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Research Article

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Climate Change, Global Peace, and Security

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Abstract

Climate change is a global security challenge, acting as a "threat multiplier" that worsens resource scarcity, migration, and conflict. This study systematically reviewed over 140 peer-reviewed articles, reports, and case studies to explore the climate–security nexus. Findings show that rising temperatures, extreme weather, sea-level rise, and biodiversity loss destabilize economies, health, and governance, particularly in fragile regions such as the Sahel, Middle East, and small island states. Global economic losses already exceed USD 280 billion annually, with projections of up to 216 million climate-displaced persons by 2050. International responses, including the Paris Agreement and UN Security Council resolutions, recognize climate–security risks but suffer from implementation gaps. Effective solutions demand integrated governance, inclusive migration policies, nature-based adaptation, social protection, and scaled-up finance. Climate change must be addressed as both an environmental and security imperative for lasting peace and resilience.

Keywords: Climate Change, Global Security, Conflict and Migration, Adaptation Strategies, Peacebuilding.

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Introduction

Preface

Climate has historically shaped civilizations, influencing economic, political, and cultural development. Unlike natural shifts of the past, today's climate crisis is anthropogenic, driven by industrialization, fossil fuel dependence, and unsustainable development. It threatens ecosystems, economies, and political stability while magnifying inequalities. By producing displacement, migration, and cultural losses, climate change must be understood as a multidimensional human challenge directly affecting global peace and security.

The Multifaceted Impacts of Climate Change

Climate change intensifies resource scarcity, fueling competition and conflict over water and land [1]. It induces forced migration and displacement, evident in Bangladesh and the Sahel [2]. Geopolitically, it reshapes dynamics, such as competition over new Arctic trade routes and resources [3]. Economically, it undermines infrastructure and livelihoods, aggravating instability and fragility [4]. Overall, climate change acts as a threat multiplier across societal systems.

Importance of the Study

This study underscores the security relevance of climate change through:

- **Conflict prevention** via early-warning systems [5].
- **Migration management** that addresses displacement drivers.
- **Policy development,** emphasizing multi-sectoral and adaptive frameworks [6].
- **Resource allocation** guided by vulnerability assessments [7].

Objectives of the Study

1. Conduct a systematic review and synthesis of current evidence on the effects of climate change on peace and security worldwide.
2. Identify and analyze the mechanisms by which climate change exacerbates threats, such as migration, conflict, and governance instability.
3. Evaluate the effectiveness of policies at the global, regional, and national levels in addressing the intersection of climate change and security.
4. Showcase successful adaptation strategies that combine climate resilience with peacebuilding efforts.

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5. Offer policy recommendations that integrate climate change mitigation and adaptation with sustainable peace and security frameworks.

Materials and Methods

The study employs a systematic review of peer-reviewed research, policy reports, and expert analyses. Protocol-driven selection, quality assessment, and data extraction were applied to ensure rigor [8]. While systematic reviews are resource-intensive and may face selection biases, they provide comprehensive evidence to guide climate–security policymaking [9].

In accordance with the systematic review methodology outlined, the study analyzed and synthesized evidence from a broad array of scholarly and policy sources. The manuscript encompasses over 140 references, including peer-reviewed journal articles, international reports, policy documents, and case studies. These references represent a variety of disciplines—climate science, peace and conflict studies, economics, migration research, and security analysis—providing a multidisciplinary perspective. The extensive literature reviewed aligns with the protocol-driven systematic approach described, bolstering the study's reliability and furthering its objective of connecting climate change to peace and security issues.

Literature Review

Most scholars conceptualize climate change as a threat multiplier rather than a direct conflict driver.

- Koubi and Kahl emphasize governance and economic development as mediating factors [10].
- Boal highlights food and water insecurity as destabilizing forces [11].
- McLeman frames migration as both an adaptive response and a vulnerability [12].
- Gleditsch stresses indirect causal mechanisms between climate and conflict [13].
- The EU identifies regional fragility as a critical risk pathway [14].
- Mastorulo and Burke argue governance resilience is decisive [15].
- Barnett and Webber critique fragmented and sectoral policy responses [16].

Collectively, these studies call for integrated, adaptive governance and interdisciplinary research to address the security dimensions of climate change.

