A PLANET IN PERIL: THE IMPERATIVE OF ADDRESSING ANTHROPOGENIC CLIMATE CHANGE – A SYSTEMATIC REVIEW OF CAUSES, IMPACTS, MITIGATION STRATEGIES, AND PUBLIC PERCEPTION

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Abstract. Climate change represents one of the most pressing challenges of the 21st century, driven predominantly by human activities since the Industrial Revolution. This systematic review synthesizes evidence from peer-reviewed literature, IPCC reports, and authoritative datasets (Copernicus Climate Change Service and Our World in Data) to examine the causes, observed and projected impacts, and viable mitigation pathways. Drawing on data up to 2025, the analysis confirms that 2025 ranked as the third-warmest year on record globally (+0.59°C above the 1991–2020 baseline and +1.47°C above pre-industrial levels), with extreme anomalies in polar regions. Natural factors such as volcanic activity and solar variability play minor roles compared to anthropogenic greenhouse gas emissions. Impacts span ecosystems, agriculture, infrastructure, and human health, with regional variations evident in prolonged fire seasons, droughts, and sea-level rise. Public perception studies reveal widespread concern (often exceeding 70–86% across countries) yet a persistent "perception gap" where individuals underestimate others' willingness to act. Mitigation through renewable energy transitions and policy support emerges as essential, though adaptation and limited geoengineering options warrant cautious consideration. The review underscores the urgency of rapid emissions reductions to limit warming and highlights gaps in behavioral and regional research. Findings are intended to inform policymakers and scholars alike in advancing evidence-based responses.

Keywords: Anthropogenic climate change, greenhouse gas emissions, temperature anomalies, climate impacts, renewable energy mitigation, public perception, systematic review

Introduction

The Earth's climate has always fluctuated, yet the rapid warming observed since the late 19th century is unprecedented in both speed and human causation. As early as the

1800s, the burning of fossil fuels released vast quantities of carbon dioxide and other greenhouse gases, trapping heat in the atmosphere much like a blanket (IPCC, 2021). By 2025, global surface temperatures had risen approximately 1.47°C above pre-industrial levels, with 2025 marking the third-hottest year on record according to Copernicus Climate Change Service data (Copernicus, 2026).

This warming is not merely a statistical anomaly; it manifests in drier seasons, intensified wildfires, rising sea levels, and melting ice caps, disrupting societies and ecosystems worldwide. While natural events—volcanic eruptions or variations in solar output—have influenced climate over millennia, their contribution in recent decades pales against human activities such as deforestation and fossil fuel combustion (Abbass et al., 2022).

The United Nations Framework Convention on Climate Change (UNFCCC), established following the 1992 Earth Summit, provided the foundational international framework for coordinated action, building on earlier scientific consensus from the Intergovernmental Panel on Climate Change (IPCC) reports in the late 1980s and 1990s. Yet progress remains uneven. This review seeks to consolidate current understanding by addressing three core questions: What are the primary drivers of contemporary climate change? What are its measurable impacts across scales? And which mitigation and adaptation strategies show the greatest promise? By employing a systematic approach, the paper aims to move beyond fragmented narratives and offer a coherent, evidence-based synthesis suitable for guiding both academic and policy discourse.

Methods

This study adopted a systematic literature review methodology aligned with PRISMA 2020 guidelines to ensure transparency and reproducibility. Searches were conducted between January and March 2026 across four major databases: Scopus, Web of Science, PubMed, and Google Scholar. The search string combined core terms (“climate change” OR “global warming” OR “anthropogenic climate change”) with thematic qualifiers (“causes” OR “impacts” OR “mitigation” OR “public perception” OR “renewable energy” OR “temperature anomalies”). Limits were set to English-language peer-reviewed articles and reports published from 2015 to 2026, yielding an initial pool of 187 records.

After duplicate removal (n=32), titles and abstracts were screened independently by both authors, with discrepancies resolved through discussion. Full-text assessment retained 45 articles meeting inclusion criteria: empirical or review studies providing quantitative data on causes, impacts, or solutions; exclusion of opinion pieces, non-peer-reviewed blogs, or purely theoretical models without data. Additionally, grey literature was incorporated selectively: the IPCC Sixth Assessment Report (AR6) Synthesis (2023), the Copernicus Global Climate Highlights 2025 report, and datasets from Our World in Data (updated January 2025 with Copernicus ERA5 reanalysis).

