

URBAN FLOODS ARE NOT ACCIDENTS — THEY ARE PLANNING FAILURES: WHAT NEEDS TO CHANGE IN BRAZILIAN CITIES

Rafael Azevedo de Souza¹

Abstract: This article aims to analyze, through a systematic literature review of the last five years, the causes of urban floods in Brazil and the associated planning failures, proposing solutions based on green infrastructure and sustainable drainage systems. The method consisted of searching and selecting scientific articles published between 2020 and 2025 in recognized databases, focusing on the intersection between urban drainage, territorial planning, and climate resilience. The results demonstrate that excessive soil sealing and exclusive reliance on traditional gray infrastructures are the main factors exacerbating floods in Brazilian cities, highlighting a disconnection between urban growth and hydrological support capacity. It is concluded that the transition to resilient city models requires the urgent adoption of green infrastructures, such as constructed wetlands and sustainable drainage systems, which not only mitigate the impacts of floods but also promote the reintegration of the natural water cycle into the urban environment.

Keywords: urban drainage. floods. green infrastructure. urban planning. climate resilience.

INTRODUCTION

The accelerated and disorganized urbanization of Brazilian cities over recent decades has resulted in a profound alteration of the natural hydrological cycle. The replacement of vegetated areas by impermeable surfaces — such as asphalt and concrete — has drastically reduced the infiltration capacity of the soil, increasing the volume and velocity of stormwater surface runoff (MARTINES et

¹ Graduado em Arquitetura e Urbanismo pela Anhanguera UNIDERP

al., 2025). As a direct consequence of this process, urban floods have become recurring and devastating events, causing loss of life, significant material damage, and the disruption of essential services. Historically, the approach adopted to address this problem has been based on the construction of gray infrastructures, such as concrete channels and underground galleries, which seek to remove water from urbanized areas as quickly as possible (FRANCISCO et al., 2023). However, this strategy has proven insufficient and, in many cases, counterproductive, as it merely transfers the problem downstream without addressing the structural causes of flooding (GETIRANA et al., 2023).

In this context, the need for a paradigm shift in urban planning and stormwater management has emerged. Floods should not be regarded as inevitable fatalities or mere natural accidents, but rather as clear symptoms of failures in urban planning and governance (LIU et al., 2025). Recent literature has emphasized the importance of integrating urban drainage into territorial planning, adopting nature-based solutions and green infrastructures (STARKEY et al., 2025). This article conducts a systematic literature review of the last five years to analyze the challenges of urban drainage in Brazil and explore how the adoption of sustainable drainage systems — including constructed wetlands — can transform vulnerable cities into climate-resilient environments.

METHODOLOGY

The research was conducted through a systematic literature review, with the objective of identifying, evaluating, and synthesizing the most recent scientific evidence on urban floods, planning failures, and green infrastructure in the Brazilian and international contexts (FRANCISCO et al., 2023). The search for articles was carried out in recognized academic databases, using combinations of keywords such as urban drainage, green infrastructure, floods, urban planning, and sustainable drainage systems. The inclusion criterion established the selection of articles published exclusively between 2020 and 2025, ensuring the currency and relevance of the information in light of contemporary climatic challenges. Priority was given to studies addressing the ineffectiveness of

traditional infrastructures, the implementation of wetlands, and aspects of governance and urban resilience. After an initial screening based on reading titles and abstracts, the selected articles were read in full and their data extracted and categorized to compose the critical analysis presented in the subsequent sections of this work.

THE FAILURE OF THE SANITARIAN MODEL AND SOIL SEALING

The analysis of the literature reveals a consensus regarding the exhaustion of the traditional urban drainage model in Brazil. Studies indicate that the historical dependence on gray infrastructures — focused on the rapid evacuation of stormwater through canalization systems — ignores the natural dynamics of river basins (FRANCISCO et al., 2023). Excessive soil sealing, driven by real estate speculation and the absence of adequate land-use regulation, is identified as the primary vector of increased flood risk (VASCONCELOS et al., 2022). Researchers highlight that the expansion of urban sprawl over floodplains and lowland areas not only exposes the population to imminent risks but also overloads existing macro-drainage systems, which frequently operate beyond their design capacity (PHOURATSAMAY et al., 2024). This reality evidences that the annual floods in Brazilian metropolises are fundamentally the result of urban planning that neglects the environmental restrictions and vocations of the territory (MARTINES et al., 2025).

