



RESILIENT BLUE-GREEN CITIES



**SIMA
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Executive Summary

2025



Resilient Blue-Green Cities

Issue

The Brazilian urban context is marked by rapid growth, socio-spatial inequality, and insufficient infrastructure. Climate change increases the probability, frequency, and intensity of rainfall, which can contribute to flooding and landslides, as well as heat waves and water shortages, disproportionately affecting the most vulnerable populations. Given this scenario, how can Brazilian cities be transformed into spaces that are resilient to climate change, fair, and sustainable?

Problem

What causes the climate vulnerability of Brazilian cities?

Urban areas in Brazil are home to about 87% of the Brazilian population (IBGE, 2024), mostly in large cities and metropolises. Furthermore, approximately 55% of the Brazilian population is concentrated within the first 150 km from the sea (IBGE, 2022), which increases the relationship between cities and estuarine and coastal environments, increasing the exposure of populations and assets to threats related to climate change. The loss of green areas, the neglect of the city's relationship with blue-green systems, the fragmentation of ecosystems, and soil sealing increase the sensitivity of urban areas and, as a result, can amplify the impacts of extreme events such as heavy rains, prolonged droughts, and heat waves (IPCC, 2022). Brazilian cities have developed on a foundation of **socioeconomic and territorial inequality**, resulting in high **vulnerability to extreme weather events**. Poorer and more vulnerable populations often occupy areas of high exposure and sensitivity, such as floodplains and hillsides, which are prone to flooding and landslides, and have a reduced adaptive capacity. This leads to an unfair distribution of the risks associated with climate change, with a significantly greater burden falling on these populations and vulnerable territories.

This scenario of vulnerability, which is caused and continuously maintained by socioeconomic inequality, is amplified by a combination of characteristics common to urban systems in Brazil:

1. **Lack of integration and synergy between the urban and ecological (green-blue) systems.** The historical denial of the interdependence and need for balance and integration between ecological and urban systems (considering the physical-built and socioeconomic environment as one) in



development processes has resulted in unhealthy and unresilient cities, with a clear scarcity or degradation of natural – green and blue – in cities, restricting the supply of ecosystem services and opportunities for adaptation and mitigation – coastal protection, reduction of heat islands, CO₂ capture, stormwater management, etc. – in the face of climate change. Historically, the urbanization process in Brazil has involved practices such as channeling rivers, draining coastal lagoons, and filling wetlands to create urbanizable land, drastically reducing water spaces in cities and compromising essential ecological functions.

In coastal cities, for example, an urbanization process that often disregards local ecological particularities and natural dynamics has promoted the removal of important ecosystems such as dunes, sandbanks, and mangroves, which act as buffer zones against extreme events.

2. **Intense and accelerated urbanization, accompanied by a deficient provision of infrastructure and housing.** Urbanization in Brazil has created sprawling cities, with a significant portion of the population living in large and mega cities, concentrated in coastal areas, and a significant presence of informal areas, vast impoverished and marginalized suburbs, accompanied by transportation deficiencies and the predominance of polluting private cars, in addition to a still significant housing and sanitation deficit throughout the country. These characteristics, combined with the disconnect between the urban and natural systems, with a predominance of gray infrastructure, river canalization, landfills, soil sealing, and informal and precarious occupation of hills and swampy areas, place Brazilian cities at a high level of exposure — especially in low-lying coastal areas — and sensitivity, which add to the low adaptive capacity of the population — especially considering the less affluent population — leading to high socio-climatic risk environments.
 3. **Inadequate and unequal urban infrastructure.** Approximately 16.4 million people (more than 8% of the Brazilian population) live in slums and informal settlements, with limited access to basic services and formal infrastructure. Basic sanitation in Brazil presents challenges such as a shortage of drinking water, a lack of sewage collection networks, and poor urban drainage. Non-resilient gray infrastructure solutions predominate. Solid waste management faces challenges such as lack of adequate infrastructure, low awareness, and informality, perpetuating pollution and affecting public health. The waste sector was responsible for 16% of methane emissions in Brazil. The importance of this sector in climate action is not yet adequately recognized.
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4. **Lack of public transportation and predominance of individual motorized modes.** Transportation accounts for 55% of greenhouse gas (GHG) emissions in São Paulo, 66% in Belo Horizonte, and 59% in Fortaleza. There are deficiencies in public transportation (lack of regularity, efficiency, and equity). The sprawl of cities requires longer commutes and increases socio-territorial inequalities. The absence of adequate sidewalks, insufficient public lighting, and lack of integration with essential services (such as education, health, and employment) compromise not only daily mobility but also safety during extreme weather events.
5. **Planning model inadequate to address the climate emergency.** There is a significant gap in the integration of climate action into urban plans and policies. Climate adaptation plans are uncommon in Brazil. Many climate plans focus on mitigation and neglect comprehensive adaptation approaches and long-term perspectives. Short-term, incremental, and autonomous actions predominate over transformative adaptation planning that would have the capacity to effectively modify the fundamental attributes of a non-resilient socio-ecological system by reducing the inequalities that produce and perpetuate its conditions of vulnerability. **Disaster management policies and plans tend to be reactive**, focusing on losses and damages after events, rather than on adaptive measures in anticipation of foreseeable impacts. Of the 27 Brazilian state capitals, 16 (59%) do not yet have a completed climate plan.
6. **Fragile governance, often fragmented and non-inclusive.** Governance structures are unable to address systemic problems and coordinate multiple actors, compounded by the lack of participation of vulnerable groups in decision-making. There are gaps in the integration of Brazilian legal frameworks governing water resources, sanitation, climate change, and civil defense.
7. **Financing challenges**, with bureaucratic processes limiting access to resources, especially for vulnerable groups and smaller municipalities. Most investments in addressing the climate emergency in Latin America have been in mitigation, to the detriment of adaptation.

