Housing Deficit Index (HDI) in Brazil: analysis based on the 2022 Census Data

Índice de Carência Habitacional no Brasil: análise a partir dos dados do Censo 2022

Maurício Polidoro [1]

Daniel Canavese de Oliveira [2]

[1] *Doctorate in Geography, Associate Professor, Federal Institute of Rio Grande do Sul, Porto Alegre, RS, Brazil*
E-mail: mauricio.polidoro@poa.ifrs.edu.br

[2] *Doctorate in Sciences of Health, Associate Professor, Federal University of Rio Grande do Sul, Porto Alegre, RS, Brazil*
E-mail: daniel.canavese@ufrgs.br

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ABSTRACT

This study analyses the Housing Deficit Index (HDI) in Brazil based on data from the 2022 Demographic Census. The index incorporates indicators of inadequate access to water supply, sanitation, and solid waste management. A cross-sectional ecological design was applied, using descriptive statistics, Pearson and Spearman correlation coefficients, and the Kruskal-Wallis test. Results show significant regional and urban-rural disparities, with the worst housing conditions concentrated in the North and Northeast regions. The HDI was strongly correlated with the Municipal Human Development Index (MHDI) and moderately associated with the Brazilian Deprivation Index (IBP). In addition, municipalities classified as more deprived exhibited significantly higher proportions of non-white populations, reinforcing the relationship between housing precariousness and structural racial inequality. The HDI proved to be a robust and replicable tool for monitoring housing deprivation, offering support for territorialised public policies aimed at reducing socio-spatial and racial disparities in access to basic infrastructure.

Keywords: Housing Deficit. Basic Sanitation. Regional Inequalities. Public Policies. 2022 Census.

RESUMO

Este estudo analisa o Índice de Déficit Habitacional (IDH) no Brasil com base em dados do Censo Demográfico de 2022. O índice incorpora indicadores sobre acesso inadequado ao abastecimento de água, esgotamento sanitário e gestão de resíduos sólidos. Aplicou-se um delineamento ecológico transversal, utilizando estatística descritiva, coeficientes de correlação de Pearson e Spearman e o teste de Kruskal-Wallis. Os resultados mostram disparidades regionais e urbano-rurais significativas, com as piores condições de moradia concentradas nas regiões Norte e Nordeste. O IDH apresentou forte correlação com o Índice de Desenvolvimento Humano Municipal (IDHM) e moderadamente associado ao Índice Brasileiro de Carência (IBP). Além disso, municípios classificados como mais carentes apresentaram proporções

significativamente maiores de populações não brancas, reforçando a relação entre precariedade habitacional e desigualdade racial estrutural. O IDH se mostrou uma ferramenta robusta e replicável para o monitoramento da privação habitacional, oferecendo subsídios para políticas públicas territorializadas que visem à redução das disparidades socioespaciais e raciais no acesso à infraestrutura básica.

Palavras-chave: *Carência Habitacional. Saneamento Básico. Desigualdades Regionais. Políticas Públicas. Censo 2022.*

1 INTRODUCTION

Intense socio-spatial segregation processes characterise the geography of urbanisation in Brazil, reflected in disparities in access to housing, infrastructure, and basic services (Guimarães, 2016; Maricato, 1996). The often-unregulated growth of cities, driven by socio-economic and political factors, has resulted in an urbanisation pattern marked by duality, with well-equipped areas coexisting alongside precarious ones (Rolnik, 1999). In this context, housing—recognised as a fundamental constitutional right (Brasil, 1988)—is directly linked to the availability of essential services, such as basic sanitation, healthcare, education, public security, and mobility (Rolnik, 2015; Souza, 2000). The absence or insufficiency of these services not only compromises the population's quality of life but also reinforces the perpetuation of exclusion, public health issues, and social vulnerability (Moreno *et al.*, 2022).

Among the key structural elements of housing quality, basic sanitation stands out as one of Brazil's main urban and environmental challenges (Coutinho, 2021; Sousa *et al.*, 2015). Historically overlooked in medium- and long-term public policies, the sector has suffered from inconsistent investment, leading to significant urban, regional, and intra-regional disparities in service provision. The centralisation of planning in the 1970s through the National Sanitation Plan (Planasa) expanded coverage in medium and large cities but was insufficient to ensure universal access (Brito *et al.*, 2012; Costa, 1991; Coutinho, 2021). The intensification of the economic crisis in the 1980s and shifts in federal governance and public management models in the 1990s exacerbated inequalities, leaving vast urban and rural areas without adequate access to sanitation, particularly in metropolitan peripheries and small municipalities (Botelho, 2002; Oliveira *et al.*, 2019). The enactment of the Basic Sanitation Legal Framework (Law No. 14,026/2020) set a goal for universalising services by 2033 (Coutinho, 2021; Fortini; Miranda, 2021), aiming for 99% of the population to have access to potable water and 90% to sewage treatment. However, structural challenges persist (Costa, 2023), especially concerning the financial feasibility of expanding infrastructure in historically neglected areas and municipalities' capacity to meet new regulatory requirements.

