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The Impact of Climate Change on the Environment

Anil Kumar

Assistant Professor, Department of Physics, Brahmanand College, Kanpur, Uttar Pradesh, India

ABSTRACT

Climate change refers to long-term shifts in temperatures and weather patterns. Such shifts can be natural, due to changes in the sun's activity or large volcanic eruptions. But since the 1800s, human activities have been the main driver of climate change, primarily due to the burning of fossil fuels like coal, oil and gas.

Burning fossil fuels generates greenhouse gas emissions that act like a blanket wrapped around the Earth, trapping the sun's heat and raising temperatures.

The main greenhouse gases that are causing climate change include carbon dioxide and methane. These come from using gasoline for driving a car or coal for heating a building, for example. Clearing land and cutting down forests can also release carbon dioxide. Agriculture, oil and gas operations are major sources of methane emissions. Energy, industry, transport, buildings, agriculture and land use are among the main sectors causing greenhouse gases.

KEYWORDS: *climate change, temperature, earth, greenhouse as, energy*

Introduction

Climate scientists have showed that humans are responsible for virtually all global heating over the last 200 years. Human activities like the ones mentioned above are causing greenhouse gases that are warming the world faster than at any time in at least the last two thousand years.

The average temperature of the Earth's surface is now about 1.2°C warmer than it was in the late 1800s (before the industrial revolution) and warmer than at any time in the last 100,000 years. The last decade (2011-2020) was the warmest on record, and each of the last four decades has been warmer than any previous decade since 1850.

Many people think climate change mainly means warmer temperatures. But temperature rise is only the beginning of the story. Because the Earth is a system, where everything is connected, changes in one area can influence changes in all others.[1,2,3]

The consequences of climate change now include, among others, intense droughts, water scarcity, severe fires, rising sea levels, flooding, melting polar ice, catastrophic storms and declining biodiversity.

Climate change can affect our health, ability to grow food, housing, safety and work. Some of us are already more vulnerable to climate impacts, such as people living in small island nations and other developing countries. Conditions like sea-level rise and saltwater intrusion have advanced to the point where whole communities have had to relocate, and protracted droughts are putting people at risk of famine. In the future, the number of people displaced by weather-related events is expected to rise.

In a series of UN reports, thousands of scientists and government reviewers agreed that limiting global temperature rise to no more than 1.5°C would help us avoid the worst climate impacts and maintain a livable climate. Yet policies currently in place point to a 3°C temperature rise by the end of the century.

The emissions that cause climate change come from every part of the world and affect everyone, but some countries produce much more than others.The seven biggest emitters alone (China, the United States of America, India, the European Union, Indonesia, the Russian Federation, and Brazil) accounted for about half of all global greenhouse gas emissions in 2020.

Everyone must take climate action, but people and countries creating more of the problem have a greater responsibility to act first.

Many climate change solutions can deliver economic benefits while improving our lives and protecting the environment. We also have global frameworks and agreements to guide progress, such as the Sustainable Development Goals, the UN Framework Convention on Climate Change and the Paris Agreement. Three broad categories of action are: cutting emissions, adapting to climate impacts and financing required adjustments.

Switching energy systems from fossil fuels to renewables like solar or wind will reduce the emissions driving climate change. But we have to act now. While a growing number of countries is committing to net zero emissions by 2050, emissions must be cut in half by 2030 to keep warming below 1.5°C. Achieving this means huge declines in the use of coal, oil and gas: over two-thirds of today's proven reserves of fossil fuels need to be kept in the ground by 2050 in order to prevent catastrophic levels of climate change.[4,5,6]

Adapting to climate consequences protects people, homes, businesses, livelihoods, infrastructure and natural ecosystems. It covers current impacts and those likely in the future. Adaptation will be required everywhere, but must be prioritized now for the most vulnerable people with the fewest resources to cope with climate hazards. The rate of return can be high. Early warning systems for disasters, for instance, save lives and property, and can deliver benefits up to 10 times the initial cost.

DISCUSSION

Climate action requires significant financial investments by governments and businesses. But climate inaction is vastly more expensive. One critical step is for industrialized countries to fulfil their commitment to provide $100 billion a year to developing countries so they can adapt and move towards greener economies.

