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Editorial: Climate-environment resiliency and adaptation

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Editorial on the Research Topic

Climate-environment resiliency and adaptation

1 Introduction

The accelerating pace of global climate change has triggered a cascade of environmental and societal impacts—from intensified storms, droughts, and heatwaves to rising seas, ecosystem degradation, and infrastructure failures. These impacts not only threaten ecosystems but also disrupt economies, exacerbate social inequalities, and compromise public health and social stability. As these challenges grow in complexity and interconnectedness, resilience—the capacity of systems to anticipate, absorb, recover from, and adapt to disturbances—has become a critical guiding principle for science, policy, and practice.

Despite substantial progress, resilience and adaptation research still face key barriers. Many studies remain siloed within specific disciplines or scales, limiting the ability to translate scientific insights into actionable strategies. Others rely heavily on correlative approaches, without sufficiently capturing underlying processes or feedback between human and natural systems. This Research Topic seeks to bridge these gaps by bringing together a diverse set of studies that address resilience from complementary perspectives—integrating physical science, social science, data analytics, policy, and engineering.

The 14 papers in this Research Topic provide a rich cross-section of current research efforts. They range from biophysical process modeling and ecosystem responses to adaptation policy analysis and social vulnerability assessment. Together, they reflect a growing consensus: addressing the challenges of a changing climate requires a systemic, multi-scale, and interdisciplinary approach.

2 Overview of the papers in this Research Topic

Several contributions focus on how societies perceive and respond to climate impacts, highlighting the importance of traditional knowledge, socioeconomic context, user-inspired projects and initiatives, and adaptive capacity. [Ayompe and Epie](#) explore Africa's climate

vulnerabilities, emphasizing the role of indigenous knowledge systems, climate-smart agriculture, and local initiatives in strengthening resilience. Their work demonstrates how bottom-up approaches can complement scientific modeling and policy interventions by case studies from the Sahel and sub-Saharan Africa. These examples reveal how localized adaptation—ranging from early warning systems to governance reform—enhances regional resilience. [Chen et al.](#) revisit traditional Chinese agrometeorological proverbs, validating their scientific relevance and demonstrating their potential to support climate-informed agricultural decision-making. [Begum et al.](#) examine gendered perceptions and adaptive behaviors among nut farmers in Bangladesh, showing that factors such as education, farming experience, and income diversification may influence adaptive capacity.

Understanding how natural systems respond to climate variability is essential for developing effective adaptation strategies. Several papers in this Research Topic make significant contributions to this area. [Pang et al.](#) analyze spatiotemporal patterns of soil heat flux in northern China, providing new insights into soil-vegetation-atmosphere energy exchanges under changing climatic conditions. [Huang et al.](#) examine how rapid urbanization and extreme weather influence wet-bulb temperature dynamics in Guangdong Province, highlighting implications for thermal risk and urban planning. [Harjupa and Nakakita](#) study winter monsoon-driven warm rain processes in the Java Sea, demonstrating how atmospheric circulation patterns contribute to extreme precipitation and flood hazards. [Zhang and Wu](#) examine how climate change, vegetation cover, and land-use patterns jointly regulate water and carbon use efficiency in China's river basins—insights that are crucial for ecosystem management and carbon mitigation strategies.

Several papers address the challenges of protecting critical infrastructure and communities from climate-related hazards through risk assessment, modeling, and adaptation planning. [Kamara et al.](#) propose a cost-effective, five-phase framework for assessing climate risks to unpaved road networks in Sierra Leone. Their approach offers a practical model for infrastructure resilience in resource-constrained settings. [Ma et al.](#) develop an integrated urban flood risk assessment methodology combining hydrodynamic modeling with fuzzy matter-element theory, demonstrating its applicability in the Chinese city of Zhengzhou. Their findings resonate with broader themes throughout this Research Topic, emphasizing resilience planning, integrated data management, and the coupling of hazard modeling with socioeconomic assessment. [Helgeson et al.](#) explore co-benefits in climate resilience planning, advocating for integrated approaches that simultaneously address environmental, health, and social outcomes.

Climate change is not only a physical problem but also a deeply social one, affecting migration patterns, governance structures, and policy frameworks. [Aziz et al.](#) conduct a comprehensive bibliometric analysis of climate-induced migration in the Global South. Their findings reveal evolving research priorities, as well as gaps related to justice, representation, and policy engagement. [Hamer et al.](#) assess adaptation strategies across diverse agroecological zones, highlighting the importance of stakeholder participation, local

leadership, coherent policy design, and the integration of traditional knowledge with modern technologies.

The development of new decision-support tools and methodologies is critical to translating resilience research into actionable strategies. [Katende](#) presents a scalable framework combining econometric modeling and geospatial interpolation for assessing climate resilience in data-scarce regions. This approach enhances the capacity of policymakers to make informed decisions even with limited data availability.

3 Conclusion and future directions

The papers in this Research Topic reflect the remarkable breadth and depth of current research on climate resilience and adaptation. Collectively, they highlight several key messages that are shaping the future of this field:

- Interdisciplinarity is essential. Building resilience requires integrating insights from hydrology, ecology, social science, engineering, and policy.
- Local context matters. Solutions must be tailored to socioeconomic, cultural, and ecological conditions while remaining scalable and transferable.
- Data and technology are enabling transformation. Advances in modeling, remote sensing, and machine learning are expanding our capacity to understand, predict, and respond to climate impacts.
- Social considerations should remain an important focus. Effective adaptation strategies should account for differing community needs, support those most at risk, and draw on a broad range of knowledge and experience.
- Bridging science and policy is critical. Research must inform decision-making at all levels—from local governance to global frameworks—to ensure that adaptation measures are both scientifically sound and practically viable.

As climatic pressures continue to intensify and their cascading impacts on natural and human systems become increasingly evident, the imperative for collaborative cross-disciplinary approaches is more pronounced than ever. We hope this Research Topic not only captures the state of current scientific understanding but also serves as a catalyst for advancing future research that effectively bridges science and practice, integrates knowledge into policy frameworks, and translates innovation into tangible societal benefits. By uniting diverse perspectives, methodologies, and domains of expertise, the contributions presented here collectively point toward a more resilient and sustainable future for communities and ecosystems worldwide.

Author contributions

XW: Conceptualization, Investigation, Project administration, Writing – original draft, Writing – review and editing. RG: Investigation, Validation, Writing – review and editing. WH: Investigation, Validation, Writing – review and editing. RL: Investigation, Validation, Writing – review and editing.

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Conflict of interest

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