to combat global warming and climate change and thus preserve nature and humanity.

Bangladesh experienced its longest heat wave in recorded history this April. According to the data available since 1948, this month (April) has already seen records of heat wave days in a single year. This year, for the first time, nearly 75% of the country has experienced continuous heat waves. Since April 19, Bangladesh Meteorological Department (BMD) issued heat alert six times. Ten people died of heat stroke across Bangladesh in the last week of April, including 2 schoolteachers, according to the Directorate General of Health Services (DGHS). The Ministry of Education announced the closure of all primary, secondary schools, colleges, madrasas, and technical education institutions in the face of heatwave.

A national Guideline of management of Heat Related illness has been developed and inaugurated on May 5, 2024, by DGHS in collaboration with UNICEF. To increase physicians' awareness as well as capability in managing this situation, seminars were arranged in different medical colleges under the guidance of Bangladesh Society of Medicine (BSM).

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