

# Cities in climate change: the Brazilian urban challenges.

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**Abstract.** Over the last two decades, Brazil's political scenario has been marked by socio-environmental turbulence. In addition to political polarization, the country has also suffered, year after year, from major natural disasters as a consequence of global climate change. Historically, Brazil is an important player in the world's environmental agenda, serving as an example for other countries in the global south. However, the climate agenda faces challenges to be integrated into urban planning in Brazilian cities. Climate change mitigation efforts have been limited due to a lack of articulation between macro and micro governance, geographical inequities, and a lack of political motivation, among other social-political factors. Consequently, the tensions between urban space and the environment have brought risks to the most vulnerable populations. However, even if the scenario seems pessimistic, some cities are leading the climate agenda in Brazil with their own initiative. In this sense, this paper seeks to provide an overview of the urban climate change mitigation and adaptation strategies that are being developed in Brazil. Even with the legal limitations of the impact and expansion of environmental policy, municipal governments have taken the lead in developing urban solutions and articulating national and international support networks to address the climate crisis. Therefore, this paper seeks to raise an overview of the advances, challenges, and failures of the implementation of climate change policies in Brazilian cities.

**Keywords.** Climate change, Green Gentrification, Brazil, Urban upgrade.

## 1. Introduction

Climate change has undeniably created new issues for our civilization. The repercussions of the climate catastrophe have had an extensive influence on the Brazilian economy and society. Because of its vast territory, Brazil must mobilize against a variety of environmental calamities, including landslides, water scarcity, temperature rises, and floods.

This perception of environmental disasters has been a new agenda in Brazilian society. Because, prior to the first decade of the 2000s, the common idea in the political-environmental imaginary was that Brazil was a disaster-free country. This viewpoint shifted dramatically following the 2011 landslide disasters in Rio de Janeiro state, which resulted in over a thousand deaths and left 35,000 people homeless [2].

Even though Brazil has been a major supporter of the global climate agenda, actively participating in environmental events and agreements, such as the Paris and Kyoto Accords. Few were the federal government's efforts to face its impacts in urban centers. Strategic environmental policies were

focused almost exclusively on the protection of the Amazon forest against illegal deforestation [2]. Thus, to a large extent, the climate agenda in Brazilian urban centers is the initiative of the local public managers themselves, especially in large metropolises such as Rio de Janeiro, São Paulo, Curitiba, and Salvador.

Therefore, this work aims to investigate the main political strategies adopted by large Brazilian cities to prevent and reduce the risks caused by environmental disasters of climate change. Identifying solutions, challenges, and failures in the political-environmental programs adopted.

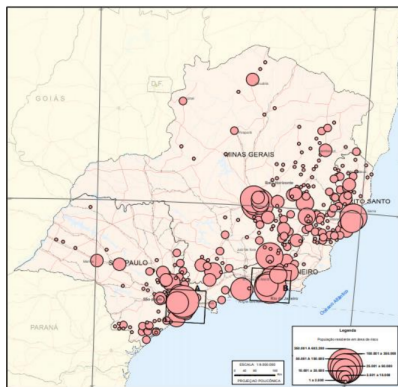
## 2. Research methods

The present work analyzes the social and environmental impacts of the application of urban policies for the climate agenda, through a literature review. Comparing results achieved by different Brazilian cities.

## 3. Geographical Inequalities

The Brazilian territory is formed by an unequal distribution of cities and economic resources. This is owing to the rapid urbanization of the twentieth century, when the urban population increased from 72 million in 1960 to more than 200 million in 2015[6]. As a result, about 60% of the Brazilian GDP is concentrated in the major cities[8]. Aside from wealth disparities between rural and urban people, the distribution of cities varies by area. The southeast has the largest population density[8] followed by the south and northeast south regions[1].

Therefore, it is in the southeast region where climate change results in a greater social and economic impact. According to the Instituto Brasileiro de Geografia e Estatística (IBGE), the region had more than 4 million people living in areas of environmental risk in 2010, which represents almost 10% of its population[1]. As can be seen in the map below, this population living under environmental risks is concentrated in the main urban networks of the region.