Implications

What are the consequences of this condition of urban vulnerability?

Without transformative action, the non-resilient urbanization model will perpetuate itself, reproducing or transferring vulnerability and amplifying socio-



climatic injustices as a consequence of inequality. The **absence of preventive measures exacerbates the consequences of extreme weather events**. This results in **increasing losses and damage**, affecting vulnerable territories and populations more severely, highlighting inequalities in the distribution of socio-climatic risk. Some of the consequences of this vulnerability are described below.

1. Each additional degree of global warming exponentially increases risks and limits the available adaptation options. Delayed adaptation drains public resources that could be directed toward meeting basic needs (housing, sanitation, and transportation, for example) and contributing to resilience, provided that their implementation incorporates adaptive construction parameters. Instead, these resources are applied to reactive, unplanned disaster response actions, which in themselves can increase existing vulnerability.
2. The lack or degradation of green-blue areas integrated into the urban system has negative consequences on environmental quality and the quality of life, health, and well-being of the population.
3. Recurring solutions applied to urban water management, such as river channeling and other watercourse conditioning techniques — a historical practice in Brazil — become inefficient in a scenario of intensification and increased frequency of extreme events. These actions can be characterized as maladaptation, resulting in the transfer or reproduction of risks to assets and populations located downstream and¹ ly of a river, for example, increasing risks in these areas (e.g., risks related to loss of life or infrastructure in events of heavy rainfall with flooding).
4. Informality and precarious housing require dealing with complex inequalities. Action in these areas can easily reproduce segregation and vulnerability if there is no coordination between housing policies, urban planning, and social inclusion.
5. The marginalization of groups living in informal areas, excluded from decision-making arenas, limits their ability to influence policies that directly affect their lives and ensure a fair transition and adaptation of urban systems.
6. The gap in the integration of legal frameworks compromises the effectiveness of public policies. Current policies in Brazil do not reflect the appropriate treatment to achieve the climate goals that have been set, and

¹ Downstream means "where the current is flowing."





there is a gap between the commitments made and effective actions in the territories.

Solutions

What can we do?

Public policies, financing, and governance

1. **Implement integrated, multilevel, intersectoral, and inclusive governance**, coordinating multiple actors and giving vulnerable groups a voice in decision-making. Co-creation and social participation are central to fair, democratic, and effective governance, integrating scientific knowledge with traditional and local knowledge. Education and communication should be seen as structural pillars for forming generations capable of understanding the complexity of climate change and strengthening governance.
2. **Ensure scalable, sustainable, and accessible financing mechanisms** for resilience projects. Diversify sources (public, private, and innovative, such as Payment for Environmental Services - PES). Facilitate access for vulnerable groups and small/medium-sized municipalities. Use urban planning and tax instruments to finance transformations.
3. **Develop local capacity and collaborative networks** for project design and implementation.
4. **Develop coordinated adaptation plans with the capacity to guide and coordinate long-term general and sectoral urban plans in an inclusive and flexible manner**, strengthening transformative adaptation processes over reactive, incremental, and autonomous adaptation.
5. **Develop contingency and disaster reduction plans to address residual risk, within participatory and inclusive processes.**

Urban planning

6. **Review and update construction plans, laws, and regulations**, integrating the climate agenda into multiple agendas to overcome sectoral fragmentation. Harmonize legal frameworks related to water resources, sanitation, climate change, and civil defense.
 7. **Address precarious housing and informal settlements** with integrated approaches, including land regularization, infrastructure improvement, and
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integration of SbN. Prioritize the use of vacant properties for social housing.

