RISCOS

CLIMATE RISKS AND PROGRAMMATIC VULNERABILITY:
THE CHALLENGES FOR THE HOMELESS POPULATION IN RIO DE JANEIRO AND RISK ANALYSIS*

RISCOS CLIMÁTICOS E A VULNERABILIDADE PROGRAMÁTICA:
OS DESAFIOS PARA A POPULAÇÃO EM SITUAÇÃO DE RUA NO RIO DE JANEIRO E PARA A ANÁLISE DOS RISCOS

Luisa Pilar Marques Martins

State University of Rio de Janeiro (Brazil)
Institute of Geography

ORCID 0009-0002-9488-1306   martins.luisa_1@graduacao.uerj.br

Antonio Carlos Oscar-Júnior

State University of Rio de Janeiro (Brazil)
Institute of Geography

ORCID 0000-0001-9751-5884   antonio.junior@uerj.br

ABSTRACT

The homeless population in Brazil has shown significant growth in recent years. This fact is perceived in the main capitals of the country, such as the city of Rio de Janeiro. The number of people affected there has reached 13 thousand, thus exposing a structural, social and economic problem that demands attention from the public authorities. The present study aims to analyse and operationalize the concept of vulnerability in its programmatic (or institutional) dimension based on public policies, also considering the exposure to climate risk to which these people are vulnerable, in a non-inclusive city. Fieldwork, interviews, data collection, and literature surveys on the subject were conducted for this purpose. As a result, it was possible to see that the difficulties faced by this population are related to the deprivation of basic rights, starting with a lack of housing, jobs, and access to public policies that fail to meet the demand for urban shelter. This social impoverishment was exacerbated during and after the COVID-19 pandemic that began in 2020.

Keywords: Institutional vulnerability, socio-spatial segregation, reception units, militarization of urban space.

RESUMO

A população em situação de rua no Brasil tem apresentado nos últimos anos um crescimento significativo, percebido nas principais capitais do país, como é o caso da cidade do Rio de Janeiro. Essa população alcança um quantitativo de cerca de 13 mil pessoas (SAGICAD, 2023), denunciando um problema estrutural, social e econômico e que demanda atenção dos setores públicos. O presente estudo tem como objetivo analisar o conceito da vulnerabilidade em sua dimensão programática ou institucional a partir das políticas públicas, tendo em vista, também, à exposição ao risco climático à que essas pessoas estão expostas, numa cidade não inclusiva. Para isso, foram realizados levantamentos bibliográficos a respeito da temática, trabalhos de campo e entrevistas. Foi possível perceber que as dificuldades dessa população estão relacionadas à privação de direitos básicos que começam pela falta de moradia, empregos e acesso às políticas públicas que não cumprem a demanda do acolhimento urbano; empobrecimento social potencializado durante e pós-pandemia do Covid-19 ocorrido a partir de 2020.

Palavras-chave: Vulnerabilidade institucional, segregação socioespacial, unidades de acolhimento, militarização do espaço urbano.

Introduction

The decree number 7,053 of 2009 defines the population in a situation of street homelessness in Brazil as:

"[...] *the heterogeneous population group that shares common extreme poverty, disrupted or fragile family ties, and the absence of regular conventional housing, and who use public places and degraded areas as their temporary or permanent living and sustenance space, as well as shelter units for temporary overnight stays or temporary housing*" (Brazil, 2009, *authors' free translation*).

According to the Institute of Applied Economic Research, there are currently 281,000 people experiencing homelessness in Brazil, with a significant increase between 2019 and 2022, which may also be related to the COVID-19 pandemic (IPEA, 2022; Oscar Jr, *et al.*, 2023). This situation is particularly evident in the major state capitals of Brazil, such as Rio de Janeiro.

The city of Rio has approximately 13,000 people experiencing homelessness, and when we zoom in on the analysis, this population is primarily concentrated in the downtown area (fig. 1). The 2022 census indicates that the neighborhood has around 1,400 people experiencing homelessness (fig. 2), which can be attributed to various factors:

"*The central area of the city of Rio de Janeiro provides opportunities for employment, social assistance, begging, engaging in minor crimes, mobility, and anonymity. The spatialities of this population are, therefore, based on an understanding of the multiple socio-spatial dynamics that occur in the city, with the aim of ensuring some stability in living conditions, whether to reproduce or to break away from the 'street situation'*" (Robaina, 2015, p. 125, *authors' free translation*).

There is, therefore, an urgent need for discussion about this population, which has been experiencing a significant increase and lacks basic rights such as healthcare and housing. Moreover, there are numerous challenges and obstacles faced in their daily lives due to invisibility (including in scientific research), denial of rights, and the absence of urban infrastructure for support. Among these challenges, exposure to urban hardships demonstrates a concerning aspect, especially in a context of climate change and a tendency towards an increase in extreme events (Rio de Janeiro, 2021).

The theory of the Urban Climate System, proposed by Monteiro in 1976, presents the relationship and influence of urban elements on the atmospheric dynamics of the city, thereby generating unique climatic effects that have
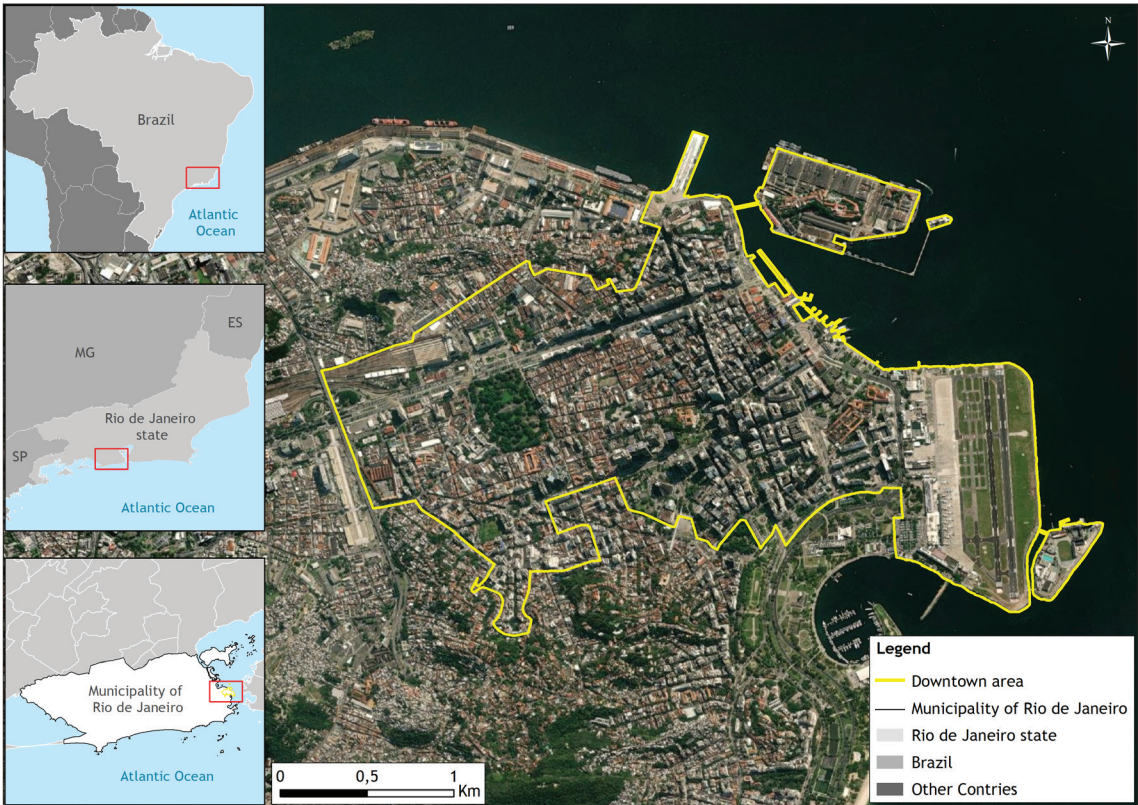

Fig. 1 - Study area, corresponding to the Downtown area, in the city of Rio de Janeiro (Data source: IBGE and Data Rio, 2023).

Fig. 1 – Área de estudo, correspondendo ao bairro do Centro, na cidade do Rio de Janeiro (Fonte dos dados: IBGE e Data Rio, 2023).

various impacts on the environment and society. Monteiro introduces three channels of human perception related to the climate: thermodynamic, physicochemical, and hydrometeorological, which demonstrate how the city can contribute inputs to climatic phenomena, leading to social issues that are perceived and experienced by individuals (Mendonça, Monteiro, 2019).