**Fig. 1** - Population exposed in risk areas in the Southeast Region in 2010[1].

However, in addition to social conditions. Brazil's territorial extension also brings challenges referring to its different climate zones. While northeastern Brazil, where there is a predominance of the semi-arid climate, faces a reduction of water resources, in the southeast the effect is the opposite, with an increase in rainfall and flooding being predicted [9,11]. This scenario is further aggravated by the cyclical effects of El Nino, which tends to invert the distribution of dry and rainy periods throughout Brazil [9].

## 4. National Policy

Thus, with such a dynamic territory, a national articulation to face climate change in Brazil becomes fundamental. Over the last two decades, the Brazilian environmental program has followed the political sphere.

The Brazilian climate agenda advanced throughout the governments of Luis Inacio Lula da Silva (2003-2011) and Dilma Rousseff (2011-2016)[1,2].

It was in the interest of these governments to continue the commitment made by the country in Rio+92 and Rio+10 [2,7]. It is possible to say that at this moment, Brazil was one of the protagonists in the global climate agenda. Brazil assumed responsibilities in the Kyoto Protocol and the Paris Agreement, actively participated in the United Nations Climate Change Conferences (COP) held in 2007, 2009, and 2015, and articulated new climate commitments during Rio+20 [2,6,7]. Obtaining important advances such as the expressive reduction of deforestation of the Amazon forest, which was one of the main drivers of the Brazilian climate agenda at the time [1,2,6,7]. This period also saw the first major mobilization of the federal government to create environmental disaster prevention programs. Following the damages caused by landslides in Rio de Janeiro State, the government initiated a comprehensive program of hydrogeological surveillance and tactical training for environmental disasters[1].

However, Bolsonaro's ascension to the presidency of Brazil completely disrupted the diplomatic directions that the country had built in previous administrations. The extreme right-wing former president adopted an "anti-globalist" political strategy, based on conspiracy theories, which considered the environmental movement as a fruit of "cultural Marxism"[6]. Thus, by an arbitrary decision, Bolsonaro prevented the holding of the 25th edition of the COP in Brazil, besides having threatened to cancel the commitments made by the country in the Paris Agreement, as Donald Trump did [6,7]. Moreover, his government decreased investments in public agencies for research and environmental protection and revoked several environmental policies adopted by previous governments [6]. Such measures generated diplomatic conflicts with countries that supported environmental projects in Brazil, such as Norway, Germany, and France [7]. Therefore, in the last few years, the Brazilian climate agenda has undergone a profound setback by the initiative of the federal government.

Thus, political instability was a factor that negatively impacted the development of the Brazilian climate agenda. In addition, the environmental agenda was almost exclusively focused on the preservation of the Amazon, without giving space to studies on the urban climate agenda.

## 5. Protagonism of the municipal governments

As a result of weak national political articulation and social awareness, the urban climate agenda has been only explored by large metropolises. In part, this scenario is due to the fact that these cities have greater financial resources than medium and small cities. Besides the fact that they have greater access to research and innovation agencies and concentrate on an active network of local and national

researchers.

But, another important factor is the internationalization of municipal governance of these cities, in a paradiplomacy actuation[6]. For at the moment when subnational governments face problems under the omission of the national state, one means of refuge is to project their politics into transnational support networks. As is the case in efforts against the global climate crisis[2].

São Paulo and Rio de Janeiro emerge as key cities in the Brazilian climate agenda. Besides being the first cities to have local secretariats for international affairs[2], they are also the stages of the main conferences and organizations for environmental issues. Accordingly, in face of the low presence of the Federal Government in the urban climate agenda, these cities have inserted themselves in transnational cooperation networks[2,4], such as Local Governments for Sustainability (ICLEI), C40, and Resilient Cities Network among others[2,4].

The integration of the metropolises into the climate cooperation networks has been fundamental to the advancement of the Brazilian climate agenda. Because among the medium and small cities, there is no easy access to knowledge and specialized technical professionals. Even though most of the municipalities apply policies that serve to mitigate the climate crisis, their actions are not understood as a strategy of the climate agenda[2]. Thus, by adopting political programs aligned to the containment of the climate crisis, the metropolises end up giving more visibility to the cause, serving as an example to other cities[6].