Some changes (such as droughts, wildfires, and extreme rainfall) are happening faster than scientists previously assessed. In fact, according to the Intergovernmental Panel on Climate Change (IPCC) — the United Nations body established to assess the science related to climate change — modern humans have never before seen the observed changes in our global climate, and some of these changes are irreversible over the next hundreds to thousands of years.

Scientists have high confidence that global temperatures will continue to rise for many decades, mainly due to greenhouse gases produced by human activities.

The IPCC's Sixth Assessment report, published in 2021, found that human emissions of heat-trapping gases have already warmed the climate by nearly 2 degrees Fahrenheit (1.1 degrees Celsius) since 1850-1900.[1] The global average temperature is expected to reach or exceed 1.5 degrees C (about 3 degrees F) within the next few decades. These changes will affect all regions of Earth.

The severity of effects caused by climate change will depend on the path of future human activities. More greenhouse gas emissions will lead to more climate extremes and widespread damaging effects across our planet. However, those future effects depend on the total amount of carbon dioxide we emit. So, if we can reduce emissions, we may avoid some of the worst effects.

U.S. Sea Level Likely to Rise 1 to 6.6 Feet by 2100[7,8,9]

Global sea level has risen about 8 inches (0.2 meters) since reliable record-keeping began in 1880. By 2100, scientists project that it will rise at least another foot (0.3 meters), but possibly as high as 6.6 feet (2 meters) in a high-emissions scenario. Sea level is rising because of added water from melting land ice and the expansion of seawater as it warms.

Climate Changes Will Continue Through This Century and Beyond

Global climate is projected to continue warming over this century and beyond.

Hurricanes Will Become Stronger and More Intense

Scientists project that hurricane-associated storm intensity and rainfall rates will increase as the climate continues to warm.

More Droughts and Heat Waves

Droughts in the Southwest and heat waves (periods of abnormally hot weather lasting days to weeks) are projected to become more intense, and cold waves less intense and less frequent.

Longer Wildfire Season

Warming temperatures have extended and intensified wildfire season in the West, where long-term drought in the region has heightened the risk of fires. Scientists estimate that human-caused climate change has already doubled the area of forest burned in recent decades. By around 2050, the amount of land consumed by wildfires in Western states is projected to further increase by two to six times. Even in traditionally rainy regions like the Southeast, wildfires are projected to increase by about 30%.

Changes in Precipitation Patterns

Climate change is having an uneven effect on precipitation (rain and snow) in the United States, with some locations experiencing increased precipitation and flooding, while others suffer from drought. On average, more winter and spring precipitation is projected for the northern United States, and less for the Southwest, over this century.

Frost-Free Season (and Growing Season) will Lengthen

The length of the frost-free season, and the corresponding growing season, has been increasing since the 1980s, with the largest increases occurring in the western United States. Across the United States, the growing season is projected to continue to lengthen, which will affect ecosystems and agriculture.

Global Temperatures Will Continue to Rise

Summer of 2023 was Earth's hottest summer on record, 0.41 degrees Fahrenheit (F) (0.23 degrees Celsius (C)) warmer than any other summer in NASA's record and 2.1 degrees F (1.2 C) warmer than the average summer between 1951 and 1980.

Arctic Is Very Likely to Become Ice-Free

Sea ice cover in the Arctic Ocean is expected to continue decreasing, and the Arctic Ocean will very likely become essentially ice-free in late summer if current projections hold. This change is expected to occur before mid-century.

Climate change is bringing different types of challenges to each region of the country. Some of the current and future impacts are summarized below. These findings are from the Third[3] and Fourth[4] National Climate Assessment Reports, released by the U.S. Global Change Research Program.

- Northeast. Heat waves, heavy downpours, and sea level rise pose increasing challenges to many aspects of life in the Northeast. Infrastructure, agriculture, fisheries, and ecosystems will be increasingly compromised. Farmers can explore new crop options, but these adaptations are not cost- or risk-free. Moreover, adaptive capacity, which varies throughout the region, could be overwhelmed by a changing climate. Many states and cities are beginning to incorporate climate change into their planning.
- Northwest. Changes in the timing of peak flows in rivers and streams are reducing water supplies and worsening competing demands for water. Sea level rise, erosion, flooding, risks to infrastructure, and increasing ocean acidity pose major threats. Increasing wildfire incidence and severity, heat waves, insect outbreaks, and tree diseases are causing widespread forest die-off.
- Southeast. Sea level rise poses widespread and continuing threats to the region's economy and environment. Extreme heat will affect health, energy, agriculture, and more. Decreased water availability will have economic and environmental impacts.
- Midwest. Extreme heat, heavy downpours, and flooding will affect infrastructure, health, agriculture, forestry, transportation, air and water quality, and more. Climate change will also worsen a range of risks to the Great Lakes.
- Southwest. Climate change has caused increased heat, drought, and insect outbreaks. In turn, these changes have made wildfires more numerous and severe. The warming climate has also caused a decline in water supplies, reduced agricultural yields, and triggered heat-related health impacts in cities. In coastal areas, flooding and erosion are additional concerns.[10,11,12]