However, in an unequal society, the impacts also tend to be distributed unequally. Urban climate affects everyone, but in different ways, as it is associated with various degrees of vulnerability within the space and experienced by different social groups (Marandola Jr., 2009). Therefore, it is the role of Geography to seek an understanding of the dynamics that involve these vulnerable groups and the challenges they face.

People experiencing homelessness face severe levels of vulnerability to urban climate, especially due to their high exposure to climatic risks on the streets. Climatic risk can be understood through the relationship between hazard, susceptibility, and the capacity to adapt to a specific atmospheric event (Nascimento Júnior, 2019). However, it is essential to understand and analyze atmospheric dynamics and urban climatic elements, considering the city as a space of segregation and vulnerability (Nascimento Júnior, 2019). This is a fundamental demand because:

"*The incorporation of class structure into the analysis will allow us to understand who benefits from economic activities whose costs are shared by society as a whole. Furthermore, the environmental impacts resulting from these activities are often more keenly felt by the less privileged sectors of the population, who, confined to areas more susceptible to the changes inherent in ecological processes but accelerated by human actions, cannot afford the costs of housing in environmentally safer areas or areas benefiting from environmental impact mitigation measures*" (Coelho, 2001, p. 20-21, authors' free translation).

These individuals face the daily risks that urban hardships can pose, and their ability to adapt to climatic phenomena is closely linked to the availability of public resources that ensure their protection and support. However, there are indications that these resources and infrastructure do not function as they should and do not guarantee this response (Robaina, 2015). In other words, there is institutional neglect on the part of decision-makers, which can even intensify situations of vulnerability and exposure to climatic risks, a phenomenon known as Programmatic or Institutional Vulnerability (Ayres, *et al.*, 2009).
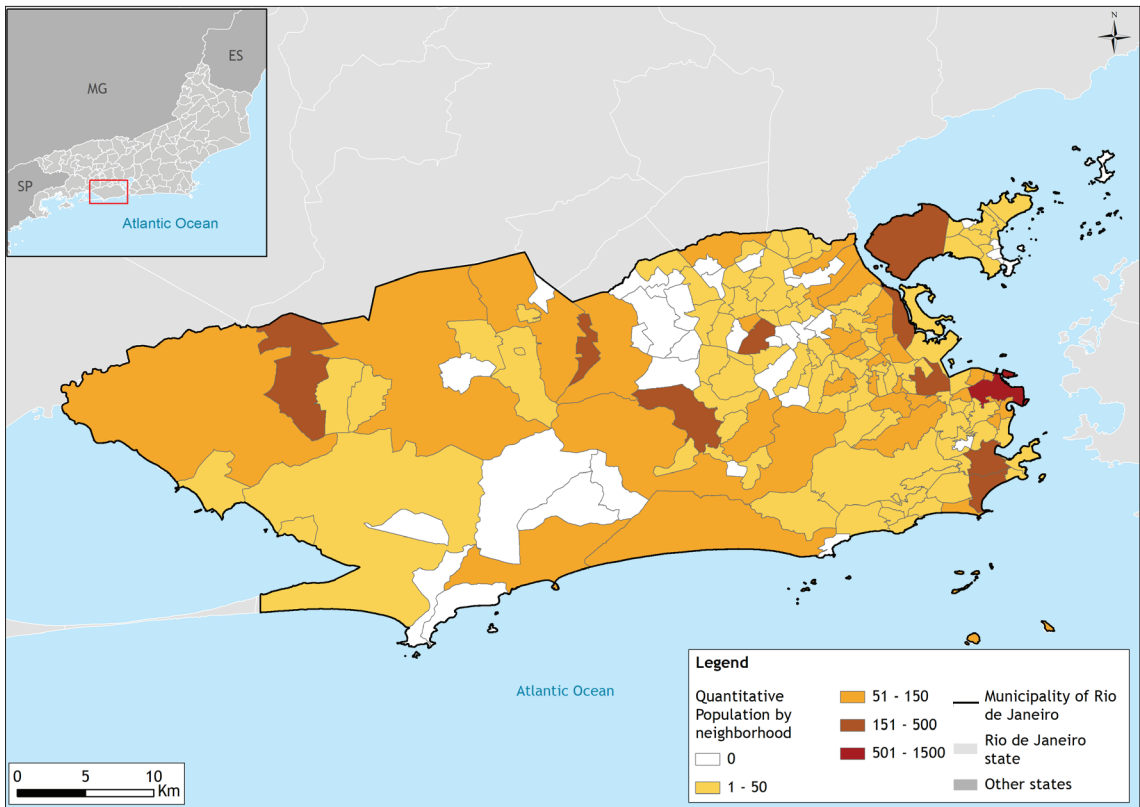

Fig. 2 - Mapping of census data by neighbourhoods in the city of Rio de Janeiro in 2022 (Source: Data Rio, 2022).

Fig. 2 - Mapeamento dos dados censitários por bairros no município do Rio de Janeiro no ano de 2022 (Fonte: Data Rio, 2022).

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Therefore, this present work considers the multidimensionality of the concept of vulnerability, which enhances the ability to understand exposure to risk not only as a result of individual aspects but also as a consequence of collectivity and contexts that shape greater or lesser exposure to a particular situation or phenomenon. It also influences the availability of resources, access, and the capacity for responses, adaptation, and resilience (Ayres *et al.*, 2009).

Thus, this current work aims to contribute to Climatology analyses and risk studies, with a focus on the vulnerability of individuals experiencing homelessness in relation to Urban Climate, through public policies developed in the downtown area of Rio de Janeiro. The analyses presented here aim to highlight the institutional aspects related to vulnerability that are linked to exposure and climatic risk. It is essential to recognize the need for institutional (or programmatic) efforts to ensure that mechanisms and resources for protecting these individuals from climatic phenomena and events are available to the homeless population.

Methodology

The data and analyses presented here were based on a process of bibliographic and cartographic survey, fieldwork in the study area, and the conducting of semi-structured interviews with the target audience.

The authors Igor Robaina (2015), Melgaço (2010) and Ayres (*et al.*, 2009) stand out in the present analyses. The concepts of programmatic vulnerability and militarization of urban space are explored from the perspective of the homeless population and their exposure to climate risks. The research delves into the concepts developed by these authors, among others, to achieve the stipulated objectives, structuring the theoretical framework of this study.

A significant focus is on climatic risks, thus requiring the search for data and information about risks related to urban hardships in the downtown area, the study area. Therefore, as an investigative procedure, it was necessary to gather information about susceptibility to the formation of heat islands in the downtown area, along with data on susceptibility to flooding.

Following the methodological approach proposed by Katzschner (2005), Lemos (2021) developed the Urban Climate Map based on geospatial data related to environmental and urban characteristics, selecting variables that directly influence the formation and intensity of urban heat islands. Thus, nine representative layers were determined and systematized into classes. These layers, at cadastral scale, were generated from information extracted from the Rio de Janeiro City Hall's database, as shown in TABLE I.

Data were collected on impacts of rainfall, through news articles published in the newspaper "O Globo" between 1996 and 2021, to understand how climatic risk manifests in the study area and its potential consequences in the urban environment. The data collected were related to the months of November, December, January, February and March, corresponding to the wettest months for the municipality, according to Brandão (2019) and, therefore, with the most significant records for the analyzes. The descriptors: rain, flood, flooding, inundation and Rio de Janeiro were used in the searches in the Journal's collection. From this, the following information was collected and tabulated: headline, neighborhood of occurrence, typology, impacts, date of the event, volume of rain and other observations.

Along with this, analyzes were made based on the mapping of susceptibility to floods produced and available by the Geological Survey of Brazil (*Serviço Geológico do Brasil* - SBG, former CPRM), in scale 1:25.000. The mapping was carried out according to the steps stipulated in TABLE II, following the activities of qualitative and quantitative approach based on morphometric indexes; application of morphometric indexes according to the hydrographic basin of the main river of the municipality; susceptibility to flooding and proposed spatialization of flooding (CPRM, 2014).

TABLE III shows the relationship between the classes established in the first two steps described above, corresponding to stage 3.

From the climate data it was possible to establish the relationship between the location of the homeless population and exposure to risks.

Additionally, official data sources that collect information about the homeless population were surveyed. Among them are the Census of the homeless population in the city of Rio de Janeiro in 2022 and data from the Secretariat for Evaluation, Information Management, and the Unified Registry, concerning families experiencing homelessness registered in the system.