For transnational organizations, this partnership also results in environmental and political gains. As only 3% of the Brazilian municipalities have an international affairs secretariat, the climate crisis has been incorporated into the political agenda of the cities in a cascade effect from the local-regional political articulation. Having large cities from the global south as allies in a social-environmental cause expands the political capital of these organizations. The ICLEI network, for example, has been successful in the country. By 2020, of the twelve cities that had passed climate change policies, 10 of them were members of the network[4]. In part, this scenario arises as a result of the programs for capacity building on climate change, consulting, articulation, and information sharing[3,4]. Moreover, by participating in these articulations, these organizations also begin to stimulate common parameters and methods of work and analysis[6].

However, even though these initiatives are innovative, they are not yet able to solve the structural problems that hinder the advancement of the climate agenda in Brazil. Medium and small towns, and even other metropolises, inspire their environmental policies in the metropolis as an easier path. Because they do not have access to financial resources, specialized professionals, and

research centers to develop studies on their own realities. Consequently, the inspiration is often a direct copy of draft laws already applied in large cities, which can result in low engagement of policies because they do not reflect the local reality.

## 6. Strategies and limitations of municipal policies.

Faced with such an extensive and unequal territory, the difficulties of managing the climate crisis go beyond the political sphere. Therefore, decentralization has been a strategy to facilitate the state's territorial management. The Brazilian Constitution of 1988 created important political mechanisms that give Brazilian cities greater autonomy in urban planning[8, 2].

These political mechanisms are also being explored for the expansion of cities' climate agenda. Although in slow steps, the climate agenda has advanced more through the initiative of the urban management powers than through the legislative Chambers. In part, this is due to the social and media impact that the climate agenda generates on the urban population. Among the strategies that stand out are urban upgrading programs and extra-fiscal incentives.

### 6.1 Urban upgrades

In general, a large part of the urban upgrading programs is done by revitalization projects of parks and water resources in the cities, commonly known as green and blue infrastructure.

São Paulo is the Brazilian city that works the most with urban and environmental upgrading projects, being one of the protagonists of the Brazilian climate agenda. In 2002, the city recognized linear parks as climate change adaptation strategies as a way to revitalize green areas and urban streams and promote greater rainfall drainage [10].

However, part of the environmental gains of these policies comes from social losses, mainly from ecological gentrification, or environmental gentrification [10, 11]. For the realization of the linear parks projects of Canivete and Sapé in São Paulo, the public power carried out removals of a large part of the vulnerable populations settled along the stream banks [10]. And, after the realization of the projects, the nearby houses went through a market valuation that changed the building pattern and local lifestyle [10]. Moreover, the policies of road afforestation and public park requalification benefit neighborhoods that were already gentrified, further increasing the value of real estate [11]. Thus, even if the urban climate agenda can be used as a tool to provide new quality green spaces to people, without a complementary housing policy to protect local populations, its effects may still generate social exclusion. In contrast, the city of Santos, localized on the coast of São Paulo state, sought to integrate vulnerable

populations into its Climate Change Plan. Because of the possibility of landslides at Morro Serrat, those who were at risk had to be relocated [12]. In addition to the relocation, the public authority wanted to stimulate the reforestation of the area, with the support of the local population [12]. Thus, in 2019, the project was initiated, relying on the training of the residents about the problems they faced, and then the development of the project in a participatory manner, incorporating local demands and the residents' own knowledge. In this way, the Santos plan proposes population relocation with low social tension and without causing local gentrification, by including the residents in the development of the revitalization program.

In Rio de Janeiro and Salvador, the planning of natural vegetation and urban streams was thought of in an integrated way. The Sustainable Development and Climate Action Plan of Rio de Janeiro foresees the creation of green corridors that connect all the fragments of natural vegetation, together with public parks, water bodies, and buildings of the historical and cultural heritage of the city [12]. Salvador, in its Plan of Mitigation and Adaptation to Climate Change, proposes the creation of a large green and blue infrastructure, integrating parks, environmental preservation areas, urban gardens, and the city's water bodies [12]. Thus the two cities present an innovative perspective that is still in progress.

## 6.2 Tax incentives

Unlike urban upgrading projects, fiscal incentives emerge as political measures that intervene indirectly in the territory. They serve as incentives for good urban practices. A good policy that has been adopted is the "Green IPTU", which gives discounts on urban use and occupation tax if the owner adopts environmental compensation strategies. Curitiba and Salvador appear as examples of the application of these strategies.

