

# **Climate change, Pakistan's Situation, Crisis and Sustainable goals**

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**It is silent yet relentless, invisible yet world-shaping, a force that touches every life on Earth without asking permission.** This force is climate change, now recognized as one of the most urgent, pressing, and transformative issues of our time, reshaping the global agenda across science, policy, economics, and ethics. No longer confined to academic discussions or environmental summits, it has become a central consideration in the decisions of governments, businesses, and communities worldwide. As the defining challenge of the 21st century, climate change demands unprecedented levels of international cooperation, bold innovation, and long-term vision. Its significance lies not only in the scale and complexity of its impacts but also in its profound role in shaping how humanity envisions and safeguards its collective future.

Yet behind this vast and urgent crisis lies a clear and troubling reality, climate change is not an abstract phenomenon, but a consequence of actions we take every day. It is fueled primarily by human activities that steadily increase the concentration of greenhouse gases in the atmosphere. One of the most significant drivers is the burning of fossil fuels such as coal, oil, and natural gas for electricity, heat, and transportation, which releases vast

amounts of carbon dioxide (CO<sub>2</sub>) and other gases that trap heat around the planet. The problem is compounded by deforestation, nature's own carbon filters, are destroyed, both eliminating their cooling effect and releasing stored carbon back into the air. Industrial processes, from cement and steel production to chemical manufacturing, emit highly potent greenhouse gases like nitrous oxide and fluorinated compounds, which have far greater heat-trapping capacity than CO<sub>2</sub>. Agriculture, too, plays a major role, with methane emissions from rice paddies and livestock digestion, along with nitrous oxide from nitrogen-based fertilizers. Even waste, when poorly managed, becomes a silent contributor, with landfills producing methane during decomposition and insufficient recycling fueling the demand for energy-intensive production of new materials.

And the chain does not end there. Transportation, whether by road, air, or sea, runs largely on fossil fuels, while the very process of extracting oil and gas releases additional methane and CO<sub>2</sub> into the air. Rapid urbanization replaces cooling green spaces with heat-absorbing concrete, raising local temperatures and compounding global warming. Even the gases used in cooling systems such as fluorinated compounds in refrigeration and air conditioning, hold thousands of times the heat-trapping power of CO<sub>2</sub>. Meanwhile, the damage we inflict on oceans through overfishing and coral reef destruction reduces their ability

to absorb carbon, and mining operations disturb the land for releasing carbon which stored in soil and vegetation. These interconnected human activities form a complex web of influence that is steadily reshaping the planet's climate.

The consequences of this reshaping are already unfolding around us. Temperatures worldwide are rising, driving more frequent and intense heatwaves that endanger human health and stress natural ecosystems. This warming is closely linked to more frequent and severe extreme weather events, including storms, floods, droughts, and wildfires, which disrupt livelihoods, damage infrastructure, and strain economies. The accelerated melting of glaciers and polar ice sheets in Greenland, Antarctica, and mountain ranges contributes significantly to sea-level rise, threatening coastal cities and small island nations with flooding and possible submersion. Oceans are also under threat from acidification due to excess carbon dioxide absorption, endangering coral reefs, shellfish populations, and marine biodiversity. On land, biodiversity loss is accelerating as shifting climate zones, habitat destruction, and disrupted food chains push many species toward extinction.

This environmental unraveling strikes directly at the foundations of human survival. Agriculture and food security are increasingly at risk as changing rainfall