In order to gather information about the location and the reality of the population, three fieldwork sessions were conducted, two of which were conducted on foot and one by car. The fieldwork route was based on a previous mapping carried out by the *Pias do Bem* project, which was developed during the early days of the COVID-19 pandemic in Rio de Janeiro. The project aimed to install handwashing stations in neighborhoods with the highest concentration of people experiencing homelessness, providing access to hygiene facilities in the city. Utilizing the mapping conducted by the *Pias do Bem* project (with support from the NGO *VOAR*), it was possible to identify areas with a high

TABLE I - Layers of information used to develop the Urban Climate Map that spatializes susceptibility to the formation of urban heat islands.

TABELA I – Camadas de informações utilizadas para elaboração do Mapa Climático Urbano que espacializa a suscetibilidade a formação de ilhas de calor urbana

THERMAL LOAD			DYNAMIC POTENTIALS		
LAYER	CLASS	WEIGHT	LAYER	CLASS	WEIGHT
Building Volume	No building	0	Ground coverage by onstruction	High potential (50-100 %)	0
	Industrial	1		Medium potential (0-100 %)	-1
	Slum	2		Low potential	-2
	Residential (2 floors)	3	Natural landscape	No vegetation	0
	Verticalization (10 floors)	4		Woodland	-1
	Verticalized (above 10 floors)	5		Grassland	-2
Land use (antrrhopogenic gains)	Low heat load	0	Slope	Flat	0
	High heat load	1		Low (1-50 %)	-1
Topographical height	Above 200 m	1		Medium (5-40 %)	-2
	10-200 m	2		High (above 40 %)	-3
	0-10 m	3	Cetylation (roughness length)	No roughness	0
Urban green space (bioclimatic effects)	No green area within urban area	0		Low roughness	-1
	Green area within urban area	-1		High roughness	-2
			Strands orientation	W, SW and NW	0
				S	-1
				N and NE	-2
				SE and E	-3

Adapted from Lemos, 2021/ *Adaptado de Lemos, 2021.*

TABLE II - Flowchart of the three steps performed for analysis, classification and flood susceptibility zoning, used by CPRM.

TABELA II – Fluxograma das três etapas realizadas para análise, classificação e Zoneamento de suscetibilidade a inundações, utilizado pelo CPRM.

Step 1 (hydrographic basin morphometry)	Obtaining the Digital Elevation Model (DEM)	Selection and extraction of morphometric parameters from contributing sub-watersheds	Classification and zoning of susceptibilities to floods, according to morphometric parameters of the hydrographic sub-basins (classes: high, medium, low)
	Definition of flow direction		
	Accumulated area calculation		
	Drain extraction		
	Delimitation of basins and sub-basins		
Step 2 (HAND)	Application of the HAND model for classification and zoning of flood susceptibilities (classes: high, medium, low)		
Step 3 (integration)	Cross-referencing of flood susceptibility classifications obtained in stages 1 and 2, with zoning cut into plain and terrace areas (classes: high, medium, low)		

Adapted from CPRM, 2014 / *Adaptado de CPRM, 2014.*

TABLE III - Correlation matrix between the two susceptibility classifications obtained from steps 1 and 2.

TABELA III - Matriz da correlação entre as duas classificações de suscetibilidade obtidas a partir das etapas 1 e 2.

HAND Model / Morphometric parameters	High	Medium	Low
High	High	High	Medium
Medium	High	Medium	Low
Low	Medium	Low	Low

Adapted from CPRM, 2014 / *(Adaptado de CPRM, 2014).*

concentration of people experiencing homelessness and cross-reference them with climatic susceptibility data, allowing for an analysis of exposure to urban climatic risks.

In addition to that, interviews were conducted with the population to understand the role of the government in the daily lives of these individuals. During the interviews were questioned the relationship of individuals with the climate of the city, impacts and challenges faced. It was also sought to analyze the relationship of public power and the provision of infrastructure to face risk, in addition to the role of NGOs in helping the population daily. Table IV shows the information about the respondents.

Through their statements, it was possible to identify the most critical issues concerning violations of their rights, the processes, and bureaucracies that hinder their daily lives, as well as their main demands. The interviews highlighted problems related to shelter units, healthcare, and the militarization of urban space. It is worth noting that the interviews conducted had a qualitative, not quantitative, character, aiming for diversity among the individuals, which justifies the number of seven interviewees.

Finally, an interview was conducted with a decision-maker from the Municipal Department of Social Assistance in the city of Rio de Janeiro (SMAS). The purpose of this interview was to gather information about the existing shelter units and public shelters in the city, as well as to obtain other information regarding the department's activities and the perspective of the public manager on the issue at hand.

The homeless population in the city of Rio de Janeiro

The homeless population in Brazil exhibits a diverse profile, comprising individuals and families with different backgrounds, distinct daily routines, and varying reasons for being on the streets (Robaina, 2015). However, it is essential to consider the socio-spatial inequality existing in the country, leading to high levels of unemployment, poverty, and hunger throughout Brazilian territory. This inequality became even more pronounced during the

pandemic years due to the lack of opportunities, mass layoffs, and the absence of public policies (Souza, 2020).

In the city of Rio, studies indicate a homeless population of approximately 13,000 people (fig. 4), accounting for approximately 69 % of the total population of homeless individuals in the entire state of Rio de Janeiro (fig. 3). It's worth noting that conducting a census and disseminating data related to homelessness in Brazil faces methodological challenges, along with political interests involved, leading to varying data and figures depending on the methodological procedures used.
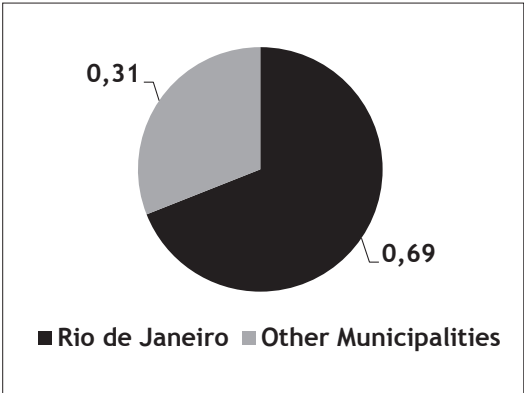

Fig. 3 - Comparison between the total number of families registered in Cadastro Único in the city of Rio de Janeiro, in relation to the other municipalities of the State (Data source: SAGICAD, 2023).

Fig. 3 - Comparativo entre o total de famílias cadastradas no Cadastro Único no município do Rio de Janeiro, em relação aos outros municípios do Estado (Fonte dos dados: SAGICAD, 2023).

This population has experienced significant growth in recent years in the city of Rio de Janeiro (fig. 5), with its concentration in the downtown area due to job opportunities, accessibility, attraction of people, capital, companies, and decision-making (Robaina, 2015). Consequently, it is expected that decision-makers would seek to provide some structure to address some of the issues faced by these individuals. Regarding urban climate, there is a great need for shelter units and public shelters as they offer

Table IV - Characteristics of the interviewees
Tabela IV – Característica dos entrevistados.

