

Comment

Climate change and the cost of rapid urbanization: planning lessons from Dubai's flood

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Abstract

This paper examines the environmental consequences of rapid urbanization in the context of Dubai's severe flooding in April 2024. Unlike cities that develop gradually, Dubai's rapid construction neglected essential adaptive processes, resulting in significant vulnerabilities during extreme weather. The 254mm rainfall event exposed shortcomings in urban planning and infrastructure, emphasizing the need for resilience through integrated environmental strategies and green infrastructure. The paper calls for a shift in urban planning to incorporate adaptive strategies that include green infrastructure and permeable surfaces, drawing lessons from traditional practices to enhance modern urban resilience. Moreover, it addresses the broader socio-economic issues, particularly the disproportionate impact of such disasters on low-income populations, underlining the importance of inclusive and equitable planning practices.

1 Main text

In contemporary urban development, the rapid emergence of new cities from non-traditional landscapes, such as deserts, raises significant challenges in terms of environmental adaptability and resilience. The flash floods in Dubai, in April 2024, illustrate the vulnerabilities of such engineered cities which often overlook the organic, adaptive processes that historically shaped urban resilience. Dubai's urbanization has been exceptionally rapid. In 1975, Dubai's built-up area was approximately 18 square kilometers, and by 2020, this had expanded to over 977 square kilometers, a growth rate of over 5,300% in just 45 years [1]. This rapid expansion has been driven by a combination of ambitious development projects and a desire to position Dubai as a global city. Such unprecedented growth often overlooks the integration of sustainable and resilient urban planning practices, leading to vulnerabilities as seen in the recent flooding events.

Dubai's experience with extreme weather events is atypical due to its desert climate, where such intense rainfall is rare. The record-breaking 254 mm of rainfall in Al Ain, resulting in unprecedented flooding in Dubai [2], underlines a critical oversight in the planning of new urban spaces. Urban centers, traditionally, evolved over time [3], learning and adapting to the local environmental conditions. This organic growth allowed cities to develop inherent systems of resilience through trial and error, gradually integrating natural and human-made solutions to manage climatic adversities. In contrast, newly planned cities like Dubai are often conceptualized and constructed in a relatively short span of time. These cities are products of modern engineering and architectural ambition, driven by economic and aesthetic goals rather than the gradual integration of environmental resilience strategies. The urban fabric of such cities frequently

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features extensive impervious surfaces, limited natural drainage, and a lack of the redundant pathways for water flow that older cities naturally developed through centuries of incremental urbanization. However, it is important to note that older cities also face these issues. Many older cities, which have expanded rapidly in recent decades, have extensive impervious surfaces and outdated drainage systems that are similarly ill-equipped to handle atypical volumes of water [4]. This is evident from the frequent flooding experienced in older urban centers, where existing infrastructure often fails to cope with the increasing intensity and unpredictability of climate change-induced weather events [5]. Furthermore, climate change is expected to result in more frequent and intense extreme weather events, which will exacerbate these challenges for both new and older cities [6].

The severe impacts of the flooding were further magnified by the city's infrastructural unpreparedness. Dubai's drainage systems, like those in many similarly developed urban areas, were not designed to handle such atypical volumes of water [7]. Older cities, too, often have drainage systems that are inadequate for handling extreme weather events, which have become more frequent due to climate change. This highlights a universal issue in urban planning, where both new and old cities must upgrade their infrastructure to be more resilient against such unexpected climatic phenomena. The rapid urban expansion, characterized by dense constructions and extensive use of non-permeable materials, exacerbates runoff and inhibits the natural absorption of water by the ground. Moreover, the public and policy discourse surrounding the flood was initially distracted by speculations on cloud seeding rather than focusing on the systemic urban planning deficiencies exposed by the floods [8]. It is essential to redirect this discourse towards a more informed understanding of the underlying issues—namely, the need for integrating comprehensive environmental planning in the urban development process.

From an academic perspective, it is crucial to analyze these events within the broader context of sustainable urban development. Urban resilience, adaptability, and vulnerability are all integral components of sustainable urban development. Resilience is a key aspect of sustainability as it ensures that cities can withstand and recover from extreme events while maintaining their core functions. By fostering resilience, cities can enhance their sustainability, providing a stable and secure environment for their inhabitants [9, 10]. Theories of urban resilience often emphasize the importance of adaptive, inclusive, and integrated approaches that consider both human and environmental factors [11]. Dubai's floods highlight a gap between urban planning practices and these theoretical frameworks, particularly the lack of adaptive strategies that can respond to unexpected or extreme environmental events. As it is difficult to limit the emergence of fast-growing modern cities, there is a pressing need going forward for urban planners and policymakers to incorporate resilience thinking into their development. This involves not only adopting advanced technologies for weather prediction and disaster management but also revisiting traditional urban planning practices that offer valuable lessons in environmental adaptation. For instance, the incorporation of green infrastructure, permeable surfaces, and urban wetlands could serve as modern applications of ancient wisdom, providing both utility and resilience [12].

Furthermore, enhancing community involvement in the planning process can lead to more robust urban development strategies. Local knowledge and experiences are invaluable in identifying potential hazards and crafting practical, context-specific solutions [13]. Engaging communities can also foster a sense of ownership and responsibility towards the urban environment, which is crucial for the sustainability of resilience measures. In Dubai, the planning process has often been top-down, with limited community involvement. The rapid pace of development and the focus on economic growth have sometimes overshadowed the need for inclusive planning practices [14]. Consequently, the voices of local residents, particularly those from lower-income and migrant worker communities, are frequently underrepresented in decision-making processes [15]. Addressing this gap by fostering greater community engagement can enhance the effectiveness of resilience measures and ensure that the needs and insights of all urban residents are considered. There is also a need to engage in co-creation processes in an equitable manner. However, on this, we note that Dubai suffers from deep socio-economic inequalities, with migrant workers living below the poverty line [16]. Tackling these socio-economic inequalities is challenging due to policy and planning frameworks that prioritize rapid economic growth over social equity. To address these issues, there needs to be a concerted effort to implement policies that promote fair wages, improved living conditions, and social integration for all residents. Additionally, planning frameworks should incorporate mechanisms for equitable participation in the urban development process, ensuring that the voices of marginalized communities are heard and addressed. As the relative impact of disasters is more often felt by low-income households, this flood is likely to exacerbate socio-economic disparities in the city. The underprivileged class in Dubai has fewer opportunities to manage risk and build resilience. Consequently, enhancing resilience in such cities also requires addressing socio-economic inequalities.

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Data availability No datasets were generated or analysed during the current study.

Declarations

Competing interests The authors declare no competing interests.

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