Overview of the Literature Review

There is broad consensus that climate change amplifies existing vulnerabilities, particularly in fragile states, though disagreements remain on its direct link to violent conflict. Future research priorities include longitudinal studies, comparative policy analysis, and deeper examination of climate-induced migration [10,12,13]. Effective management of climate–security risks will require tailored adaptation strategies and integrated policy frameworks.

Definitions, Concepts, and Interrelations

Definition and Historical Perspective

Climate change refers to long-term shifts in temperature, precipitation, and extreme weather patterns [17]. Historically, such variations were influenced by natural factors including Milankovitch cycles, volcanic eruptions, and solar activity. Since the Industrial Revolution, however, human activities—especially fossil fuel burning, deforestation, and industrial agriculture—have driven rapid increases in greenhouse gas (GHG) concentrations, intensifying global warming [18].

International frameworks such as the Kyoto Protocol (1997) and the Paris Agreement (2015) represent landmark global mitigation efforts to curb emissions and limit temperature rise.

Anthropogenic Causes of Climate Change

Human activities dominate the drivers of current climate change:

- Fossil Fuels: The burning of coal, oil, and gas accounts for roughly three-quarters of global CO_2 emissions, with transport responsible for nearly a quarter of energy-related emissions [19].
- Deforestation & Land Use: Forest clearing reduces carbon sinks and contributes about 13% of global CO_2 emissions, particularly in tropical regions [20].
- Agriculture: Farming contributes 10–12% of GHGs, largely from methane emissions by livestock and nitrous oxide from fertilizers [21].
- Industry: Cement, steel, and chemical production are major industrial sources, with cement alone contributing around 8% of emissions [19].
- Waste: Landfills release methane, contributing about 3% of GHG emissions worldwide [22].
- Energy Dependence: As of 2020, fossil fuels supplied 84% of global energy, cementing their central role in climate change [23].

Manifestations of Climate Change

Climate change manifests through interconnected Earth systems:

- **Global Warming**: Global average surface temperatures have risen by about 1.2°C since the late 19th century, with polar ice melt driving sea-level rise [24].
- **Extreme Weather**: Warmer conditions intensify storms, floods, and heatwaves. For example, the 2020 Atlantic hurricane season produced a record 30 named storms [25].
- **Ocean Acidification**: Higher CO_2 absorption lowers ocean pH, threatening coral reefs and disrupting marine ecosystems [26].
- **Biodiversity Loss**: Climate-driven habitat shifts heighten extinction risks, with widespread impacts on species survival and ecosystem stability [27].

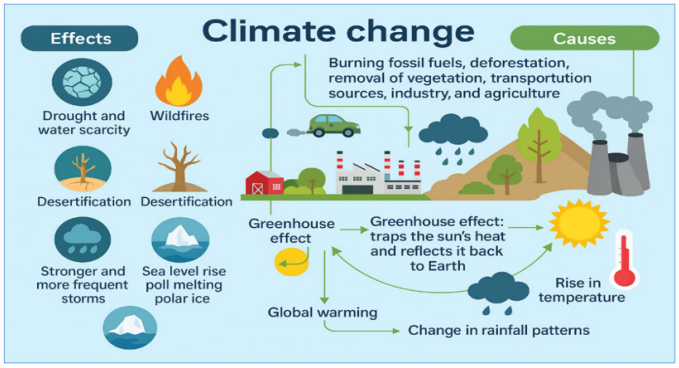

Figure 1: Illustration of the Causes, Manifestations, and Repercussions of Global Climate Change

Impacts of Climate Change

Economic Impacts

Climate change disrupts economies across agriculture, infrastructure, health, labor, finance, and global supply chains.

- **Agriculture and Food Security**: Rising temperatures and extreme events reduce yields and destabilize markets. For instance, the 2010 Russian heatwave cut wheat output by 25%, sparking export bans and global food price volatility [28].
- **Infrastructure**: Sea-level rise, floods, and storms threaten critical systems. Hurricane Harvey (2017) caused approximately $125 billion in damages, crippling infrastructure in Texas [29].
- **Health Costs**: Climate-driven heatwaves and disease outbreaks strain health systems. The 2003 European heatwave caused over 70,000 deaths and an estimated €13 billion in economic losses [30].
- **Labor Productivity**: Heat stress reduces outdoor labor efficiency. The International Labour Organization projects a 2.2% decline in global working hours by 2030—equivalent to 80 million jobs and $2.4 trillion in annual losses, concentrated in South Asia and West Africa [31].
- **Insurance and Financial Risks**: Climate disasters escalate insurance claims and premiums, threatening solvency. The 2018 California wildfires resulted in $12 billion in insured losses, sharply increasing premiums in high-risk areas [32].
- **Global Supply Chains**: Extreme events disrupt production and trade. The 2011 Thailand floods caused $46 billion in losses, with hard disk drive prices soaring by 80% due to disrupted global manufacturing [33].