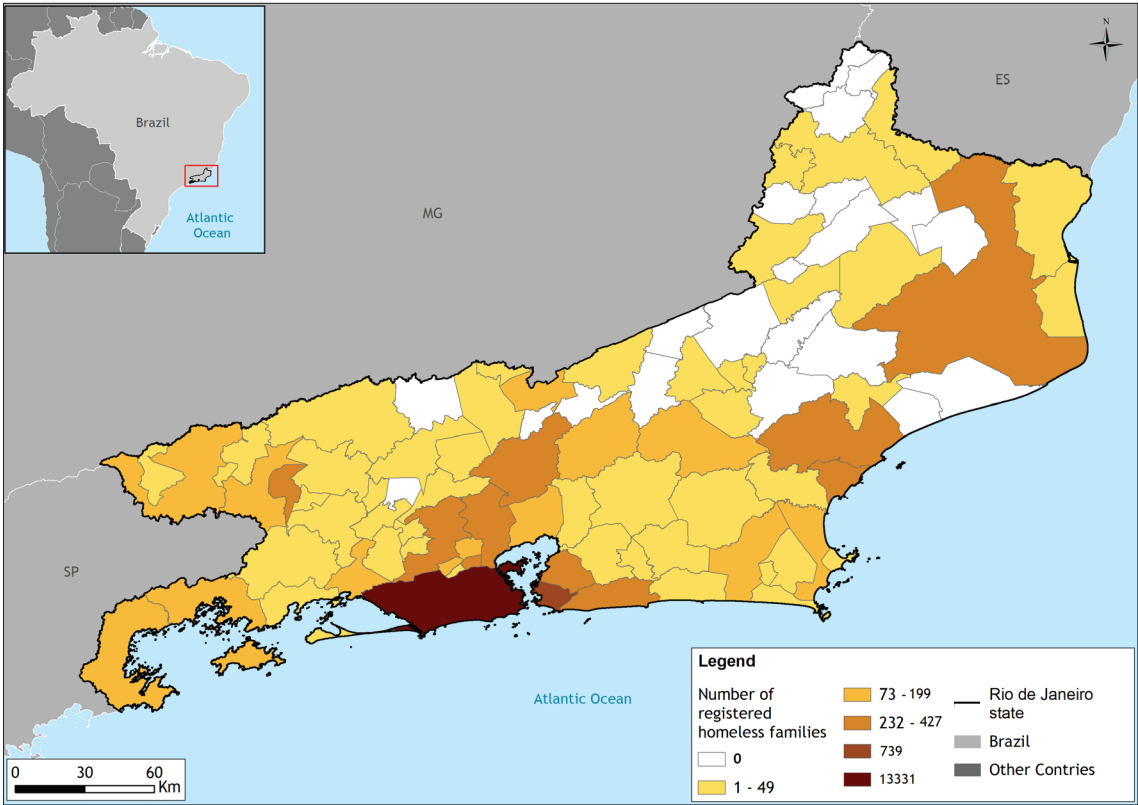| Characteristics	Interviewee						
	1	2	3	4	5	6	7
Gender	Cis man	Trans woman	Cis man	Cis man	Cis man	Cis woman	Cis man
Age group	Young	Young	Middle-aged	Middle-aged	Middle-aged	Young	Young
Length of time on the streets	3 years	1 year	10 years	6 years	1 month	6 months	1 year
Main reason	Financial	Family	Narcotics	Undefined	Nomadism	Financial	Family

Fig. 4 - Map showing the number of homeless families enrolled in Cadastro Único, in the state of Rio de Janeiro
(Data source: IBGE, Data Rio and SAGICAD, 2023).

*Fig. 4 - Mapeamento da quantidade de famílias em situação de rua inscritas no Cadastro Único, no estado do Rio de Janeiro
(Fonte dos dados: IBGE, Data Rio e SAGICAD, 2023).*

protection from rain, cold, and provide areas of relief during excessively hot days. However, what is observed is the inadequacy of these shelters, among other problems and limitations in this policy, which was frequently mentioned during the interviews and is also highlighted in the media through reports from the homeless population.

Additionally, health plays a crucial role in addressing climatic exposure, particularly in dealing with climatic stress caused by heatwaves or extreme cold, as well as treating illnesses related to air quality, etc. (Aleixo, 2012; Mendonça, Monteiro, 2019; Oscar Jr. *et al.*, 2023). However, the same scenario of inadequacy and absence accompanies the healthcare treatment of these individuals.
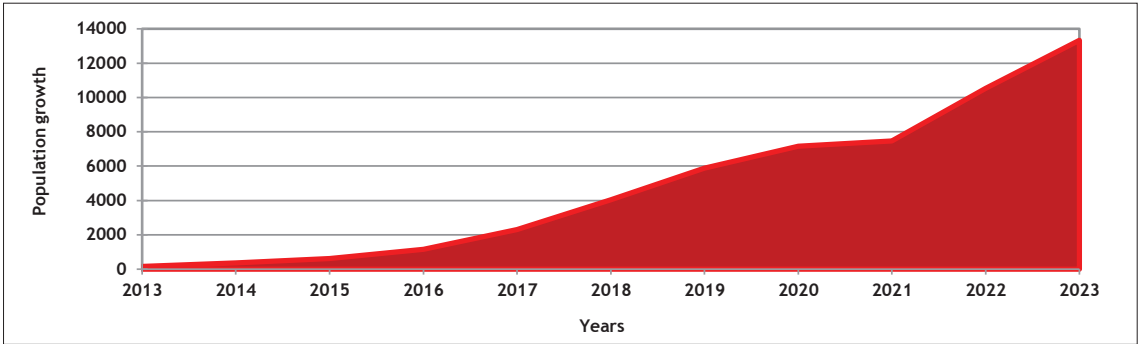
Fig. 5 - Number of homeless families registered in the Single Registry (Cadastro Único) for Social Programs in the Municipality of Rio de Janeiro, from 2013 to 2023. The Single Registry is an instrument for collecting data from families in vulnerable situations for inclusion purposes (Data source: SAGICAD, 2023).

Fig. 5 - Quantidade de famílias em situação de rua cadastradas no Cadastro Único para Programas Sociais no Município do Rio de Janeiro, de 2013 a 2023. O Cadastro Único é um instrumento de coleta de dados de famílias em situação de vulnerabilidade para fins de inclusão (Fonte dos dados: SAGICAD, 2023).

Furthermore, there is the daily confrontation with a hostile urban structure that seeks the social cleansing of space (Filho, Alvim, 2022), characterized by anti-indesirable architectures aimed at pushing the homeless population away from certain areas in the city. This phenomenon is referred to in the literature by Melgaço (2010) as the militarization of urban space, as it involves the use of violent and aggressive, almost military, measures to expel people. This is often disguised as a desire for security but, in reality, perpetuates stigmas and symbolic violence against those who are marginalized and invisible (Melgaço, 2010).

All these factors contribute to a process of erasure and invisibility of basic rights for the population, intensifying their vulnerability and susceptibility to various issues faced in their daily lives.

Public Policies and the programmatic dimension of vulnerability

The concept of vulnerability seeks to explain that exposure to risks is not solely a result of individual behavior, challenging the idea of individual blame. Therefore, the multidimensional nature of the vulnerability concept takes into account collective and contextual factors.

In this context, it is essential to understand the institutional role in providing the capacity to respond and protect the urban climate for a population facing erasure and violation of their basic rights such as health and housing. According to healthcare professionals, exposure to urban hardships can lead to dehydration, leptospirosis, hepatitis, respiratory and gastrointestinal infections, hypothermia, or hyperthermia for individuals experiencing homelessness. Additionally, there is a confrontation with the symbols scattered throughout the city that highlight the anti-undesirable nature of the housed population, along with the denial of their rights.

> "*The analysis plan for the programmatic (or institutional) dimension of vulnerability precisely aims to assess how, under given social circumstances, institutions, especially those related to health, education, social welfare, and culture, act as elements that reproduce, if not exacerbate, socially determined conditions of vulnerability*" (Ayres *et al.*, p. 397, *authors' free translation*).

According to the interviews conducted with the homeless population in the central district of Rio de Janeiro, it was evident that there is a lack of government assistance, inadequacies in shelter institutions, and particularly a stigma experienced at all levels, especially concerning healthcare. This

situation has various consequences for the population, exacerbating the preexisting degree of vulnerability and further intensifying their exposure to various types of risks on the city streets. That's why we argue that programmatic vulnerability, despite being widely used in the field of public health, is of great importance for the field of environmental (and social and technological) risk, given its comprehensive perspective on social structure.

Militarization of urban space

Generally associated with the concept of "urban securitization," the "militarization" of urban space is used to describe the processes of implementing objects and infrastructures aimed at achieving some form of security or the perception of it, often based on fear and segregation. These urban forms aim to create spaces that prevent and expel unwanted individuals or groups, seeking to protect private and public properties and prevent the devaluation of commercial areas or real estate developments, in other words, aiming to meet the demands of private capital:

> "*It is also important to highlight that securitization is primarily concerned with property security and only secondarily with personal security. Furthermore, security is the main but not the sole objective of the securitization process, as it is also used to promote segregation by creating homogeneous spaces free from unwanted individuals*" (Melgaço, 2010, p. 67, *authors' free translation*).

The concept of the militarization of space is related to the symbolism of the built forms in this process, which increasingly resemble war and militarized scenes. Examples include electric fences, barbed wire, and motion sensors.

In the context of the homeless population, this anti-undesirable architecture can be considered even more "heavy" and militarized. Furthermore, many times these infrastructures are validated, accepted, and even encouraged by society, with fewer questions raised about the treatment of people experiencing homelessness. In one of the interviews, the use of grease or oil on certain establishments to prevent people from staying there was reported, for example. Another common aspect in some areas of the downtown district is the placement of iron bars on benches, preventing people from sleeping on them or distancing themselves from the often colder ground or puddles on rainy days (photo 1).

