

Global Warming: A Threat to Life on Earth

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Abstract: *Global warming, driven primarily by human-induced greenhouse gas emissions, represents one of the most pressing threats to life on Earth. This paper examines the causes, scientific evidence, and multifaceted impacts of global warming on ecosystems, biodiversity, human health, and societal structures. Drawing on recent scientific assessments, it highlights the acceleration of climate change effects, including rising temperatures, sea level rise, extreme weather events, and biodiversity loss. Projections indicate that without immediate mitigation, these threats could lead to irreversible damage, potentially causing mass extinctions and widespread human hardship. The paper concludes with strategies for mitigation and adaptation, emphasizing the urgency of global action to safeguard life on the planet.*

Keywords: Greenhouse, Ecosystems, Automobiles, biodiversity, Mitigation

I. INTRODUCTION

Global warming refers to the long-term rise in Earth's average surface temperature due to the accumulation of greenhouse gases in the atmosphere, which trap heat and prevent it from escaping into space [1]. This phenomenon is a subset of broader climate change, encompassing shifts in weather patterns, ocean currents, and ecosystems [2]. Since the late 19th century, the planet's average surface temperature has risen by approximately 2 degrees Fahrenheit (1 degree Celsius), with most of this warming occurring in the past 40 years. Human activities, particularly the burning of fossil fuels, deforestation, and industrial processes, are the principal drivers, leading to unprecedented rates of change not seen in the past 10,000 years [3].

The implications of global warming extend far beyond mere temperature increases; it poses an existential threat to life on Earth by disrupting natural systems and human societies. Biodiversity faces particularly acute risks. Recent projections, drawing from syntheses of thousands of studies and models (including IPCC assessments and independent research), indicate that under high-emission scenarios, a substantial fraction of species could face extinction [4]. For instance, at warming levels around 3–5°C by 2100 (plausible under continued high emissions), up to 15–30% of species may be at high risk of extinction globally by century's end, with some estimates reaching 27% loss in vertebrate diversity in ecosystems. Even under more moderate pathways aligned with Paris goals, risks remain elevated, though significantly lower (e.g., around 5% or less in some stabilized scenarios) [4]. Earlier warnings of one-third of species facing extinction by 2050 under business-as-usual have evolved with better data, but the urgency persists: habitat loss from warming and land-use changes could push thousands of species toward critical thresholds in coming decades. Scientists warn that if emissions continue unchecked, up to a third of Earth's animal and plant species could face extinction by 2050, with losses reaching 70% by the end of the century.

This paper explores the causes and evidence of global warming, its impacts on biodiversity and human life, future projections, and potential solutions, underscoring the need for immediate intervention.

Causes of Global Warming

The primary cause of global warming is the enhanced greenhouse effect resulting from increased concentrations of greenhouse gases such as carbon dioxide (CO₂), methane (CH₄), and nitrous oxide (N₂O). These gases are released through human activities, including the combustion of fossil fuels for energy production, transportation, and heating,

which accounts for a significant portion of global emissions. Deforestation and land-use changes further exacerbate the issue by reducing the planet's capacity to absorb CO₂ through photosynthesis [5].

Industrial agriculture contributes through methane emissions from livestock and nitrous oxide from fertilizers. Additionally, feedback loops such as melting permafrost releasing stored methane amplify warming. The Intergovernmental Panel on Climate Change (IPCC) confirms that these anthropogenic factors have altered Earth's climate balance toward warming. Without curbing emissions, these causes will continue to drive temperature increases, threatening the stability of life-supporting systems [6].

Scientific Evidence of Global Warming

Multiple lines of evidence demonstrate that global warming is occurring at an accelerated pace. Earth's average surface temperature rose by 0.11 degrees Fahrenheit (0.06 degrees Celsius) per decade since 1850, totaling about 2 degrees Fahrenheit. [7].