Figures 2 and 3 illustrate the projected change in per capita income by 2050 and the expected scale of global economic losses across sectors under climate change scenarios.

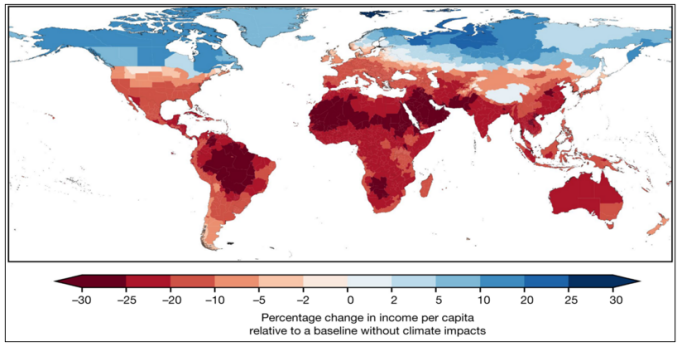

Figure 2: The Average Expected Loss or Gain in Per Capita Income by 2050 Due to Global Climate Change

Source: Wikipedia (2025, April 1). (Red color indicates loss; blue color indicates gain).

Social Impacts

Climate change reshapes societies by driving displacement, inequality, health risks, and conflict. Low-lying island nations such as Tuvalu and Kiribati face existential threats from rising seas [12]. In Sub-Saharan Africa, increasingly erratic rainfall deepens rural poverty and undermines food security [34]. The World Health Organization projects an additional 250,000 annual deaths between 2030 and 2050 from malnutrition, malaria, diarrhea, and heat stress [35]. Resource scarcity has already intensified conflicts in fragile regions, such as farmer–herder clashes in the Sahel [36].

Figure 3: Projected Global Economic Losses in 2050 Due to Climate Change

Cultural and Heritage Impacts

Climate change also erodes cultural identity, particularly in Indigenous and traditional communities. In the Arctic, warming disrupts hunting, fishing, and herding practices central to Indigenous livelihoods and intangible cultural heritage [37]. The loss of sacred landscapes and heritage sites undermines social cohesion and intergenerational knowledge transfer.

Socioeconomic, Political, and Security Impacts

Resource Scarcity and Conflict

Degradation of land and water resources drives competition and instability. In Darfur and around Lake Chad, droughts have escalated conflicts among farmers, herders, and fishers, with extremist groups exploiting instability to expand influence [38-40].

Forced Migration and Social Tensions

Sea-level rise and desertification displace millions, fueling urban overcrowding and social tensions. Syria's pre-war drought contributed to rural–urban migration, aggravating social unrest [41]. In Bangladesh, up to 13.3 million people could be displaced by 2050 due to sea-level rise, increasing risks of unemployment, poverty, and violence [42-44].

Geopolitical Tensions

The Arctic illustrates how climate change reshapes geopolitics. Melting sea ice is opening new trade routes and exposing vast energy reserves—estimated at 13% of the world's undiscovered oil and 30% of undiscovered gas. Rivalries among the U.S., Russia, Canada, and Norway highlight the region's growing strategic importance [45-47].

Military Operations

Climate risks threaten military infrastructure, logistics, and readiness. The U.S. Department of Defense identifies climate change as a critical national security challenge, citing risks to bases, supply chains, and strategic stability [48].

Peacebuilding Processes

In fragile states such as Somalia, recurrent drought undermines food security, governance, and social trust. Integrating climate resilience into peacebuilding strategies is therefore essential to prevent conflict relapse and build sustainable stability [49].

Global Peace and Security (Definitions – Concepts – Interrelations)

Definitions and Key Concepts

Global peace is broadly defined as the absence of armed conflict and instability, supported by mechanisms for nonviolent dispute resolution. Galtung distinguished between negative peace—the absence of direct violence—and positive peace, which entails justice, equitable development, and institutions that promote rights and security [50].