Between 2013 and 2018, Salvador implemented a green and yellow IPTU program, guaranteeing a discount of up to 10% under urban occupation taxes to buildings that were more sustainable or that produced solar energy locally [3]. Curitiba applied the same strategy in a simpler way. The municipality only required the owner to preserve native vegetation on his property, giving a discount proportional to the vegetation cover on the lot [3]. The measure was applied to a restricted region of the city where the government was interested in its revitalization and environmental preservation.

These two strategies were well-evaluated at the time of their implementation. In addition to guaranteeing a more sustainable occupation, the green IPTU could be a tool for environmental justice, compensating residents from lower economic classes with tax reductions. However, the policy's implementation outcomes fell well short of the "green marketing" hype.

First, in Salvador, even though the tax reduction policy covered the whole urban territory, its adhesion was given under a series of technical criteria and, therefore, an extensive bureaucracy [3]. Besides, there was a low disclosure to the city's population of how they could have access to the benefit [3]. Accordingly, the adhesion to the program by the population was very low. Second, in Curitiba, the access to the benefit was simpler than in Salvador. However, as the benefit was given to a restricted area of the city its adhesion also had low performance [3]. Moreover, the green revitalization of the neighborhood, added to this tax exemption, are factors that increase the cost of local land, which can lead to local gentrification in the medium term [3].

Consequently, this political strategy, although innovative, does not produce significant results on the climate agenda. It would be necessary that local governments facilitate access to the benefit to the most disadvantaged communities, encouraging more social engagement in urban renewal and sustainability. However, the limitations of the Green IPTU program are understandable. This policy impacts the tax collection of municipalities and, considering that Brazil has been in a deep economic recession in recent years, cities still need to stabilize their tax collection [3].

## 7. Climate agenda integrated into urban legislation

A good way to ensure the permanence of climate policies in municipal administrations is to integrate them into urban legislation. This way, the public authorities, and the real estate market would be conditioned to consider the climate agenda in urban and architectural planning [2].

One of the main legal resources for the management of cities is the Master Plan, a legal instrument that is mandatory for all cities that: (I) have more than 20 thousand inhabitants; (II) are part of a metropolitan region; (III) are areas of tourism interest; (IV) are under the influence of developments or activities with environmental impact and; (V) are mapped as areas susceptible to landslides, floods, and geological or hydrological risk processes [8]. Thus, through the Master Plan, towns are obliged to plan their urban development in a strategic manner, including environmental aspects. Some state capitals, such as São Paulo, Palmas, Belo Horizonte, and Curitiba already include climate change in their master plan [6, 8].

Palmas, the capital of the State of Tocantins, was the city that best worked with climate change policies in its Master Plan [6]. Already in 2003, the city included in its master plan the responsibility of the

public power to prevent the development of heat islands, encourage the adaptation of buildings to climate change and popular environmental education, promote the reforestation of degraded green areas, and encourage sustainable urban drainage systems [6]. Curitiba also incorporates the responsibility of preparing the urban space for the consequences of climate change, in addition to adopting mitigation measures[13]. In Belo Horizonte, the capital of the state of Minas Gerais, the 2019 master plan includes the fight against climate change as one of the missions of the local government and also proposes that the municipality's housing policies should be based on social justice, economic efficiency and contribute to climate change control[6].

São Paulo has also advanced in the use of urban legislation, as the municipality has articulated complementary laws to the Master Plan to promote the climate agenda at different stages of city planning. Thus, besides the Strategic Master Plan, São Paulo has the: (I) Policy of Climate Change in the City of São Paulo; (II) Climate Action Plan of São Paulo; (III) Agenda 2030, and; (IV) Target Program, as legal instruments to combat climate change[11]. This framework, although with its legal flaws and limitations, creates more favorable conditions for the perpetuation of more sustainable urban practices in the medium and long term.

## 8. Conclusion

Brazil is a country developing, that has much to advance in its urban climate agenda. Its large territory and ecological variety present complicated geographical obstacles, which, when combined with political instability, result in poor performance. Despite these obstacles, Brazilian towns are resilient and eager to collaborate in the battle against climate change. To increase the influence of the climate agenda's political agendas, it is vital to develop mechanisms that clarify the sharing of information and activity across cities. In addition, envisioning the integration of social and environmental policies in order to encourage city readjustment while protecting vulnerable populations.

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