Melgaço (2010) points out the symbolic violence experienced by these individuals. The militarization of urban space promotes images of war and makes it clear the goals of expulsion and segregation of an entire

Photo 1 - Bench in a square in Cinelândia, a neighbourhood near Downtown area, in the city of Rio de Janeiro. The bench features an iron bar across the middle, making it impossible to sleep with the body stretched
(Photograph from the authors' archive, taken in 2021).

Fot. 1 - Banco em praça na Cinelândia, bairro próximo ao Centro, na cidade do Rio de Janeiro. O banco apresenta uma barra de ferro no meio, impedindo a possibilidade de dormir com o corpo esticado
(Fotografia do arquivo dos autores, tirada em 2021).

social group. This fact is even more concerning because it not only originates from the private sector but also has direct involvement from the government, which should be providing the infrastructure to address these problems rather than generating and exacerbating them (photo 2).

Photo 2 - Workers from a company contracted by São Paulo City Hall install uneven and pointed stones under an overpass. The action by São Paulo City Hall was intended to deter and remove homeless people from this area
(Source: Folha de São Paulo, 2021).

Fot. 2 - Trabalhadores de uma empresa contratada pela Prefeitura de São Paulo instalam pedras desniveladas e pontiagudas embaixo de um viaduto. A ação da Prefeitura de São Paulo teve a intenção de evitar e afastar moradores de rua nessa área
(Fonte: Folha de São Paulo, 2021).

Beyond the symbolism and segregation that accompanies this anti-undesirable infrastructure, there are other problems and consequences associated with it, such

as increased exposure to climate risk caused by hostile architectures. The removal of awnings (photo 3), for instance, prevents protection from rain and direct solar radiation. Awnings were identified in interviews as one of the primary strategies for protection against weather phenomena. Therefore, the policy of removing awnings restricts safe and more climatically comfortable areas for occupation, leading to an increased exposure of this population to urban climate risk.

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Photo 3 - Impediment in overhangs. a) Removal of overhang from a building in a street of the Flamengo neighbourhood. b) Potted plants placed under an overhang on a street in the neighbourhood of Botafogo. Photo (b) was taken on a rainy day and a piece of cardboard can be seen, left behind by a homeless person who was prevented from staying there. Both images show actions taken to prevent homeless people from staying in that place, contributing to their exposure to rain and solar radiation
(Photograph from the authors' archive, taken in 2023)

Fot. 3 - Impedimento em marquises. a) Retirada de marquise de um prédio em uma rua do bairro Flamengo. b) Colocação de vasos de plantas embaixo de uma marquise em uma rua no bairro de Botafogo. A fot. b foi tirada em um dia de chuva e é possível perceber a presença de um papelão deixado para trás por alguma pessoa em situação de rua, que foi impedida de permanecer naquele local. Ambas as imagens apresentam ações que procuraram impedir a permanência de pessoas em situação de rua no local, contribuindo para a exposição à chuva e radiação solar (Fotografia do arquivo dos autores, tirada em 2023).

This is a population that grows every day, as does the movement to expel them. In this regard, authors point to the occurrence of a double exclusion: the denial of access to housing and the denial of space (Melgaço, 2010; Robaina, 2015), to which we also add the denial of environmental protection and comfort.

Housing Dimension: Shelter Units

The Brazilian Federal Government, through the Ministry of Social Development and Assistance, Family, and Hunger Combat, defines Shelter Units (SUs) as follows:

"[...] *provide specialized services that offer shelter and protection to individuals and families temporarily separated from their family and/or community nucleus and are in a situation of abandonment, threat, or violation of rights. These services serve as temporary housing until the person can return to their family, be referred to a substitute family when applicable, or achieve autonomy*" (Brazil, 2019, *authors' free translation*).

According to the Brazilian government, municipalities have autonomy in structuring these SUs, which can vary depending on the reality of each territory. These units accommodate various groups, including children and adolescents, adults and families, elderly individuals, women victims of violence, people with disabilities, and individuals facing calamities and emergencies (Brazil, 2019). Furthermore, they can be provided by both the public and private networks. In this study, data related to public network SUs serving children and adolescents, adults and families, and elderly individuals in the Rio de Janeiro area will be discussed, considering the study's objectives regarding public services and the homeless population.

In the city of Rio de Janeiro, the agency responsible for receiving and sheltering the homeless population is the Municipal Department of Social Assistance (SMAS, in portuguese). Public agents work 24 hours a day, seeking to provide assistance to the population and directing individuals according to their needs. It's worth noting that the department's activities primarily focus on the neighborhoods of the South Zone and Center, which have the highest number of homeless individuals and are also areas with greater economic attraction in the city. However, as a result of this, the department's presence in other neighborhoods is often limited.

The first contact with SMAS is made through an agent who collects the data of the person being approached. Following this, the person is asked if they are interested in shelter, and if the response is affirmative, they are typically directed to Reception Centers. In the city of Rio, there are three reception centers located in neighborhoods significantly distant from the Center (fig. 6). The neighborhood of Paciência plays an important role in providing shelter to these individuals, being approximately 63 km away from the Center and other more central neighborhoods with a higher concentration of homeless population.

In these centers, individuals receive food and can take showers before being directed to other locations based on their needs. They may be referred to shelters, where they can spend the night and leave in the morning; more structured Accommodation Units, where they
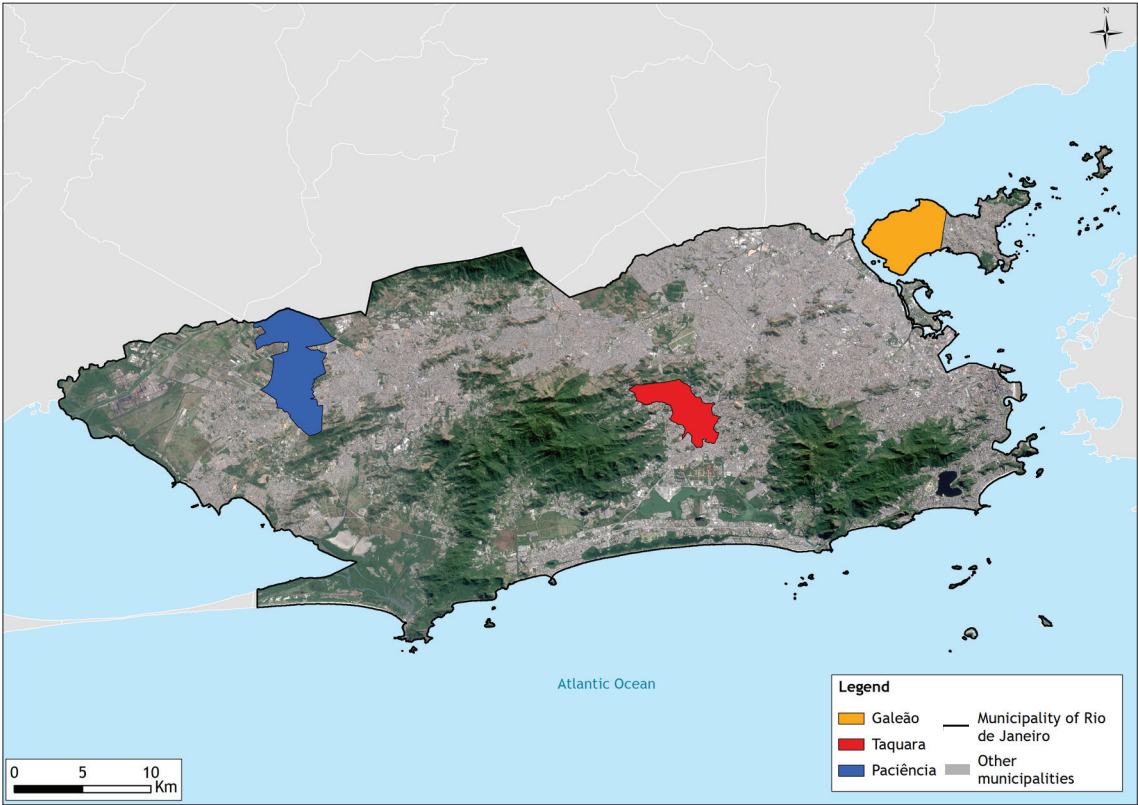

Fig. 6 - Neighbourhoods where Reception Centres have been installed for homeless people (Source: SMAS, 2023).