The inadequacy of sanitation services has direct implications for public health (Barrocas *et al.*, 2019; Heller, 1998) and environmental sustainability (Souza *et al.*, 2015), particularly in the context of environmental racism. Environmental racism is not only about differential exposure to pollution but also reflects a historical process of infrastructural neglect in territories inhabited predominantly by non-white populations, reinforcing cycles of socio-environmental vulnerability (Jesus, 2020). The lack of sewage networks and improper waste disposal facilitates the spread of waterborne and vector-borne diseases, disproportionately affecting impoverished populations (Teixeira *et al.*, 2014), particularly in the context of environmental racism (Jesus, 2020). Moreover, water pollution resulting from untreated sewage threatens ecosystems, water availability, and exacerbates environmental management issues in various regions of the country (Oliveira; Lobo, 2010).

These challenges are further intensified by the worsening impacts of climate change, which affect the hydrological cycle and heighten pre-existing vulnerabilities. Extreme events, such as prolonged droughts, heatwaves, and intense rainfall, place additional pressure on already deficient infrastructure, increasing the risk of landslides, flooding, and groundwater contamination (Maia *et al.*, 2017; Silveira *et*

al., 2019). Thus, the failure to achieve universal sanitation not only perpetuates historical demands but also amplifies the effects of the climate crisis, particularly in environmentally sensitive areas.

Against this backdrop, this study aims to present and analyse the Housing Deficit Index (HDI), applying it to all Brazilian municipalities using data from the 2022 Demographic Census. Through geostatistical analysis, the study seeks to identify spatial patterns of housing precariousness and its correlations with other relevant variables. The adopted approach allows for the quantification of inequalities in access to sanitation and urban infrastructure, providing critical insights for public policies aimed at reducing the housing deficit and promoting the right to adequate housing, particularly considering the challenges posed by the climate crisis.

2 METHODOLOGY

The formulation of the Housing Deficit Index (HDI) followed the methodology proposed by the Institute for Research and Urban and Regional Planning (Ippur), as outlined in the Methodological Note on the Housing Deficit Index, developed by the Metropolis Observatory at the Federal University of Rio de Janeiro in 2003 (Ippur, 2003). This index aims to quantify inadequate housing conditions by considering access to essential sanitation services, such as water supply, sewage disposal, and solid waste management.

For the operationalisation of the HDI, data from the IBGE Automatic Recovery System (Sidra), based on the 2022 Demographic Census (IBGE, 2025), were used. The analysed variables followed appropriate criteria: water supply was classified as adequate when sourced from a piped general network or an artesian well and inadequate when derived from alternative sources, such as shallow wells or rainwater collection. Sewage disposal was considered adequate when managed through a general sewage system or septic tank, and inadequate when involving rudimentary cesspits or direct discharge into water bodies. Solid waste management was deemed adequate when carried out by formal collection services, either direct or indirect, and inadequate when waste disposal occurred through burning, burial, or dumping on irregular sites.

Additionally, sociodemographic data from the 2022 Census were used to characterise the racial composition of municipalities. The population was categorised according to the official IBGE classification: white, Black, brown (pardo), yellow (Asian descent), and Indigenous. In this study, the proportion of the non-white population was computed by aggregating individuals who identified as Black, brown, yellow, or Indigenous. This variable was subsequently used in a comparative analysis to investigate differences across the levels of housing deprivation. To assess whether the distribution of the non-white population varied significantly between the HDI classification groups, a Kruskal–Wallis test was performed.

The data extracted from the 2022 Census underwent a pre-processing phase in which missing or null values were replaced with zero. The calculation of the HDI followed the methodological structure proposed by Ippur, where the index for each municipality was obtained from the percentage of households in inadequate conditions, considering 0% as the best scenario (absence of housing deficiencies) and 100% as the worst (all households in inadequate conditions). The final index resulted from the weighted aggregation of sub-indices, with differentiated weights according to the relevance of each component: HDI-Water (weight 3), HDI-Sewage (weight 2), and HDI-Waste (weight 1).