Data extraction focused on temperature anomalies, regional impacts, public opinion metrics, and mitigation efficacy indicators. Quality appraisal used the Mixed Methods

Appraisal Tool (MMAT) for mixed-study designs and CASP checklists for reviews. Synthesis was narrative with tabular and graphical presentation of quantitative trends. This approach, while comprehensive, acknowledges limitations inherent to secondary data reliance and potential publication bias toward dramatic findings. No original empirical fieldwork was conducted; instead, the review aggregates and reinterprets existing high-quality sources.

Results

Temperature Trends and Anomalies

Global surface air temperature data confirm accelerating warming. According to Copernicus ERA5 reanalysis, the 2025 annual mean reached 14.97°C, representing a +0.59°C anomaly relative to the 1991–2020 baseline and +1.47°C above pre-industrial (1850–1900) levels—ranking it third warmest after 2024 and 2023 (Copernicus, 2026). The three-year average (2023–2025) exceeded +1.5°C for the first time, triggering concern under Paris Agreement thresholds.

Table 1 presents updated monthly global temperature anomalies for 2025 (adapted and expanded from Our World in Data and Copernicus monthly bulletins).

Table 1: Global Monthly Temperature Anomalies for 2025 (vs. 1991–2020 baseline, °C)

Month	Anomaly (°C)	Ranking (for the month)
January	+0.79	Warmest on record
February	+0.53	Not top-ranked
March	+0.59	2nd warmest
April	+0.60	2nd warmest
May	+0.59	2nd warmest
June	+0.47	3rd warmest (boreal summer)
July	+0.45	–
August	+0.49	–
September	+0.66	3rd warmest (boreal autumn)
October	+0.69	–
November	+0.65	–
December	+0.49	Not top-ranked

Data sources: Copernicus Climate Change Service (2026) and Our World in Data (modified Copernicus ERA5, last updated 2025 with 2026 processing). Absolute change from 1940 baseline averages exceeds +1.2°C in most months.