Fig. 6 - Bairros em que estão instalados os Centros de Recepção para população em situação de rua (Fonte: SMAS, 2023).

can stay for the day and engage in activities for a longer duration; or they may be referred for medical or psychiatric care. According to SMAS, there are 33 Public Network UA (Units of Accommodation) scattered throughout the city, categorized into the following axes: SUs (6), Adults and Families (11), and Children and Adolescents (16) (fig. 7).

From the mapping of the units and Reception Centers, there is a noticeable trend of these locations moving away from the city center and the South Zone. It's worth noting that the South Zone includes the city's most famous tourist neighborhoods and is also where the Rio de Janeiro elite resides, such as Ipanema and Leblon, where the price per square meter is the highest in Brazil. It's in these neighborhoods that scenes and reports of hostile treatment towards people experiencing homelessness occur more frequently, along with the promotion of urban space militarization (photo 4). What can be observed through the maps is an uneven distribution of UA throughout the municipality and the distancing of units from the city center, which has only three closely spaced shelter units where individuals can spend the night and must leave the following day.

Thus, one can observe an attempt to push people experiencing homelessness away from the more central and affluent neighborhoods of the city, thereby

prioritizing real estate capital (Mascarenhas, 2014). This fact illustrates the daily violence experienced by the population, leading them to opt not to use public shelters to avoid being taken to distant neighborhoods in the municipality. The City Center, for instance, is where they carry out their activities, have some source of income, and receive support and assistance from NGOs.

According to the interviews conducted with the homeless population, these shelter units face significant problems beyond the issue of distance (fig. 8). The number of available spots in these shelters is small compared to the number of homeless people in the city of Rio. According to the official website of the Federal Government, these shelters offer between 10 and 50 spots each (Brazil, 2019). Furthermore, all the interviewees mentioned the lack of hygiene in these units, as well as incidents of violence and theft. There are also security issues related to gender and LGBTQIAPN+ phobia. Many times, people experiencing homelessness prefer to stay on the streets rather than use this public service (Robaina, 2015).

Therefore, all these factors present obstacles to the use of Shelter Units in the city, whether due to the lack of available spots, distance, security or hygiene issues, which keep individuals on the streets and exposed to the risks posed by urban weather conditions.
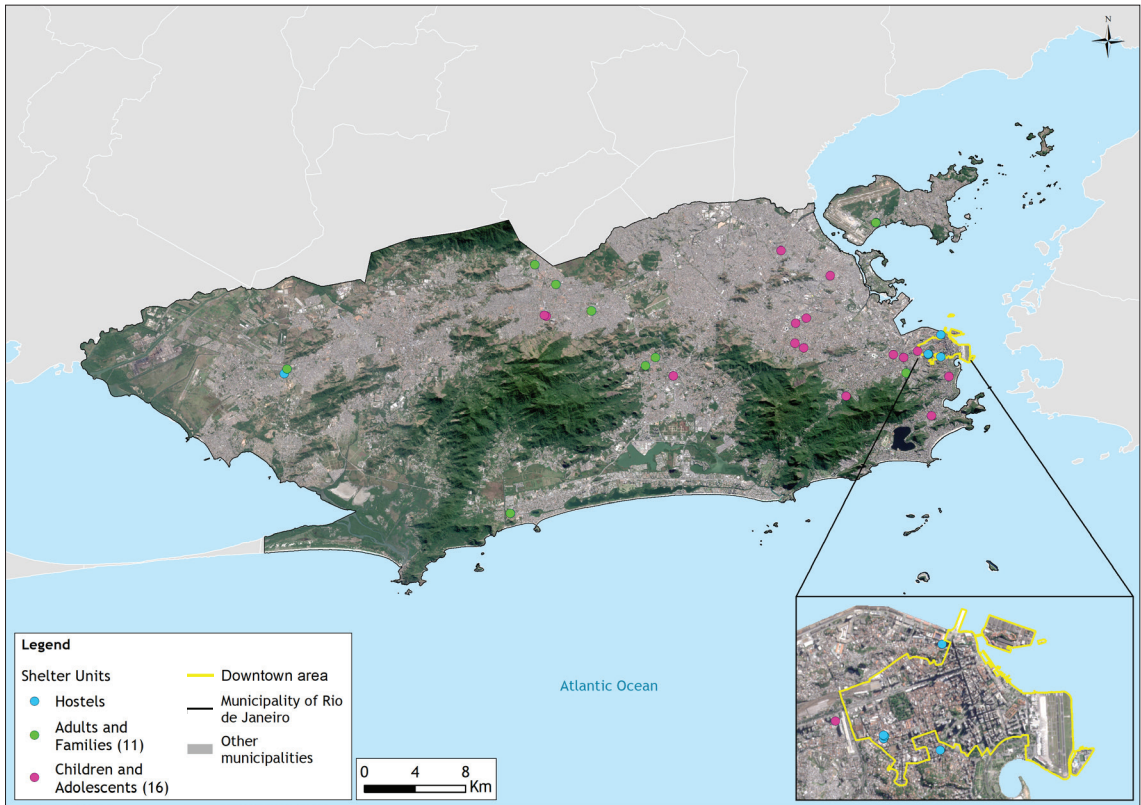

Fig. 7 - Map of the distribution of Reception Units (Unidades de Acolhimento) in the city of Rio de Janeiro (Source: SMAS, 2023).

Fig. 7 - Mapeamento da distribuição das Unidades de Acolhimento na cidade do Rio de Janeiro (Fonte: SMAS, 2023).
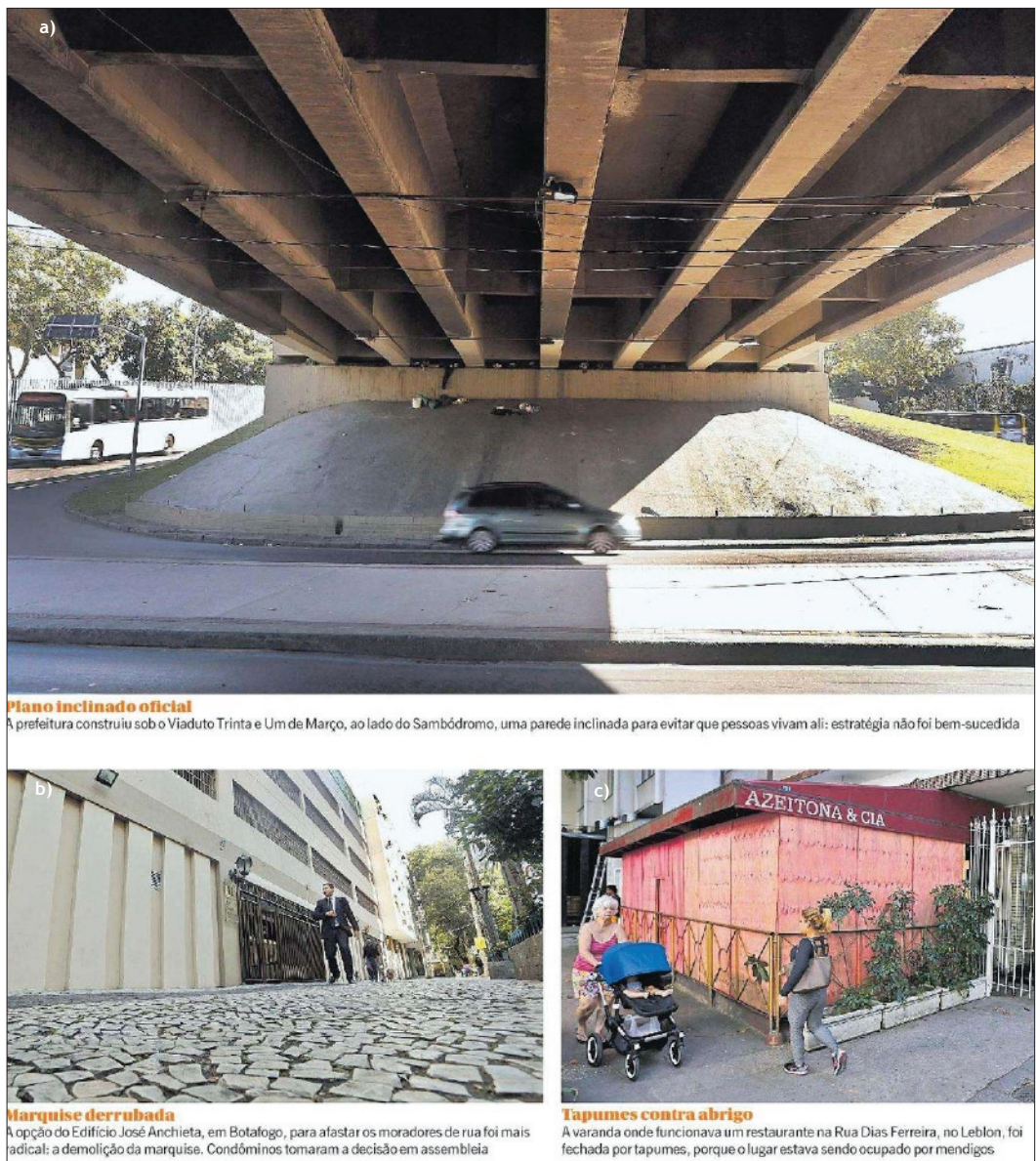
Photo 4 – O Globo newspaper report that presents various forms of militarization of space in the city of Rio, aimed at the removal of homeless people. Translations of the news articles: a) Official sloping wall - The City Hall built a sloped wall under the March 31 viaduct, next to the Sambadrome, to prevent people from living there: the strategy was not successful; b) Marquee demolished - The residents of the José de Anchieta Building in Botafogo took a more radical approach to drive away homeless people: a condominium meeting decided to demolish the marquee; c) Hoardings against shelter - The balcony where a restaurant used to operate on Dias Ferreira Street, in Leblon, was closed off with hoardings because the place was being occupied by beggars (Source: O Globo, 2020).