Global security refers to protecting the international community against diverse threats, including military aggression, terrorism, transnational crime, pandemics, and environmental crises. The United Nations' Human Security Agenda stresses that security extends beyond military strength to include economic, political, societal, and environmental concerns [51].

Peace and security are interdependent: sustainable peace requires stability, while long-term security depends on justice and inclusion. The limits of military-centric approaches, such as in Afghanistan, underscore the need for comprehensive peacebuilding strategies [52-54].

Contemporary Challenges to Global Peace and Security

Global stability faces challenges from multiple, intersecting sources. Non-state actors, including terrorist groups and organized criminal networks, destabilize security through asymmetric tactics and illicit economies [55]. Cybersecurity threats have grown significantly, with attacks undermining sovereignty, disrupting infrastructure, and eroding trust in governance [56].

Additionally, climate change is increasingly recognized as a security risk, driving displacement, resource competition, and conflict. In the Sahel, climate-driven degradation has intensified clashes between pastoralist and agricultural communities [52-54].

Strategies for Achieving Global Peace and Security

Addressing these challenges requires multidimensional strategies. Preventive diplomacy—through mediation, arbitration, and dialogue—can de-escalate tensions before violence erupts [50].

Inclusive security policies are essential, tackling structural drivers of conflict while incorporating social, economic, and environmental dimensions through participatory approaches [57].

Long-term peace depends on sustainable development and good governance, including equitable resource distribution, resilient livelihoods, and accountable institutions that foster legitimacy and stability [52-54].

Impact of Climate Change on Global Peace and Security

Climate change acts as a critical threat multiplier, amplifying vulnerabilities, fueling instability, and deepening conflict and geopolitical tensions.

Climate Change Drivers of Global Security Risks

Rising Temperatures and Security Threats

Rising global temperatures intensify extreme weather, strain resources, and destabilize societies.

- **Extreme Events**: Anthropogenic warming worsens heatwaves, hurricanes, and floods, complicating crisis responses. The IPCC confirms rising extremes, while NOAA reports a threefold increase in billion-dollar disasters since the 1980s [18,58].
- **Water Stress**: Rising heat reduces freshwater supplies. The MENA region may lose 10–20% of water with a 2–3°C rise, threatening key basins such as the Tigris and Euphrates [59,60]. The Sahel may lose 30% of arable land, fueling transboundary river disputes [61,62].
- **Conflict Risk**: Each 1°C rise increases conflict risk by 4–14% [63]. Syria's 2006–2010 drought illustrates how climate stress can contribute to unrest [38]. Vulnerable regions include Sub-Saharan Africa and the Middle East [64].
- **Military Readiness**: Extreme heat reduces operational capacity; above 40°C, most units lose significant performance and equipment failures rise sharply [65]. The U.S. Department of Defense formally classifies climate change as a security threat [66].
- **Migration & Displacement**: Scarcity and crop failure drive mass migration. The UN (2020) projects up to 200 million displaced by 2050, with hotspots in Africa.

Extreme Weather Events and Security Risks

Extreme weather exacerbates displacement, fragility, and conflict.

- **Displacement:** Hurricanes, floods, and droughts drive migration, straining host states. Haiti's crises highlight how disasters can escalate instability [67].
- **Trends**: Global disaster displacements rose from 23.7 million in 2021 to 32.6 million in 2022, with floods accounting for the largest share [68]. Somalia's drought illustrates acute vulnerability.

According to the Internal Displacement Monitoring Centre (IDMC), disaster-induced displacements sharply increased between 2020–2022. Table 1 illustrates these trends.

Table 1: Global Internal Displacement Due to Disasters (2020–2022)

(Figures in millions)

Year	Total Disaster-Related Displacements	Flood-Related Displacements	Storm-Related Displacements	Drought-Related Displacements
2020	30.7	13.9	9.8	2.4
2021	23.7	9.5	7.7	1.7
2022	32.6	19.6	10.1	1.1

Source: Internal Displacement Monitoring Centre (IDMC). (2023), Annual Reports 2020–2022

Future Projections and Global Implications

The World Bank projects that up to 216 million people could be displaced by climate impacts by 2050, posing profound political and infrastructural challenges [42,69].