8. **Promote safe and accessible urban mobility**, prioritizing public transportation and active modes (walking, cycling). Coordinate mobility planning with land use (concepts such as the 15-minute city and Transit-Oriented Development – TOD). Apply the Avoid-Shift-Improve framework.
9. **Improve and universalize basic sanitation services** (water, sewage, drainage, waste), incorporating adaptive parameters and NbS. Invest in infrastructure for selective collection, stimulate the circular economy, and reverse logistics. Promote environmental awareness and education.

Nature-Based Solutions

10. **Integrate Nature-Based Solutions (NBS)** and blue-green infrastructure into urban planning and projects, protecting and restoring ecosystems. Examples include urban tree planting, green roofs, green walls, renaturalization of urban environments, restoration of marine-coastal habitats, and integration of NBS into sanitation infrastructure.

Benefits

Why should we invest in these solutions?

Integrated and transformative actions increase **urban resilience**, **reduce socioeconomic and territorial inequalities**, and **improve the quality of life, health, and well-being** of the population.

Environment, health, and quality of life

1. **The adoption of SuB improves water management, regulates urban temperature, improves air quality, and conserves biodiversity.** Green and blue spaces contribute to mental health, reduce stress, and promote physical activity. Greater tree diversity is associated with a lower incidence of physical and mental health problems.
 2. Sustainable waste management, focused on non-generation, reduction, reuse, and recycling, **contributes to a circular economy and reduces environmental and health impacts.**
 3. **Investing in green-blue areas and urban tree planting** has numerous benefits, such as **reducing public health spending** by promoting improved physical and mental health, reducing stress, and strengthening social bonds.
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4. Integrated and inclusive housing and mobility policies **reduce the burden of commuting and marginalization and promote environmental and climate justice**. Slum urbanization and housing improvements focused on resilience reduce disaster risks and socio-environmental vulnerabilities. Using vacant properties for social housing in central areas takes advantage of existing infrastructure.

Governance, financing, and work

5. **Participatory governance and co-creation lead to more effective, legitimate policies that are adapted to local realities**. Integrating scientific and local knowledge improves solutions. Transparency and *accountability* strengthen public trust.
 6. The transition to a sustainable and resilient development model aligns the country with global goals such as the Sustainable Development Goals (SDGs) and the Paris Agreement, **positions Brazil as a leader in conservation, and generates economic opportunities and green jobs**.
 7. Facilitated financing mechanisms ensure the **participation of various actors and the equitable implementation of projects**.
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About the "Resilient Green-Blue Cities" Report

This executive summary presents the main discussions in the Synthesis Report "Resilient Green-Blue Cities," produced and made available by **the Center for Synthesis on Environmental and Climate Change – SIMACLIM** (<https://simaclim.com.br/>).

SIMACLIM's main mission is to integrate accumulated and ongoing research from various national and international research networks and groups, organizing information and assisting in the Brazilian government's planning to achieve goals established in agreements on climate change. SIMACLIM is being funded by the MCTI through the National Fund for Scientific and Technological Development (FNDCT), FINEP Process 01.22.0584.00.

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Use of artificial intelligence:

This summary was prepared with the help of *Large Language Model* (LLM) tools, also known as artificial intelligence (AI). To learn how these tools were used, access the methodological appendix, available at this link: <https://simaclim.com.br/relatorios-de-sintese/>



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The complexity of the effects of global environmental and climate change, including their future projections, requires interdisciplinary and transdisciplinary approaches. These approaches are essential for understanding the interactions between social, biophysical, and ecological systems, characterizing the risks of impact, vulnerability, possibilities for mitigating their causes, and adaptation solutions. The Synthesis Center on Environmental and Climate Change (SIMACLIM) has as its main mission to integrate accumulated and ongoing research from various national and international research networks and groups, organizing information and assisting in Brazilian government planning to achieve goals established in agreements on climate change. SIMACLIM is funded by the Ministry of Science, Technology and Innovation (MCTI) through the National Fund for Scientific and Technological Development (FNDCT), FINEP Process 01.22.0584.00.

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