To assess the relationship between housing conditions and human development, a correlation analysis was conducted between the HDI and the Municipal Human Development Index (MHDI), using data from 2010, obtained from the Institute for Applied Economic Research (Ipea), a federal public institution responsible for government policy analysis in Brazil. Additionally, data on rural and urban populations from the 2022 Demographic Census were considered. Pearson's correlation coefficient was employed to measure

the association between the indicators, allowing for the identification of socio-economic inequality patterns related to housing conditions. All analyses were performed using Google Colab with the Python programming language, and thematic maps were created using QGIS 3.30.1 to spatialise the HDI.

In addition to the variables described above, the Brazilian Deprivation Index (IBP) was incorporated into the analysis to explore associations between general socio-economic deprivation and housing inadequacies. The IBP is a composite indicator developed by the Centre for Data and Knowledge Integration for Health (Cidacs/Fiocruz Bahia), based on data from the 2010 Demographic Census, and includes dimensions of income, education, and housing quality. The municipal-level IBP data were obtained from the public database provided by Cidacs (Cidacs, 2025). To assess the association between the HDI and the IBP, Spearman's rank correlation coefficient was calculated, given the differences in scale and distribution between the two indices. Additionally, municipalities were stratified by IBP quintiles to compare distributions of the HDI across deprivation levels.

This study is classified as an ecological, cross-sectional analysis based exclusively on publicly available secondary data aggregated at the municipal level. All data were obtained from official and open-access sources. In accordance with national and international research ethics guidelines, the use of anonymised and aggregated public data does not require prior approval from an ethics committee. Nonetheless, ethical principles related to data transparency, responsible use, and public interest were observed throughout the research process.

3 RESULTS AND DISCUSSION

The results reveal statistically significant variations in the distribution of the Housing Deficit Index (HDI) and its subdimensions across Brazilian municipalities. The national mean HDI was estimated at 0.668, with a standard deviation of 0.174, highlighting the heterogeneity of housing conditions in the country. Among the analysed subdimensions, HDI-Water exhibited the highest mean (0.841), suggesting that access to an adequate water supply remains a considerable challenge. HDI-Sewage presented the lowest mean (0.343) but the highest data dispersion (standard deviation of 0.328), reflecting significant disparities in sanitation infrastructure. Similarly, HDI-Waste, with a mean of 0.802, indicates that inadequate solid waste disposal remains a persistent issue. Furthermore, the range of HDI values, varying from 0.070 to 0.997, underscores disparities among municipalities, revealing markedly different housing conditions across the national territory (Table 1).

Table 1 – Descriptive statistics of the Housing Deficit Index (HDI) and its subdimensions across Brazilian municipalities

Indicator	*Mean*	*SD*	*Minimum*	*1st Quartile*	*Median*	*3rd Quartile*	*Maximum*
HDI-Water	0,841	0,161	0,002	0,769	0,892	0,953	0,999
HDI-Sewage	0,343	0,328	0,000	0,020	0,227	0,572	0,999
HDI-Waste	0,802	0,174	0,017	0,693	0,837	0,918	0,999
HDI	0,668	0,174	0,070	0,556	0,701	0,797	0,997

Source: Prepared by the authors based on 2022 Demographic Census data.

The observed disparity in access to water reflects historical challenges in the universalisation of basic services in Brazil, particularly in peripheral and rural regions (Araújo *et al.*, 2016; Crispim *et al.*, 2016; Venson *et al.*, 2017). The lower mean value of HDI-Sewage, combined with its high dispersion, reinforces inequalities in sanitation coverage — a problem widely documented in studies on public sanitation policies (Coutinho, 2021; Pereira *et al.*, 2020). The persistence of deficits in solid waste management, even in urbanised municipalities, suggests gaps in integrated waste management, an issue requiring greater coordination between urban and environmental planning (Oliveira; Galvão Júnior, 2016).

Municipalities with lower fiscal and administrative capacity tend to exhibit higher levels of housing deficiency, reinforcing the need for targeted policies (Grin, 2016; Martins; Melo, 2015; Tristão, 2002) to mitigate regional inequalities.