Fot. 4 - Reportagem do Jornal O Globo que apresenta diversas formas de militarização do espaço na cidade do Rio, voltadas para o afastamento da população em situação de rua (Fonte: O Globo, 2020).

Fig. 8 - Translation: "The elderly report infestation of bedbugs in Albergue Alfonso Lavalle, in Lapa. Images obtained by BandNews FM show several nests of these animals in the mattresses and pillows that are in use". Newspaper report about an infestation of bed bugs in a Reception Unit for the elderly, near the Downtown area (Source: Band, 2023).

Fig. 8 - Reportagem denunciando uma infestação de percevejos em uma Unidade de Acolhimento para pessoas idosas, próxima ao Centro (Fonte: Band, 2023).

Health Dimension

A third aspect observed in the challenging reality of the homeless population in the city of Rio de Janeiro is access to medical assistance. The health dimension has significant impacts on the daily lives of the population, who face difficulties in accessing healthcare services and treatments, despite the existence of the Brazilian Unified Health System (SUS, in Portuguese), which is free and universal for all.

Exposure to the urban climate of Rio de Janeiro has health impacts, resulting from air pollution, rainfall and flooding events, cold and heatwaves. For the homeless population, exposure to these phenomena is very high due to their presence on the streets, with limited possibilities for protection, as seen, for example, in relation to the lack of access to public shelters. Furthermore, the militarization of urban space exacerbates this exposure situation, leading to health consequences as well (Oscar Jr. *et al.*, 2023).

Regarding medical care, there is a system called "Consultório na Rua" (Street Clinic) specialized in providing medical services to the homeless population in the city of Rio. However, according to the literature and the interviewees, this type of service is still limited due to technical unpreparedness and cases of prejudice and hostility in receiving these individuals (Oscar Jr. *et al.*, 2023). Therefore, in many cases, individuals prefer not to return to healthcare facilities.

It is necessary to understand that there is a social structure involving economic, social, cultural, and political aspects that influence individual lifestyles (Ayres *et al.*, 2009). Therefore, limitations and the lack of access to healthcare services hinder the capacity to respond and be resilient in the face of climate exposures. This is a social group with various opportunities for exposure to causal agents of diseases, considered people under threat and a population at risk represented by exposure, especially in the case of climate-related diseases. As Ayres *et al.* (2009) point out, increased exposure leads to an increase in the incidence of infection. Additionally, it becomes difficult to monitor individuals who often cannot maintain medium and long-term treatments, which was mentioned by the Municipal Social Assistance Secretariat (SMAS) as one of the major challenges of public policy and the work of the "Consultório na Rua" program.

Another important point is the health of elderly individuals, especially regarding dehydration issues. There is concern on the part of the Social Assistance Secretariat, but there is a lack of infrastructure. In another neighborhood of the city, it was reported that there were around 108 elderly people in situations of homelessness who expressed a desire to be taken to Shelter Units. However, the issue is the lack of available spots for these individuals, forcing them to remain on the streets.

Therefore, the existing structural and social reality in the area determines health opportunities based on exposure to harmful conditions and affects susceptibility to risks and different situations of vulnerability (Barata, 2009).

Urban Climate and Programmatic Vulnerability

The municipality of Rio de Janeiro presents a specific climatic context characterized by the relationship between geomorphology and urban structures. The city is surrounded by three coastal massifs, marked by its proximity to the coastline, humidity influence, and tropical climate. Therefore, this configures a climatic reality characterized by precipitation events and high temperatures (Brandão, 2019).

The urbanization process of the municipality has, in its history, a significant transformation of landscapes, mainly due to urban reforms over the years that carried a hygienic character (Filho, Alvim, 2022) and aimed to serve private capital (Mascarenhas, 2014).

The neighborhood of Centro (Downtown) was the focus of these transformations precisely because of its centrality and importance to the city of Rio, given its attractiveness to significant flows such as financial and real estate capital. It is also an important location for decision-making, as it houses numerous public institutions influenced by political and social factors.

Historically, the area was characterized by various wetlands, swamps, and lakes (Braga, 2020). Throughout its history, it underwent various urban reforms that involved land reclamation, removal of hills, river channelization, changes in surface and underground drainage, soil sealing, street widening, and vertical growth through the construction of buildings (Braga, 2020). This led to a susceptibility to the formation of water pockets, flooding, and favorable conditions for the creation of urban heat islands.

In addition to this, the social hygiene aspect of these reforms favored and intensified spatial segregation, leading to the violent actions of public and decision-making agents, as well as stigma and prejudice from passersby, shopkeepers, and residents of the neighborhood (Robaina, 2015).

When analyzing the climatic aspects of the neighborhood in question and relating them to the homeless population in the city of Rio de Janeiro, we can conclude that there is exposure to climatic risk, capable of causing various problems for the population. What we observe, therefore, are some risks to which the population of Rio de Janeiro is exposed, but in different ways, depending on the degree of vulnerability of a particular social group:

"Exposure includes the socioeconomic and demographic component, which captures the predisposition of a population group to be harmed by a hazardous phenomenon. This predisposition results from the level of marginality, social segregation, and economic weakness to which a particular population group is subjected. Often, the exposure is manifested in the territory receptivity due to the absence of infrastructure, which potentializes and catalyzes dangerous and impactful processes and, consequently, the population exposure" (Oscar Jr. *et al.*, 2023).

Based on fieldwork, it was possible to estimate and map the location of the homeless population in the neighborhood of Centro. By cross-referencing this information with data on susceptibility to flooding obtained from the Brazilian government's Geological and Environmental Resources Research Company (CPRM, in Portuguese), it is possible to see the risk exposure experienced by these individuals (fig. 9).

Furthermore, through the mapping of susceptibility to the formation of heat islands in the neighborhood (fig. 10) carried out by Lemos (2021) based on the methodology of

the Urban Climate Map developed by Katzschner (1988), it is also possible to observe the problems faced in relation to exposure to solar radiation, heat islands, and thermal stress.

The population is concentrated in areas highly susceptible to the formation of heat islands, as indicated by classes 6, 7, and 8, as shown on the map. These areas are associated with higher foot traffic and provide greater security for the homeless population. However, they also become more exposed to constant situations of thermal stress, which can be detrimental to human health.

It is possible to perceive, therefore, the importance of climatic analyses that promote the understanding of the unequal production of space, seeking to comprehend the processes experienced by vulnerable individuals who suffer from the lack of shelter and access to the necessary mechanisms to confront risky situations.

