

Global Warming

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ESSAY

Record-breaking heatwaves, melting glaciers, and destructive floods signals that the Earth's climate system is under severe stress. These extreme events are no longer occasional anomalies but recurring warnings of the accelerating threat posed by global warming. Global warming refers to the long-term increase in the Earth's surface temperatures caused by the rising concentration of greenhouse gases in the atmosphere. Although not a new phenomenon, it has been harming the planet for decades. Human carelessness, the extensive use of harmful chemicals and industrial expansion have further intensified the problem. While the Industrial Revolution brought many positive changes, it also exposed humanity to large-scale emissions of dangerous gases and pollutants. Thus, global warming is primarily driven by human

activities, produces severe environmental, economic, and social consequences, and demands urgent mitigation and adaptation strategies to safeguard the planet and ensure a sustainable future.

The one of the major causes of global warming is rapid population growth that has significantly increased the demand for energy, food, and natural resources. A growing population requires more housing, transportation, and industrial goods, all of which depend heavily on fossil fuels and energy-intensive production. This surge in resource consumption leads to higher greenhouse gas emissions and greater environmental degradation. As urban areas expand, forests are cleared, and natural carbon sinks are lost, further worsen the climate imbalance. According to the Global Carbon Budget and Energy reviews, fossil fuel carbon dioxide emissions are projected to rise in 2025, reaching a record high of around 38.1 billion tonnes of CO₂, driven by increased consumption of coal, oil, and natural gas in major

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economies. Therefore, the rapid rise in population and associated resource demands amplify human contributions to global warming.

Another cause of global warming is industrial manufacturing, as it relies on energy intensive processes that release substantial amount of greenhouse gases. Factories release vast amounts of fossil fuels to power machinery and heat raw materials, releasing large volumes of carbon dioxide. Production of goods such as cement, steel, and chemicals generates additional emissions as unavoidable byproducts. Rising global demand for manufactured products further amplifies the sector's contribution to climate change. According to the Industrial Energy Accelerator's Explainer Brief on Industrial Emissions (2023), the industrial sector accounts for over 21 percent of total global greenhouse gas emissions, and emissions have nearly doubled since 1990 due to increased industrial output. Hence, industrial manufacturing is a major human-driven factor in global warming.

Additionally, the removal of forests reduces the Earth's ability to absorb carbon dioxide, weakening a key natural defense against climate change. Trees act as carbon sinks, storing carbon that would otherwise remain in the atmosphere. When forests are cleared for agriculture, logging, or urban expansion, this stored carbon is released back into the air.

The loss of forest cover also diminishes biodiversity and disrupts local weather patterns, making ecosystems less resilient to climate stress. According to the Food and Agriculture

Organization's Global Forest Resources Assessment 2025, the world lost millions of hectares of forest between 2015 and 2025, releasing significant amounts of stored carbon and reducing global carbon sequestration capacity. However, deforestation accelerates global warming by both releasing carbon dioxide and reducing the planet's ability to capture future emissions.

Furthermore, chemically intensive agricultural,

practices contribute significantly to global warming through the release of potent greenhouse gases. Synthetic fertilizers and chemical soil treatments increase emissions of nitrous oxide, a greenhouse gas with much higher warming potential than carbon dioxide. These emissions occur when nitrogen compounds in fertilizers undergo biological processes in the soil. Combined with mechanized farming, the widespread use of chemicals amplifies the agriculture sector's contribution to climate change. Agriculture, forestry, and other land use (AFOLU) sectors are estimated to account for about 23 percent of global greenhouse gas emissions, with nitrous oxide from agricultural soils contributing a major share of these emissions. Consequently, excessive reliance on chemical inputs in agriculture accelerates global warming.

Moreover, the expansion of global transportation systems has become a major contributor to greenhouse gas emissions, reinforcing its role

in driving global warming. Road vehicles, ships, and aircraft depend heavily on fossil fuels, releasing carbon dioxide when those fuels are burned. As personal mobility and global trade increase with economic growth, fuel demand in transportation continues to rise. Without clear alternatives, this dependence intensifies the sector's climate impact.

According to the International Energy Agency's Transport, Energy and CO₂ analysis, the transport sector accounts for nearly one quarter of global energy-related CO₂ emissions, reflecting the ongoing reliance on fossil fuels across all modes of mobility. As a result, the expansion of transportation networks and fuel consumption accelerates global warming.

Last but not least, modern economies' heavy dependence on coal, oil, and natural gas is a primary driver of global warming. Fossil fuels power industries, transportation, and electricity generation, releasing vast amounts of carbon dioxide into the atmosphere. Despite the

growth of renewable energy. Fossil fuel consumption continues to rise in major economies.

This ongoing reliance locks societies into high-emission energy systems, making climate mitigation more challenging. The 2025 Global Carbon

Budget projects that carbon dioxide emissions from fossil fuel use will rise by 1.1 percent to about 42.2 billion tonnes, showing that continued dependence on coal, oil, and gas remains the central cause of rising atmospheric CO₂ level.