RESULTS

Fossil fuels – coal, oil and gas – are by far the largest contributor to global climate change, accounting for over 75 per cent of global greenhouse gas emissions and nearly 90 per cent of all carbon dioxide emissions.

As greenhouse gas emissions blanket the Earth, they trap the sun's heat. This leads to global warming and climate change. The world is now warming faster than at any point in recorded history. Warmer temperatures over time are changing weather patterns and disrupting the usual balance of nature. This poses many risks to human beings and all other forms of life on Earth.

Causes:

Generating power

Generating electricity and heat by burning fossil fuels causes a large chunk of global emissions. Most electricity is still generated by burning coal, oil, or gas, which produces carbon dioxide and nitrous oxide – powerful greenhouse gases that blanket the Earth and trap the sun's heat. Globally, a bit more than a quarter of electricity comes from wind, solar and other renewable sources which, as opposed to fossil fuels, emit little to no greenhouse gases or pollutants into the air.

Manufacturing goods

Manufacturing and industry produce emissions, mostly from burning fossil fuels to produce energy for making things like cement, iron, steel, electronics, plastics, clothes, and other goods. Mining and other industrial processes also release gases, as does the construction industry. Machines used in the manufacturing process often run on coal, oil, or gas; and some materials, like plastics, are made from chemicals sourced from fossil fuels. The manufacturing industry is one of the largest contributors to greenhouse gas emissions worldwide.

Cutting down forests[13,14,15]

Cutting down forests to create farms or pastures, or for other reasons, causes emissions, since trees, when they are cut, release the carbon they have been storing. Each year approximately 12 million hectares of forest are destroyed. Since forests absorb carbon dioxide, destroying them also limits nature's ability to keep emissions out of the atmosphere. Deforestation, together with agriculture and other land use changes, is responsible for roughly a quarter of global greenhouse gas emissions.

Using transportation

Most cars, trucks, ships, and planes run on fossil fuels. That makes transportation a major contributor of greenhouse gases, especially carbon-dioxide emissions. Road vehicles account for the largest part, due to the combustion of petroleum-based products, like gasoline, in internal combustion engines. But emissions from ships and planes continue to grow. Transport accounts for nearly one quarter of global energy-related carbon-dioxide emissions. And trends point to a significant increase in energy use for transport over the coming years.

Producing food

Producing food causes emissions of carbon dioxide, methane, and other greenhouse gases in various ways, including through deforestation and clearing of land for agriculture and grazing, digestion by cows and sheep, the production and use of fertilizers and manure for growing crops, and the use of energy to run farm equipment or fishing boats, usually with fossil fuels. All this makes food production a major contributor to climate change. And greenhouse gas emissions also come from packaging and distributing food.

Powering buildings

Globally, residential and commercial buildings consume over half of all electricity. As they continue to draw on coal, oil, and natural gas for heating and cooling, they emit significant quantities of greenhouse gas emissions. Growing energy demand for heating and cooling, with rising air-conditioner ownership, as well as increased electricity consumption for lighting, appliances, and connected devices, has contributed to a rise in energy-related carbon-dioxide emissions from buildings in recent years.

Consuming too much

Your home and use of power, how you move around, what you eat and how much you throw away all contribute to greenhouse gas emissions. So does the consumption of goods such as clothing, electronics, and plastics. A large chunk of global greenhouse gas emissions are linked to private households. Our lifestyles have a profound impact on our planet. The wealthiest bear the greatest responsibility: the richest 1 per cent of the global population combined account for more greenhouse gas emissions than the poorest 50 per cent.