Conclusions

The unequal organization and production of space began to promote a significant population increase of homeless people in the city of Rio de Janeiro who began to occupy the most central neighborhoods of the city, seeking access to profitable means and help from people and NGOs.
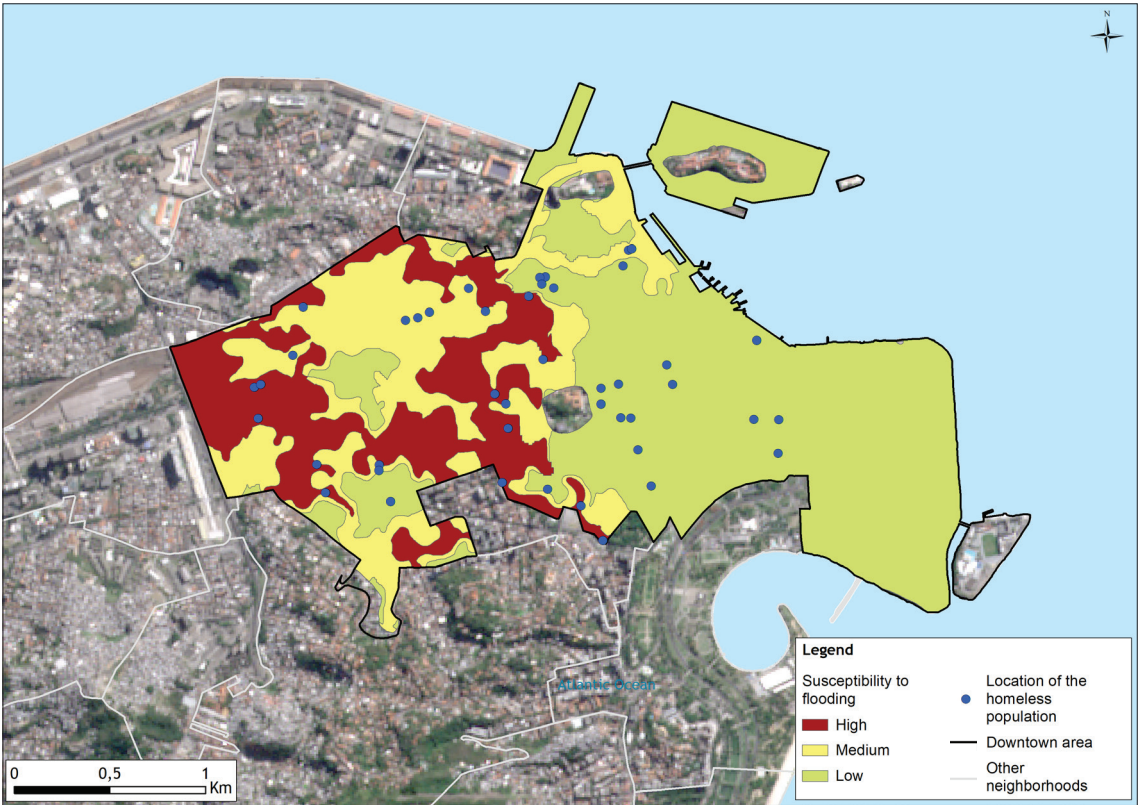

Fig. 9 - Flood susceptibility map of the Downtown area. The blue dots show the location of the homeless population in the neighbourhood (Data source: CPRM (2018), Pia do Bem, 2020).

Fig. 9 - Mapeamento de suscetibilidade à inundação, no Centro. Os pontos em azul mostram a localização da população em situação de rua no bairro (Fonte dos dados: CPRM (2018), Pia do Bem, 2020).

The city of Rio de Janeiro has climatic characteristics that include heavy precipitation events and high temperatures. Therefore, the way the urban structure is designed will determine the impacts on the homeless population in the city. Removing building marquises leads to greater exposure to solar radiation and lack of protection against rainwater. Attempts to render benches in public squares unusable force the population to stay on the streets, exposed to puddles of water or to very low temperatures on cold days and very high temperatures on hot days. The lack of available spots in shelters, along with their precarious conditions, results in people remaining in public spaces without access to suitable places to sleep, bathe, seek shelter from the cold and heat, eat, and address health issues.

Amidst this reality, one of the consequences of the lack of access, expulsion, and segregation of people from certain places is the illness of this population, who face the city's sanitation problems, water contamination, accumulation of debris and dirt on the streets, respiratory, circulatory, gastric, and dermatological diseases, as well as thermal stress and discomfort, which can lead to death. This fact is exacerbated by easy access to drugs and alcohol, which also serve as an escape from reality.

When dealing with the risks to urban weathering, it was possible to observe through the risk mapping and fieldwork the high susceptibility to atmospheric events to which this vulnerable population is exposed,

especially in relation to the events of rain and formation of heat islands. This fact is intensified through public and private mechanisms to prevent the use of protective spaces, in addition to the limitations found in health care and shelter.

Therefore, it is possible to list some suggestions for improvements in terms of these policies. Regarding the use of anti-undesirable architecture, in 2023 the Júlio Lancelotti Law was passed in Brazil, which prohibits the use of these impediments in urban space. Other possibilities extend to the largest job offers and guarantee the rights of the population, along with policies directly focused on the demands of these people, based on their perceptions and needs.

The offer of Public units for temporary shelter with provision of fresh water and air-conditioned spaces and Reception Units in the central areas of the city becomes exceptional for ensuring the care of the population, joining the technical preparation of health professionals to ensure the care and monitoring of this public. Moreover, It is important to improve early warning systems with specific strategies to inform the homeless population about imminent adverse weather conditions; distribute survival kits containing essential items such as suitable clothing and waterproof blankets; install drinking water points at strategic locations to ensure access to safe liquids during heatwaves; create cooling areas in public facilities, with shades, to provide
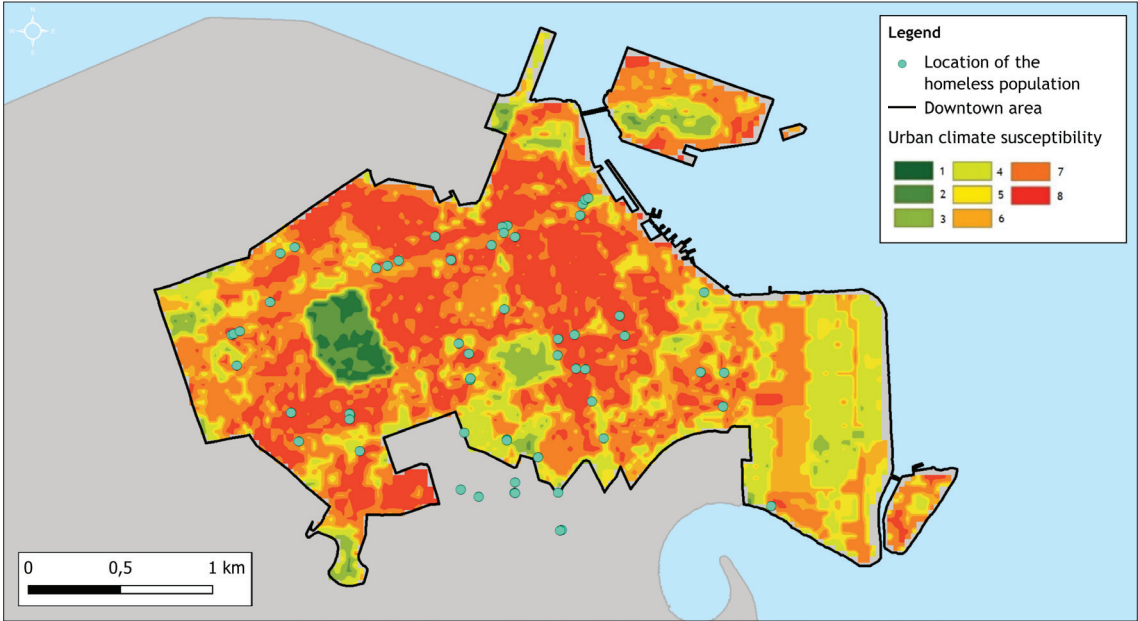

Fig. 10 - Map of urban climate susceptibility, in the Downtown area, where classes 1, 2, 3, 4 and 5 are considered moderate or neutral and classes 6, 7 and 8 are considered strong moderate, strong, or very strong in relation to the impact on thermal comfort (Source: Adapted from: Lemos, 2021, p. 109).

Fig. 10 - Mapeamento de suscetibilidade climática urbana, no Centro, onde as classes 1, 2, 3, 4 e 5 são consideradas moderadas ou neutras e as classes 6, 7 e 8 são consideradas moderadas fortes, fortes ou muito fortes, em relação ao impacto no conforto térmico (Fonte: Adaptado de Lemos, 2021, p. 109).

relief during periods of intense heat; provide training for the homeless population on how to deal with climate emergencies and promote awareness of associated risks.

Therefore, it is essential to understand the role of public policies in intervening and preventing these processes. This requires an ethical commitment to equity, aiming to implement systems that can provide protection and support while also being mindful of not reproducing actions and professional services that increase vulnerability and social inequality.

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