patterns, soil degradation, and temperature extremes reduce crop yields and disrupt farming cycles. This worsens food scarcity, particularly in regions already vulnerable to hunger and malnutrition. Human health faces mounting challenges from heat-related illnesses, respiratory diseases linked to poor air quality, and the spread of vector-borne diseases like malaria and dengue into new regions. Water scarcity is another urgent concern, with reduced rainfall, melting snow packs, and prolonged droughts threatening fresh water supplies. The economic consequences include damaged infrastructure, reduced productivity, rising insurance costs, and growing instability, particularly in developing nations. Climate change is also driving forced migration, as communities affected by sea-level rise, droughts, or extreme events. The natural systems we depend on for stability such as forests, wetlands and oceans are losing their ability to regulate climate, purify water, and sustain life. Even the great ocean currents, like the Gulf Stream, are weakening, threatening to disrupt weather patterns and monsoons in ways that could reshape entire regions. If the world continues on its current trajectory, these challenges will escalate beyond anything we have yet experienced. The World Meteorological Organization and NOAA report that 2024 was the warmest year on record, with global temperatures about 1.55°C above pre-industrial levels, an ominous signal of the thresholds we are approaching. The IPCC warns that under high-emission scenarios, sea levels could

rise between 0.63 and 1.01 meters by 2100, with worst-case outcomes nearing 2 meters. Coral reefs, critical to marine biodiversity and coastal protection, could decline by 70–90% if warming surpasses 1.5°C, and by over 99% at 2°C. Food security will be severely strained; in Africa, crop yields could drop by 10% at 2°C and by 23% at 4°C even with adaptation. Without strong governance and adaptation measures, the World Bank estimates climate migration could reach 216 million people by 2050. Meanwhile, the weakening of the Atlantic Meridional Overturning Circulation could disrupt monsoons, alter rainfall patterns, and accelerate regional sea-level rise, compounding global instability.

Pakistan ranks among the top ten most climate-vulnerable countries according to the Global Climate Risk Index (Germanwatch, 2021), despite contributing less than 1% of global greenhouse gas emissions but still bears a disproportionate share of the impacts. This vulnerability calls for urgent adaptation, resilience-building, and low-carbon development. A key step is transitioning to renewable energy such as solar, wind, and small hydropower can cut dependence on imported fossil fuels, reduce emissions, and save billions in fuel imports, as the World Bank (2023) notes. Expanding large-scale afforestation programs, such as the Ten Billion Tree Tsunami, can help restore degraded land, increase carbon sequestration, and reduce flood and heatwave risks.

Climate-smart agriculture, including drought-tolerant crops, drip irrigation, and efficient farming techniques, can conserve water and stabilize yields. Urban centers like Karachi need heatwave management and green urban planning, with shaded walkways, urban forests, and reflective roofing to combat extreme heat. Water management strategies such as small dams, rainwater harvesting, and wastewater recycling are essential as the country approaches absolute water scarcity by 2025. Strengthening early warning systems, embedding climate education into schools and effective policy implementation, will be critical for Pakistan's climate resilience.

Other developing nations facing similar challenges have demonstrated that effective adaptation and mitigation strategies are possible. Bangladesh has reduced cyclone-related deaths by over 90% since the 1970s through community-based early warning systems and has introduced floating agriculture to sustain farming during floods. Kenya generates more than 48% of its electricity from geothermal power, reducing emissions and stabilizing energy supply. Costa Rica has doubled its forest cover from 26% to over 50% through payments for ecosystem services, boosting both eco-tourism and conservation. Vietnam has restored mangroves to shield coasts from storms and store carbon, while Morocco has developed large-scale solar projects like the Noor Solar Complex,

which powers over a million homes. These examples prove that vulnerability need not mean defeat; with political will, community engagement, and targeted investment, transformation is within reach.

Climate change is no longer a distant threat, it is the defining reality of our time, shaping the present and determining the future. The stories of resilience from around the world show that action can reverse the tide, but the window is narrow. For Pakistan and all nations, the choice is clear: act decisively now, or inherit a future of escalating crises. By embracing renewable energy, restoring ecosystems, modernizing agriculture, and uniting traditional wisdom with modern science, we can turn the greatest challenge of our age into a turning point for sustainable progress. The urgency is undeniable, but so is our capacity for change. If we act today, guided by knowledge, driven by solidarity, and anchored in hope, we can ensure a future where people and planet thrive together.