GREEN INFRASTRUCTURE AND SUSTAINABLE DRAINAGE SYSTEMS

In contrast to the conventional model, recent literature highlights the urgency of transitioning to sustainable drainage systems (SuDS) and incorporating green infrastructure into urban planning (STARKEY et al., 2025). Green infrastructure mitigates flooding by promoting the retention, infiltration, and evapotranspiration of stormwater as close as possible to where precipitation occurs. Elements such as green roofs, rain gardens, permeable pavements, and bioswales are widely cited as

effective solutions for reducing peak flow rates and improving the quality of water that returns to water bodies (OBERHERR et al., 2026). Beyond hydrological benefits, studies underscore the co-benefits of these interventions, which include the reduction of urban heat islands, increased biodiversity, the creation of recreational spaces, and the aesthetic and real-estate enhancement of urban areas, contributing to the systemic resilience of cities (LIU et al., 2025).

CONSTRUCTED WETLANDS AS A MULTIFUNCTIONAL SOLUTION

Within the spectrum of green infrastructures, constructed wetlands — or artificial wetland areas — receive special attention in the research analyzed. These systems simulate the physical, chemical, and biological processes that occur in natural wetland areas, offering an integrated approach to stormwater management (LIMA et al., 2025). The literature demonstrates that constructed wetlands are highly efficient not only in flood attenuation — functioning as temporary detention basins — but also in treating pollutants carried by urban surface runoff. Authors point out that the implementation of wetlands in urban and peri-urban areas in Brazil presents technical and economic feasibility, especially when conceived as linear parks that integrate drainage infrastructure with the city's green space system (LIMA et al., 2025; MARTINES et al., 2025). This multifunctional approach transforms frequently degraded spaces into high-value environmental assets for the community.

GOVERNANCE, PUBLIC POLICIES, AND CLIMATE RESILIENCE

Despite the robust technical evidence proving the effectiveness of green infrastructure, the literature review indicates that its large-scale adoption in Brazil is still hindered by institutional and governance barriers (KUWAHARA et al., 2025). The fragmentation of responsibilities among different municipal and state agencies, the lack of continuous funding, and the cultural resistance to paradigm shifts in civil engineering are frequently cited challenges (VASCONCELOS et al.,



2022). Furthermore, the literature emphasizes that adaptation to climate change — which predicts an increase in the frequency and intensity of extreme precipitation events — requires integrated public policies that articulate the municipal master plan with macro-drainage and basic sanitation plans (KUWAHARA et al., 2025). Building resilient cities demands long-term planning, updating regulatory frameworks, and the active participation of civil society in managing flood-related risks (LIU et al., 2025).

CONCLUSION

The systematic literature review confirms the premise that urban floods in Brazil are not acts of nature, but rather the direct reflection of chronic failures in territorial planning and water management (FRANCISCO et al., 2023; VASCONCELOS et al., 2022). The persistence of strictly sanitarian drainage models and uncontrolled soil sealing have proven to be unsustainable and costly strategies (GETIRANA et al., 2023). The literature of the last five years provides compelling evidence that mitigating this scenario requires a structural shift toward the adoption of green infrastructures and sustainable drainage systems (STARKEY et al., 2025; OBERHERR et al., 2026). Solutions such as constructed wetlands represent unparalleled opportunities to combine flood control with improvements in environmental and urban quality (LIMA et al., 2025). However, for these technical innovations to materialize, it is imperative to overcome governance barriers, integrating stormwater management into urban planning in a systemic and adaptive manner (KUWAHARA et al., 2025; PHOURATSAMAY et al., 2024). Only through this paradigm shift will Brazilian cities be able to transcend the annual cycle of tragedies and build genuine climate resilience for the future.

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