- **Resource Strains**: Climate change reduces water, land, and food security, damages infrastructure, and erodes biodiversity.
- **Conflict**: Environmental shocks heighten resource competition, displacement, and extremist exploitation. Illustrative cases include East Africa's 2015–2016 drought, the shrinking waters of Lake Chad, and ongoing instability across the Sahel [70-72].
- **Economic Instability**: Climate-related disasters are driving mounting global economic losses, rising from USD 202 billion in 2020 to USD 291 billion in 2023 [73]. These shocks cut GDP in developing countries by up to 1% annually while disrupting supply chains and production [74]. Sectoral impacts are severe: agriculture suffers from declining yields and food insecurity, tourism and energy are disrupted by environmental decline and infrastructure stress, and public budgets are strained as recovery costs divert resources from development. Most losses in low-income countries remain uninsured, compounding vulnerability to recurring shocks.

Table 2 summarizes global economic and insured losses (2020–2023).

Table 2: Global Economic and Insured Losses Due to Natural Disasters (2020–2023)

(Figures in USD billions)

Year	Total Global Economic Losses	Insured Global Losses	Protection Gap (Uninsured Losses)
2020	202	89	113
2021	280	120	160
2022	284	132	152
2023	291	117	174

***Source**: (Swiss Re Institute, 2024).*

Infrastructure, Humanitarian, and Health Risks

Climate change magnifies risks by damaging critical infrastructure, triggering humanitarian crises, and endangering public health.

- **Infrastructure Damage**: Extreme events cripple housing, transport, energy, and telecom systems. Hurricane Maria (2017) in Puerto Rico demonstrated cascading infrastructure failures [75].
- **Humanitarian Crises**: Climate shocks displace millions, as seen in Pakistan's 2022 floods that uprooted 12 million people [61,62].
- **Health Risks:** Climate extremes increase injuries, heat-related illnesses, vector-borne diseases, and mental health strain. The World Health Organization projects that by 2080, floods may affect up to 400,000 people annually in Europe [76].

Ocean Acidification and Security Risks

Ocean acidification, driven by CO_2 absorption, has reduced average ocean pH from 8.2 to 8.1 since the Industrial Revolution, with projections of 7.8 by 2100. This shift threatens ecosystems, food security, and international stability.

- **Marine Food Chains**: Calcifying organisms such as corals, shellfish, and pteropods are highly vulnerable, disrupting ecosystems and fisheries [77]. Even a 0.1 pH decline reduces coral calcification by 15–20%.
- **Economic & Food Security**: Global fisheries could lose USD 10 billion annually by 2050 [78]. With 3 billion people reliant on seafood as a primary protein source, food security risks are acute [79].
- **Human Security**: Declining marine resources threaten livelihoods and nutrition, heightening migration and unrest in vulnerable states.
- **International Tensions**: Marine resource disputes have increased significantly, with high-emission nations under pressure to finance adaptation [80,81].
- **Ecosystem Services:** Loss of reefs and mangroves reduces natural coastal protection by nearly 50%, raising flood exposure for an estimated 197 million people [52-54].

Biodiversity Loss and Security Risks

Biodiversity decline weakens food, water, and economic stability, increasing the likelihood of social unrest and conflict.

- **Climate Linkages**: Loss of forests and wetlands diminishes carbon sinks and ecosystem resilience [82].
- **Ecosystem Services**: Biodiversity underpins pollination, soil fertility, water purification, and carbon storage. Declines weaken agricultural productivity and resilience [27].
- **Agriculture & Food Security**: With 75% of crops pollinator-dependent, biodiversity loss poses severe threats to global yields and food access [83].
- **Economic Losses**: Over USD 44 trillion of global GDP depends on nature, while coral reef loss alone is estimated to cost USD 375 billion annually [84,85].
- **Conflict & Tensions**: Resource degradation contributes to instability; biodiversity loss has been a factor in dozens of global conflicts [86].
- **Public Health:** Habitat loss drives zoonotic disease emergence—around 70% of new infectious diseases are linked to biodiversity decline [87]. Access to biodiverse green spaces also supports mental health [88].
- **Environmental Migration**: Ecosystem collapse displaces an estimated 26 million people annually [89].

Global, Regional, and International Responses

Global Responses

United Nations Frameworks

The UNFCCC (1992) laid the foundation for international climate cooperation, expanded by the Kyoto Protocol (1997) and the Paris Agreement (2015), which seeks to limit warming to 1.5–2°C and links climate action to peace and security [90,91]. COP21 adopted the Paris Agreement, and COP26 emphasized financing for vulnerable states.