This, excessive reliance on fossil fuels intensifies global warming.

The human-driven causes of global warming have ^{set} the stage for increasingly severe environmental consequences. Understanding these effects is essential to grasping the full scale of the climate crisis and its implications for life on the Earth.

One of the major impacts is that global warming has led to a significant rise in Earth's average temperatures, triggering more frequent and intense weather events. Higher global

temperatures disrupt atmospheric and oceanic systems, resulting in heatwaves, droughts, storms, and floods. These extreme weather events have become more unpredictable and severe, affecting millions of people worldwide. Rising temperatures also amplify secondary climate impacts, such as wildfires and sea-level rise, compounding the threat to ecosystems and human settlements. The World Meteorological Organization reports that 2025 was projected to be amongst the warmest years on record, with global surface temperatures expected to be $\sim 1.4^{\circ}\text{C}$ above pre-industrial levels. Therefore, rising global temperatures are directly linked to the increasing frequency and intensity of extreme weather events.

Additionally, global warming is accelerating the melting of glaciers and disrupting freshwater availability, creating severe water scarcity in many regions. Rising temperatures cause glaciers and ice caps to melt at unprecedented rates, reducing long-term water reserves for millions of people. Changing precipitation patterns and

prolonged droughts further strain freshwater resources. This combination threatens agriculture, drinking water supplies, and hydroelectric power generation in vulnerable areas. According to the World Glacier Monitoring Service 2025, glaciers worldwide are retreating at record speeds, losing an average of 1.3 meters of ice thickness per year, and many high-altitude regions could face severe water shortages within decades. Thus, melting glaciers due to global warming intensify water scarcity, posing a challenge for ecosystems.

Moreover, global warming is worsening food insecurity by undermining agricultural productivity and destabilizing food systems. Higher temperatures, unpredictable rainfalls and extreme weather events disrupt crop growth and harvest crops. These climate stresses reduce yields and damage farmlands, making it harder for farmers to produce reliable food supplies. In climate-vulnerable countries, this undermines both rural livelihoods and national food availability. In Pakistan, more than 14 million people, around 22 percent of the analysed population,

Faced acute food insecurity b/w November 2024 and March 2025 in flood-affected rural districts of Balochistan, Sindh, and KP, according to the 2025 Global Report on Food Crises by the Food and Agriculture Organization of the UNs. Consequently, climate-driven agricultural disruption has translated into real food insecurity.

Besides, global warming poses serious public health risks by increasing the prevalence of climate-related diseases. Rising temperatures and changing rainfall patterns create favorable conditions for the spread of infectious diseases such as malaria, dengue, and waterborne illnesses. Heatwaves, floods, and droughts are exacerbate respiratory and cardiovascular problems, particularly among vulnerable populations. These health risks strain public health systems and increase mortality rates during extreme climate events. In Pakistan, the 2022 floods triggered outbreaks of waterborne diseases. The World Health Organization reports that climate change is expected to cause an additional 250,000 deaths

per year globally between 2030 and 2050 from malnutrition, malaria, diarrhoea, and heat stress.

Hence, global warming not only endangers the environment but also directly threatens human health.

Furthermore, global warming inflicts severe economic losses and undermines livelihoods, particularly in climate-vulnerable regions. Extreme weather events such as floods, heatwaves, and droughts destroy infrastructure, agricultural lands, and businesses.

Rising temperatures and changing precipitation patterns reduce productivity across key sectors like agriculture, fisheries, and others. Vulnerable communities dependent on natural resources face income loss, unemployment, and long-term economic instability. In Pakistan, the 2022 floods affected over 33 million people and caused economic losses exceeding USD 30 billion, a catastrophe that the World Bank explicitly associated with climate change-driven warming rather than natural variability.

However, global warming substantial economic costs and threatens livelihood.

Last but not least, global warming is accelerating ecological degradation and causing widespread loss of biodiversity. Rising temperatures, changing rainfall patterns, and extreme weather events disrupt ecosystems, forcing species to migrate, adapt, or face extinction. Habitats such as forests, wetlands, and coral reefs are particularly vulnerable, while fragmentation and human pressures compound the stress on wildlife. The decline in biodiversity weakens ~~ecosystem~~ ecosystem services that humans rely on, including pollination, clean water, and climate regulation. The 2025 update of the International Union for Conservation of Nature (IUCN) Red List reports that 61 percent of global bird species are now in decline, a significant increase from 44 percent in 2016, highlighting how climate change is accelerating species loss worldwide. As a result, global warming is driving rapid ecological degradation and biodiversity loss.

The severe environmental, economic, and social consequences of global warming highlights the

vigilant need for effective responses. Understanding and implementing mitigation and adaptation strategies is essential to reduce future risks and protect both human and natural systems too.