Observable changes include shrinking glaciers and ice sheets, reduced Arctic sea ice, and rising sea levels up 8-9 inches since 1880 due to thermal expansion and melt water. The Arctic is warming four times faster than the global average, disrupting jet streams and leading to unpredictable weather. Ocean heat content has increased, and acidification from absorbed CO₂ threatens marine life. Shifts in plant blooming times, animal migration patterns, and species ranges further corroborate these trends. The IPCC's assessments affirm that these changes are unequivocal and human-induced [8].

Impacts on Ecosystems and Biodiversity

Global warming profoundly threatens ecosystems and biodiversity, pushing many species toward extinction. Warming alters habitats, causing soil degradation, desertification, and loss of productivity in agricultural lands. In Polar Regions, melting sea ice endangers species like polar bears and seals, which rely on it for hunting and breeding. Coral reefs, vital for marine biodiversity, face severe degradation; at 1.5 degrees Celsius of warming, 70-90% could be lost, rising to 99% at 2 degrees [6-7].

Increased frequency of extreme events heatwaves, droughts, floods, and wildfires exceeds tolerance thresholds for plants and animals, leading to mass mortalities. Ocean acidification impairs shell formation in marine organisms, disrupting food chains. Biodiversity loss cascades through ecosystems, reducing resilience and services like pollination and water purification. Overall, climate change risks the survival of terrestrial and oceanic species, with vulnerable regions experiencing amplified effects [9].

Impacts on Human Health and Society

The health and societal impacts of global warming are extensive and multifaceted. Extreme weather events, such as heatwaves and storms, directly cause deaths and injuries, while indirectly exacerbating noncommunicable diseases, malnutrition, and mental health issues. Heat stress is the deadliest weather phenomenon, increasing aggression, violence, and health risks like cardiovascular strain. Vector-borne diseases, including those spread by mosquitoes and ticks, expand ranges due to warmer conditions [2-6].

Food and water security are compromised; droughts reduce crop yields, leading to famine in water-stressed areas. Sea level rise threatens coastal populations with flooding and erosion, potentially displacing billions by 2050. Low-income countries and small island states bear disproportionate burdens despite low emissions. Economic costs mount from infrastructure damage, higher insurance premiums, and health expenditures. In vulnerable regions, death rates from extreme events are 15 times higher [8-9].

Future Projections

If current trajectories persist, long-term effects will intensify. Projections include further decreases in sea ice, increased permafrost thawing, more frequent heatwaves, heavier precipitation, and reduced water resources in semi-arid regions.

The IPCC warns that risks appear faster than expected, with 3.6 billion people in highly susceptible areas. Exceeding 1.5 degrees Celsius could trigger tipping points, such as irreversible ice sheet melt or ecosystem collapses [9]. At 2 degrees, impacts double in severity compared to 1.5 degrees, including near-total coral reef loss and halved insect habitats. Sea levels could rise 1.5-1.8 feet by 2100, affecting 1 billion people. These scenarios underscore the potential for catastrophic biodiversity loss and human displacement [8-9].

Mitigation and Adaptation Strategies

Mitigating global warming requires rapid reductions in greenhouse gas emissions. Transitioning to renewable energy, improving energy efficiency, and halting deforestation are key. The Paris Agreement aims to limit warming to 1.5 degrees Celsius, necessitating global cooperation. Adaptation measures include building resilient infrastructure, sustainable agriculture, and ecosystem restoration [10].

Policy interventions, such as carbon pricing and regulations on emissions, are essential. Individual actions reducing energy consumption and supporting green technologies complement systemic changes. Urgent implementation can secure a livable future.

II. CONCLUSION

Global warming constitutes an unparalleled threat to life on Earth, driven by human activity and manifesting in profound environmental and societal disruptions. From biodiversity collapse to heightened health risks and economic burdens, its impacts are already evident and will worsen without intervention. Scientific consensus calls for limiting warming to 1.5 degrees Celsius to avert the worst outcomes. By prioritizing mitigation and adaptation, humanity can protect ecosystems and ensure the survival of future generations. The time for action is now; delay risks irreversible catastrophe.

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