UN Security Council

Since 2007, the Security Council has debated climate-security, recognizing it as a threat multiplier. Resolution 2349 (2017) addressed Lake Chad, while Resolution 2585 (2021) acknowledged climate's role in Syria [92,93].

Key International Agreements
The Montreal Protocol (1987) and Kigali Amendment (2016) reduced ozone-depleting substances, mitigating warming and fostering cooperation [52]. The Climate Security Mechanism (2018) further integrated risks into UN peacebuilding.

Human Rights and Risk Reduction
The Human Rights Council recognized climate threats to rights, while the Sendai Framework (2015–2030) emphasized preparedness, resilience, and inclusion, linking disaster risk reduction to stability and migration management [94-96].

Sustainable Development Goals
SDGs, particularly Goal 13 (Climate Action), integrate resilience into development alongside food, water, land, and peace goals [57].

Migration Governance
The Global Compact for Migration (2018) addresses climate displacement, protecting rights and managing root causes [97,98].

Regional Initiatives
African Union's (AU) Agenda 2063 prioritizes adaptation and governance [99]. The EU integrates climate into defense and cooperation (EC, 2020). Together, these frameworks strengthen climate-security links globally.

Regional and National Responses

Strategies include:

- **AU**: African Union Strategy on Climate Change links adaptation, peacebuilding, and early warning.
- **EU:** European Union Frames climate as a "threat multiplier" in its Global Strategy; Climate & Defense Roadmap strengthens resilience.
- **Pacific Islands Forum**: Boe Declaration (2018) treats climate as the "greatest threat."
- **G5 Sahel:** Integrates agriculture, water, and security.
- **Bangladesh:** Climate Trust Fund supports adaptation and displacement responses.
- **Netherlands**: Delta Programme addresses sea-level rise.
- **Arctic Council**: Regional cooperation on rapid warming impacts.

Mechanisms include: strategic planning, early warning, sustainable agriculture, infrastructure resilience, renewable energy, education, financing mechanisms, and governance strengthening.

Case studies:

- **Sahel:** Desertification drives conflict and displacement; Niger's NAP prioritizes water and agriculture.
- **Arctic**: Melting ice reshapes geopolitics; Norway's High North Strategy balances environment and Indigenous rights.
- **SIDS:** Existential threats from sea-level rise; Maldives' NAPA invests in resilient infrastructure and artificial islands.

Assessment of Regional and National Responses
Strengths: Paris Agreement anchors resilience; Sendai Framework integrates risk reduction; UNSC links climate and conflict; SDGs highlight climate action; GCF supports vulnerable states [58,90,93,95,96,100].

Weaknesses: Implementation gaps; finance access barriers; weak policy integration; lack of legal framework for climate-displaced persons [80,81,101-103].

Non-Governmental Actors' Responses

NGOs, civil society, private firms, and research networks address the climate–security nexus through advocacy, innovation, and field action.

- **Advocacy**: NGOs like Greenpeace influence global agendas [104].
- **Field interventions**: IFRC reduces disaster risks and builds resilience [105].
- **Policy and research**: SIPRI informs UN debates (SIPRI, 2019).
- **Private sector**: Unilever and tech firms like Microsoft pledge resilience and carbon neutrality [106,107].
- **Case studies:** IRC provides food and conflict resolution in the Sahel; COICA promotes Indigenous rights in the Amazon; in Dominica, CREAD builds resilient infrastructure post–Hurricane Maria [108-110].

Assessment: NGOs elevate climate-security risks and strengthen preparedness, but face fragmentation, donor dependence, and political barriers [111-113].

Military and Defense Institutions' Responses

- **Planning**: U.S. DoD labels climate a "threat multiplier" (U.S. DoD, 2014) [114].
- **Infrastructure**: NATO's Climate Change and Security Action Plan strengthen resilience [115].
- **Disaster relief**: Armed forces assist in humanitarian crises, e.g., India in Uttarakhand floods (Indian MoD, 2020).
- **Training:** EU missions integrate climate-security (EEAS, 2020).
- **Cooperation**: Forums like PESF and Arctic Council foster regional partnerships.