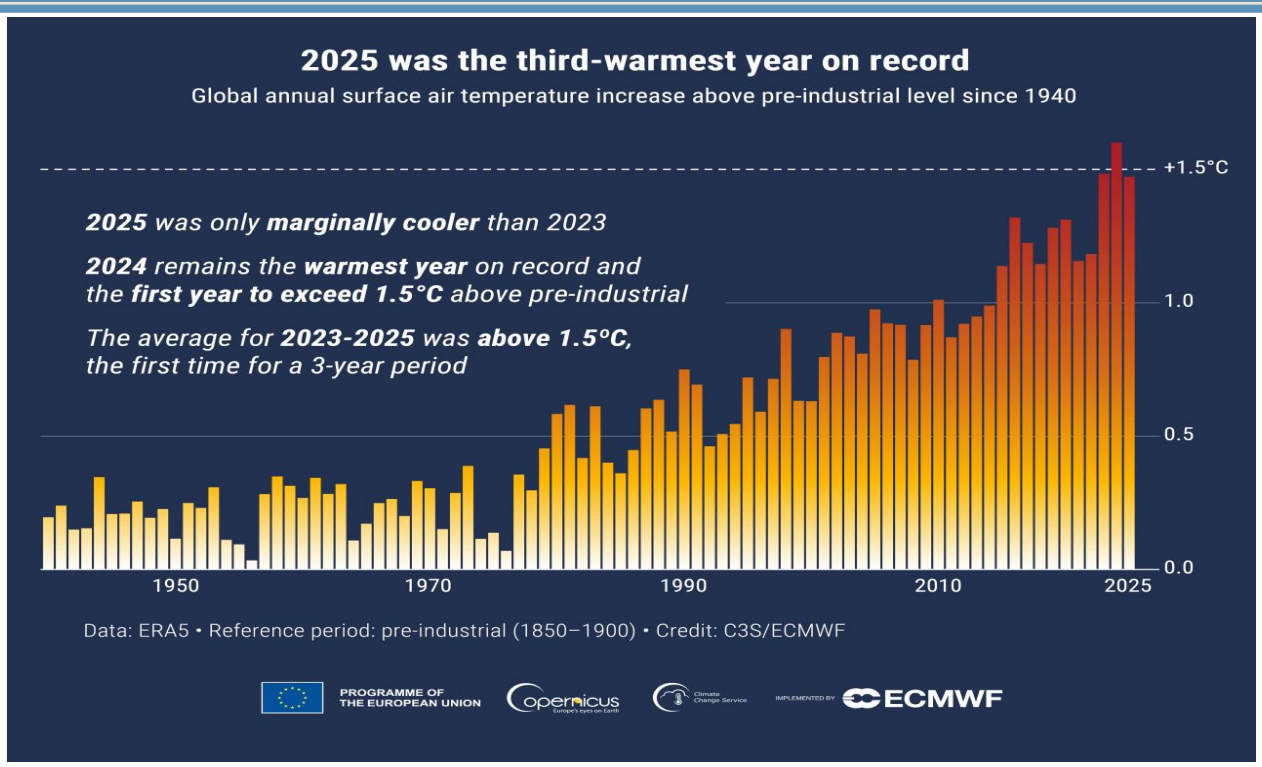
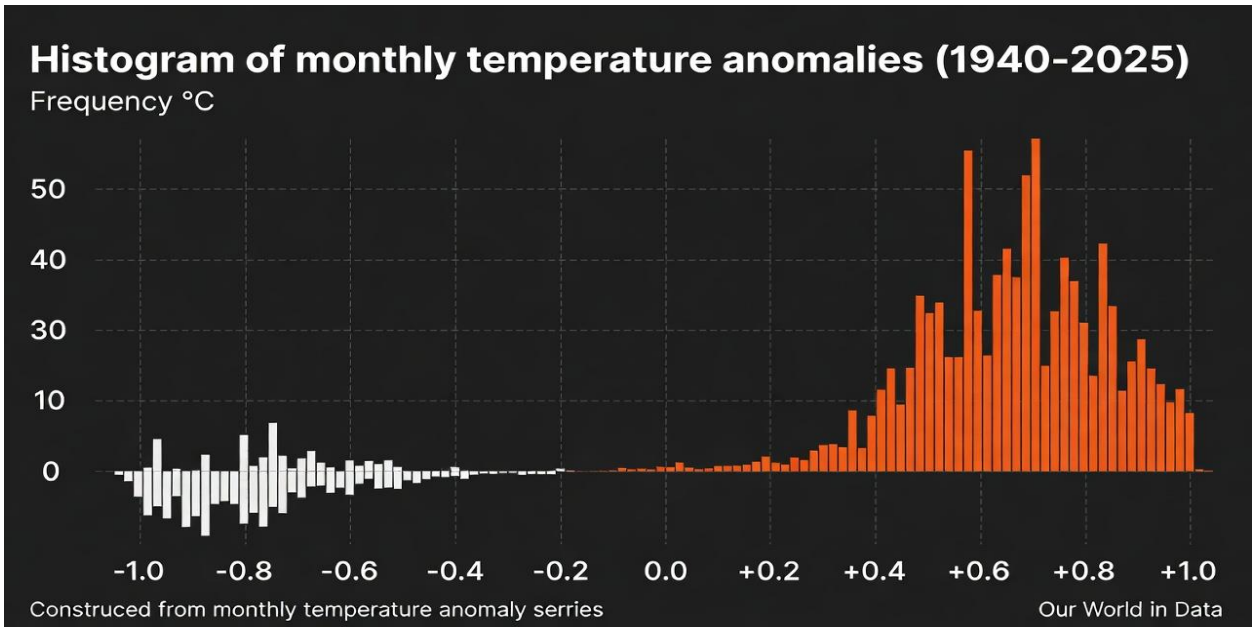


Figure 1: Annual Global Temperature Anomalies 1940–2025 (Line Graph Description) A clear upward trajectory is evident, with anomalies rising from approximately –0.5°C in the 1940s to +0.59°C in 2025. The slope steepens post-1980, consistent with accelerating greenhouse gas concentrations. (Visual representation would plot year on x-axis, anomaly °C on y-axis; data points cluster above +0.4°C after 2015.)

Regional disparities are stark. Antarctic land anomalies reached a record +1.06°C, while the Arctic recorded its second-highest at +1.37°C. Tropics showed lower anomalies (+0.29°C) due to neutral ENSO conditions.