Firstly, transition from fossil fuels to renewable and clean energy sources is essential to reducing greenhouse gas emissions and slowing global warming. Renewable energy, including solar, wind, and hydro, produces little or no carbon emissions once operational, unlike coal and oil.

Expanding renewable capacity lowers reliance on fossil fuels and supports long-term emissions reductions. Growing clean energy infrastructure also encourages investment, innovation, and energy security across economies. The Renewable Capacity Statistics 2025 report by the International Renewable Energy Agency (IRENA) shows that global renewable power capacity grew by 88.5 gigawatts in 2024, accounting for 92.5 percent of all new power capacity added worldwide, with solar and wind making up the vast majority of this growth. How...

accelerating the shift to renewable and clean energy is a powerful mitigation strategy that can stabilise the climate.

In addition to, large-scale tree planting and afforestation are essential strategies to sequester carbon dioxide and mitigate global warming.

Trees capture atmospheric carbon through photosynthesis, reducing greenhouse gas concentrations while stabilising soil and supporting ecosystems. Expanding forest cover also enhances biodiversity, protects watersheds, and provide natural buffers against climate extremes. Urban and rural plantations improve air quality and strengthen community resilience.

Under Pakistan's Upscaling Green Pakistan Programme, more than 2.229 billion saplings were planted between 2019 and December 2024, achieving 60 percent of the target. This initiative not only increased forest cover but also restored degraded land. However, mass-level plantation is an effective mitigation measure that helps in combating the impacts of global warming.

Moreover, global collaboration through international

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climate agreements is essential to coordinate mitigation efforts and limit the impacts of global warming.

Climate change transcends national borders, requiring countries to share technology, finance, and expertise.

International agreements provide frameworks for emission reductions, climate adaptation, and sustainable development. Cooperation also supports developing countries

in implementing climate solutions while holding major emitters accountable. The 2025 NDC

Synthesis Report published by the UN Framework

Convention on Climate Change shows that the new

nationally determined contributions (NDCs) submitted by 64 Parties outline emission reductions of 17 percent

(range 11-24 percent) below 2019 levels by 2035,

demonstrating measurable progress in coordinated

global climate action. Therefore, strengthening

international climate cooperation ensures that countries collectively commit to emission reduction.

Besides, raising public awareness and promoting education on climate change are essential to

driving behavioral changes that reduce greenhouse

gas emissions. Informed citizens are more likely to

adopt sustainable practices such as energy conservation, waste reduction, and the use of public transport. Education programs empower individuals to understand climate risks and take proactive measures. Widespread behavioral change complements policy and technological interventions, amplifying mitigation efforts.

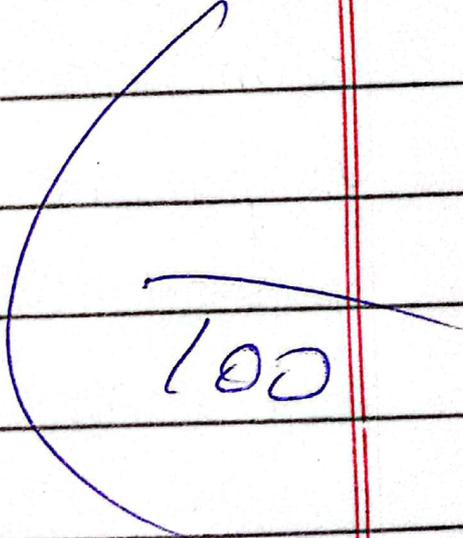
A 2025 meta-analysis published in *Frontiers in Education* found that climate change education interventions produce significant positive effects on knowledge, attitudes, and behaviors related to sustainability. Thus, public awareness and education are essential tools for engaging communities in combating global warming.

Furthermore, controlling rapid population growth is an important long-term strategy to reduce environmental pressure and mitigate global warming. A growing population increases demand for energy, food, housing, and transportation, which intensifies fossil fuel consumption, deforestation, and waste generation. High population growth also places stress on water resources.

and agricultural systems, especially in developing countries. Managing population growth asks governments to plan resources more sustainably and reduce cumulative emissions. The United Nations Population Fund (UNFPA, 2025) emphasizes that voluntary family planning, female education, and reproductive health services help slow population growth and reduce pressure on natural resources. Consequently, controlling population growth supports sustainable resource use and strengthens efforts to combat global warming.

In a nutshell, global warming stands as one of the most serious challenges confronting the modern world, with its roots firmly embedded in human activities and its consequences spreading across environmental, economic, and social spheres. The unchecked exploitation of natural resources and dependence on fossil fuels have disrupted the Earth's climate balance and intensified risks to ecosystems and human survival. Rising temperatures, food insecurity, health crises, and biodiversity disruption confirm that global warming is no

longer a distant threat but a present reality. Addressing this crisis requires a coordinated response that combines mitigation through clean energy, conservation, and international cooperation with adaptation strategies. Ultimately, decisive action today is essential to secure a stable climate, preserve biodiversity, and ensure a sustainable and resilient future for coming generations.



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