Strengths: Climate is now integrated into military strategies; defense forces provide disaster relief and logistics (Indian MoD, 2020) [116].

Weaknesses: Risks of securitizing migration; limited socio-economic focus; budget trade-offs (Levy & Patz, 2022) [117,118].

Policies, Strategies, Programs, and Successful Experiences

Climate change multiplies social, economic, and environmental risks, undermining humanitarian security and stability, especially in fragile and conflict-affected regions. Governments, international organizations, and communities address these challenges through integrated strategies that strengthen resilience, reduce risks, and promote sustainable peace. This chapter highlights key policy approaches, frameworks, and successful experiences linking climate action to conflict prevention and security.

Policies and Frameworks for Adaptation, Peacebuilding, and Resilience

- **Integrated Planning**: Countries (Germany, Netherlands, Ethiopia) embed conflict sensitivity; Kenya and Bangladesh adopt resource-based adaptation [42,69].
- **Nature-Based Solutions**: Costa Rica's Payment for Ecosystem Services and the EU Biodiversity Strategy restore ecosystems and prevent conflict (EC, 2020).
- **Disaster Risk Reduction**: National and global frameworks, e.g., Philippines' multi-hazard plan and the Sendai Framework (2015–2030), strengthen preparedness and governance [95,96,119].
- **Regional Cooperation**: CARICOM and AU coordinate climate-resilient development strategies [120].
- **Climate Migration & Human Security**: Bangladesh's NAP integrates migration; the Sendai Framework urges displacement inclusion [121].
- **Global Commitments:** SDGs (esp. Goals 13 & 16) link climate and peace; Paris Agreement and Gender Action Plan stress justice, inclusion, and resilience [57,90,122].

Integrating climate adaptation, conflict prevention, and inclusive governance strengthens resilience and humanitarian security.

Strategies for Mitigation and Adaptation to Climate–Security Impacts

- **Resource & Ecosystem Management**
- **Water Cooperation**: Seine Basin transboundary management reduced conflicts and flood risks [123].
- **Fisheries Governance**: Great Lakes ecosystem-based management eased tensions [124].
- **Community Adaptation & Conservation**
- **Community-Based Adaptation**: West Africa empowered locals, reducing resource competition [125].
- **Integrated Conservation:** Madagascar's ICDPs improved cohesion and resource use [126].
- **Risk & Disaster Management**
- **ICRM**: South Africa reduced floods via sustainable land use [127].
- **CBDRR**: Bangladesh mobilized communities for disaster planning, reducing vulnerability [128].
- **Conflict Resolution & Migration**
- **Local Mediation**: Kenya's "Councils of Elders" resolve drought disputes [129].
- **Migration Policies**: EU integrates climate drivers into frameworks (EC, 2019).
- **Peacekeeping & Conflict Sensitivity**
- **UN Operations**: Increasingly climate-aware [130].
- **Mali (MINUSMA)**: Climate-informed peacekeeping with community engagement [131].
- **Social Protection & Gender Sensitivity**
- **Adaptive Safety Nets**: In Bangladesh/Ethiopia, protect vulnerable groups [132].

Effective strategies combine ecosystem governance, local adaptation, conflict mediation, climate-sensitive peacekeeping, and inclusive protection to minimize climate-related insecurity.

Programs of Mitigation and Adaptation to the Impacts of Climate Change on Global Peace and Security

Climate change poses significant threats to human security and social stability, necessitating comprehensive adaptation and mitigation strategies. This section summarizes key international programs designed to enhance peace and resilience:

- **Climate and Security Programs**
- **Climate Security Initiative**: Integrates climate, security, and development in policy guidance to mitigate environment-driven conflict [61,62].
- **Climate Security Mechanism:** Facilitates coordinated UN action on climate-related security risks, especially in peacekeeping [133].
- **Resilience Building and Infrastructure**
- **Resilience in the Sahel Enhanced (RISE)**: Embeds conflict resolution within climate adaptation to bolster community risk management [50,60].
- **Early Warning Systems**
- **Climate-Related Conflict Early Warning Systems**: Predicts potential conflict induced by climate change to support mediation and stability [134].
- **Migration and Climate Change**
- **Climate-Induced Migration**: Develops policies and research to assist governments in responding to migration driven by climate stress [103].
- **Nature-Based Solutions and Urban Adaptation**
- **Bonn Challenge:** Aims to restore degraded lands, reduce resource-based conflict, and enhance sustainability [135].
- **Social Protection and Resilience Enhancement**
- **Social Protection for Resilience**: Provides cash transfers and food aid to vulnerable households to help adapt to climate shocks [42,69].
- **Women's Empowerment and Climate Adaptation**
- **Adaptation Fund**: Finances gender-aware climate projects in developing countries, improving women's participation in adaptation [136].