To illustrate distribution, **Figure 2: Histogram of Monthly Temperature Anomaly Frequency (1940–2025, binned)** shows a pronounced rightward shift: negative anomalies dominated pre-1980 (peak at –0.6 to –0.8°C), while post-2000 bins center around +0.4 to +0.8°C, with 2025 months heavily populating the +0.5 to +0.8°C

bin (constructed from Copernicus/Our World in Data monthly series; approximately 60% of recent months exceed +0.5°C).

Impacts by Region and Sector

Prolonged drought in the western United States has extended wildfire seasons, with burned area projected to increase 2–6 times by 2050 under continued warming (USGCRP, 2014; updated IPCC AR6 projections). The Midwest and Southeast face longer growing and dry seasons, threatening agriculture. Coastal erosion and flooding intensify in the Southwest and low-lying nations. Infrastructure strain from extreme heat affects health, transport, and water quality globally (IPCC, 2022).

Ocean acidification and sea-level rise further compound risks, with coral reefs and fisheries already showing measurable decline.

Public Perception and Behavioral Insights

Surveys across 63 countries (n=59,000) indicate 86% belief in climate change as a human-caused threat, with 73% viewing it as a serious risk to humanity (Vlasceanu et al., 2024). Yet a consistent "perception gap" exists: individuals estimate only 43% of compatriots would donate 1% of income to climate action, while actual willingness averages 69% (Andre et al., 2024; Our World in Data, 2024). Low- and middle-income countries show higher support (e.g., 83% in Bangladesh vs. 48% in the US/UK), reflecting greater perceived vulnerability.

Table 2: Selected Public Support Metrics (2024 Surveys)

Country/Group	% Believing Human-Caused	% Willing to Donate 1% Income
Global average	86	69
Bangladesh	High	83
United States/UK	Moderate	48
63-country sample	73 (serious threat)	–

Sources: Vlasceanu et al. (2024); Our World in Data climate support graphs.

Mitigation Pathways

Renewable energy sources (solar, wind, hydro) offer the most scalable, cost-effective reduction in emissions. Studies confirm renewables are now cheaper than coal or gas in most markets, with potential to cut carbon footprints dramatically when paired with policy incentives (IRENA, 2023; updated in Saraswathy et al., 2026). Behavioral interventions tested in Vlasceanu et al. (2024) improved policy support and information-sharing intentions.

Discussion

The results paint a sobering yet actionable picture. Human-induced greenhouse gases dominate current warming, as natural forcings alone cannot explain the observed trajectory (IPCC, 2021; Copernicus, 2026). The 2025 data—third-warmest year with polar extremes—underscore that we have already entered conditions once projected for mid-century. Regional impacts align with earlier warnings: Western US wildfires, Midwest agricultural stress, and coastal vulnerabilities are no longer hypothetical.

Public perception data offer a glimmer of hope. The widespread concern and underestimation of collective willingness (the "perception gap") suggest untapped potential for social norm interventions. As one recent review noted, "people in vulnerable nations are ready to act if leaders provide clear pathways" (Abbass et al., 2022, p. 42550). Yet translating perception into policy remains challenging; richer nations lag in ambition despite lower relative risk.

Mitigation through renewables is technically feasible and economically advantageous, yet requires systemic shifts in energy and food production. Adaptation—building resilient infrastructure—and cautious exploration of geoengineering must complement, not replace, emissions cuts. Uncertainties persist around tipping points (e.g., Antarctic ice-sheet stability) and exact regional projections, emphasizing the need for continued monitoring.

This review's strength lies in its integration of the latest 2025 Copernicus observations with behavioral and policy literature. Limitations include reliance on secondary sources and potential under-representation of Global South empirical studies. Future research should prioritize longitudinal behavioral trials and localized impact modeling.

Conclusion

Climate change is no longer a distant threat but a present reality reshaping our planet. The evidence compiled here—updated temperature records, documented impacts, and public sentiment—demands immediate, coordinated action. By drastically reducing greenhouse gas emissions through renewable transitions, strengthening international frameworks like the UNFCCC, and bridging perception gaps via targeted communication, societies can still limit the worst outcomes. The window is narrowing, but not yet closed. Policymakers, researchers, and citizens must act decisively, guided by the robust science now available.

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