Effects:

Hotter temperatures

As greenhouse gas concentrations rise, so does the global surface temperature. The last decade, 2011-2020, is the warmest on record. Since the 1980s, each decade has been warmer than the previous one. Nearly all land areas are seeing more hot days and heat waves. Higher temperatures increase heat-related illnesses and make working outdoors more difficult. Wildfires start more easily and spread more rapidly when conditions are hotter. Temperatures in the Arctic have warmed at least twice as fast as the global average.

More severe storms

Destructive storms have become more intense and more frequent in many regions. As temperatures rise, more moisture evaporates, which exacerbates extreme rainfall and flooding, causing more destructive storms. The frequency and extent of tropical storms is also affected by the warming ocean. Cyclones, hurricanes, and typhoons feed on warm waters at the ocean surface. Such storms often destroy homes and communities, causing deaths and huge economic losses.

Increased drought

Climate change is changing water availability, making it scarcer in more regions. Global warming exacerbates water shortages in already water-stressed regions and is leading to an increased risk of agricultural droughts affecting crops, and ecological droughts increasing the vulnerability of ecosystems. Droughts can also stir destructive sand and dust storms that can move billions of tons of sand across continents. Deserts are expanding, reducing land for growing food. Many people now face the threat of not having enough water on a regular basis.[16,17,18]

A warming, rising ocean

The ocean soaks up most of the heat from global warming. The rate at which the ocean is warming strongly increased over the past two decades, across all depths of the ocean. As the ocean warms, its volume increases since water expands as it gets warmer. Melting ice sheets also cause sea levels to rise, threatening coastal and island communities. In addition, the ocean absorbs carbon dioxide, keeping it from the atmosphere. But more carbon dioxide makes the ocean more acidic, which endangers marine life and coral reefs.

Loss of species

Climate change poses risks to the survival of species on land and in the ocean. These risks increase as temperatures climb. Exacerbated by climate change, the world is losing species at a rate 1,000 times greater than at any other time in recorded human history. One million species are at risk of becoming extinct within the next few decades. Forest fires, extreme weather, and invasive pests and diseases are among many threats related to climate change. Some species will be able to relocate and survive, but others will not.

Not enough food

Changes in the climate and increases in extreme weather events are among the reasons behind a global rise in hunger and poor nutrition. Fisheries, crops, and livestock may be destroyed or become less productive. With the ocean becoming more acidic, marine resources that feed billions of people are at risk. Changes in snow and ice cover in many Arctic regions have disrupted food supplies from herding, hunting, and fishing. Heat stress can diminish water and grasslands for grazing, causing declining crop yields and affecting livestock.

More health risks

Climate change is the single biggest health threat facing humanity. Climate impacts are already harming health, through air pollution, disease, extreme weather events, forced displacement, pressures on mental health, and increased hunger and poor nutrition in places where people cannot grow or find sufficient food. Every year, environmental factors take the lives of around 13 million people. Changing weather patterns are expanding diseases, and extreme weather events increase deaths and make it difficult for health care systems to keep up.

Poverty and displacement

Climate change increases the factors that put and keep people in poverty. Floods may sweep away urban slums, destroying homes and livelihoods. Heat can make it difficult to work in outdoor jobs. Water scarcity may affect crops. Over the past decade (2010–2019), weather-related events displaced an estimated 23.1 million people on average each year, leaving many more vulnerable to poverty. Most refugees come from countries that are most vulnerable and least ready to adapt to the impacts of climate change.

CONCLUSION

The Earth's climate is changing and the global climate is projected to continue to change over this century and beyond. The magnitude of climate change beyond the next few decades will depend primarily on the amount of greenhouse (heat-trapping) gases emitted globally and on the remaining uncertainty in the sensitivity of the Earth's climate to those emissions. With significant reductions in the emissions of greenhouse gases (GHGs), global annual averaged temperature rise could be limited to 2°C or less. However, without major reductions in these emissions, the increase in annual average global temperatures, relative to preindustrial times, could reach 5°C or more by the end of this century.[19,20,21]

The global climate continues to change rapidly compared to the pace of the natural variations in climate that have occurred throughout Earth's history. Trends in globally averaged temperature, sea level rise, upper-ocean heat content, land-based ice melt, arctic sea ice, depth of seasonal permafrost thaw, and other climate variables provide consistent evidence of a warming planet. These observed trends are robust and confirmed by multiple, independent research groups around the world. [22]

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[12] Cattaneo et al. 2019; IPCC AR6 WG2 2022, pp. 15, 53

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