These initiatives collectively strengthen global peace and security by building resilience, enabling early warning, managing migration, promoting nature-based solutions, ensuring social protection, and empowering women.

Successful Experiences in Climate Change Adaptation and Peacebuilding

Climate change challenges socio-economic stability, requiring solutions that link adaptation with peacebuilding. Global experiences demonstrate success through sustainable resource management, disaster risk reduction, migration planning, and inclusive governance.

- **Climate Adaptation and Conflict Mitigation**
- **Resilience in the Sahel Enhanced (RISE)**: Promotes land management and conflict resolution, easing tensions in Sahel communities [59,60].
- **Liberia Peacebuilding & Adaptation Project**: Combines conflict resolution and climate adaptation, reducing disputes over water and land [137].
- **Nature-Based Solutions and Regional Cooperation**
- **Amazon Fund**: Reduces deforestation and supports indigenous collaboration, mitigating land conflicts [138].
- **Forest Resilience Bond**: Innovative financing for forest restoration, reducing wildfire risks in California [139].

- **Disaster Risk Reduction and Early Warning**
- **Build Back Better (Nepal):** Post-2015 earthquake recovery integrated resilience and preparedness [140].
- **Cyclone Early Warning (India):** Advanced forecasting reduced losses from cyclones [141].
- **Climate-Induced Migration**
- **Kiribati Adaptation Program:** Builds local resilience and integrates climate adaptation with voluntary migration policies [142].
- **Gender-Sensitive Climate Adaptation**
- **Women in Agriculture (Malawi)**: Trains women farmers in climate-resilient agriculture, improving food security [143].

These initiatives highlight how adaptation linked with peacebuilding reduces conflict, strengthens resilience, and ensures inclusive governance.

Summary and Recommendations

Summary

Climate change is a threat multiplier, with significant geopolitical, economic, and social consequences. Historically, stable climates supported civilizations, while disruptions—like the Maya drought—have triggered collapse. Today, human-driven warming from industrialization, deforestation, and fossil fuel use accelerates instability.

Resource scarcity fuels conflict in fragile regions (e.g., Middle East, Sahel), while migration pressures from rising seas and extreme events elevate socio-economic tensions. Geopolitical dynamics are also shifting, as seen in Arctic competition. Economic impacts include reduced agricultural productivity, food insecurity, infrastructure loss, rising recovery costs, and health risks—particularly affecting marginalized groups, Indigenous peoples, and women. Case studies such as Syria's drought-linked conflict and Sahel farmer–herder clashes illustrate how climate stress exacerbates violence and expands the role of militaries in disaster and migration response.

While international agreements like the Paris Agreement continue to anchor global cooperation, progress often stalls due to political inertia and competing interests [90]. Organizations such as the UN, EU, AU, and NATO are incrementally integrating climate security into their agendas. The pressing takeaway: global, collective action is required to prevent destabilization and build a resilient future.

Recommendations

To address the climate–security nexus effectively, the following strategy elements are essential:

- **Integrated Governance**: Embed climate risks in security and defense frameworks; strengthen early warning systems for both disasters and conflict; adopt resilience-based infrastructure models ("Build Back Better").
- **Resource Sustainability**: Prioritize water governance, land restoration, and nature-based solutions to reduce resource-driven conflict.
- **Migration and Adaptation Policy**: Establish legal migration pathways (e.g., Tuvalu–New Zealand cooperation) and integrate adaptation into national strategies.
- **Social Protection & Gender Inclusion**: Use cash transfers and food assistance for climate-vulnerable households; implement gender-sensitive programs that empower women in agriculture and peacebuilding.
- **Climate Finance & Regional Cooperation:** Scale up support through mechanisms like the **Green Climate Fund**, and expand collaborative efforts in contexts such as the Ganges Basin initiative.

Climate change must be treated as a global security challenge, demanding coordinated, inclusive, and equitable efforts to bolster resilience and avert conflict in a changing world.

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