Figure 1 presents the distribution of the Housing Deficit Index (HDI) and its subdimensions: water supply, sewage disposal, and waste management. The data indicate that housing deficiency related to water supply follows a negatively skewed distribution, with the median close to 0.9, and most municipalities concentrated in the upper quartiles. This suggests that most municipalities exhibit low housing deficiencies in this aspect, despite the presence of lower-end outliers. Sewage-related housing deficiency shows the highest dispersion among the subdimensions, with a median around 0.5 and a broad interquartile range, reflecting significant inequalities in access to adequate sanitation conditions across municipalities. The waste disposal subdimension displays a distribution pattern similar to that of water supply, with a high median and lower variability. However, it also exhibits extremely low values, indicating the existence of localities with particularly precarious conditions. The Housing Deficit Index (HDI), which aggregates these three dimensions in a weighted manner, presents a median above 0.6, with broad dispersion and lower-end skewness, highlighting substantial disparities among the analysed municipalities.

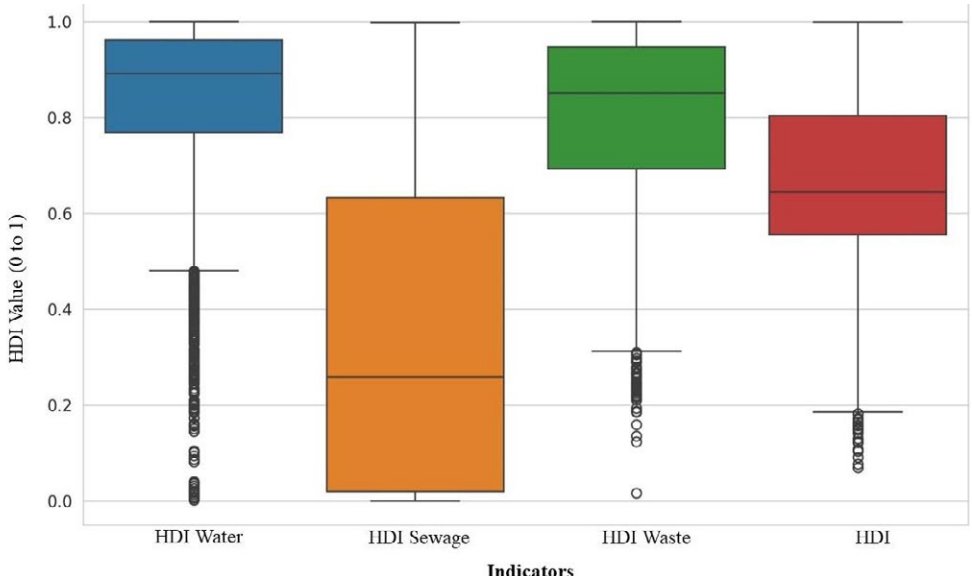

Figure 1 – Distribution of the Housing Deficit Index (HDI) and its subdimensions, Brazil, 2022

Source: Authors (2025)

The greater dispersion observed in HDI-Sewage suggests that this dimension is the most influenced by local factors, such as the availability of sanitation infrastructure, municipal governance, and the implementation of sanitation policies (Galvão Júnior, 2009; Santos *et al.*, 2020). While access to water, even when precarious, can be partially supplied through alternative sources such as wells and water lorries, the absence of an adequate sewage disposal system has direct impacts on public health and environmental quality. Additionally, the inadequate disposal of solid waste, particularly in small municipalities and rural areas, remains a critical issue, requiring decentralised management strategies (Clark, 2014; Ferreira *et al.*, 2017; Fidelis-Medeiros *et al.*, 2020).

Beyond the direct implications for health and quality of life, the precariousness of basic services also compromises the principles of urban and environmental sustainability. The lack of sewage treatment and inadequate solid waste management hinder the reuse of resources, exacerbate water contamination, and compromise the ecological resilience of territories. These deficits converge with the critical literature on environmental justice and sustainable development, highlighting that environmental impacts fall disproportionately on historically marginalised populations (Acselrad, 2004; Leff, 2002). The challenge of sustainability, in this sense, must be understood not only from a technological perspective but also

as a political and redistributive project that articulates environmental justice, territorial equity, and democratic participation (Sachs, 2011; Un-Habitat, 2020).

Figure 2 presents the distribution of the percentage of non-white population across the four classification groups of the Housing Deficit Index (HDI). The results reveal a clear and consistent pattern: municipalities classified as "Very Low" and "Low" in terms of housing conditions tend to concentrate higher proportions of non-white residents, while those classified as "High" exhibit lower percentages. A Kruskal–Wallis test confirmed that these differences are statistically significant ($H = 554.27$; $p < 0.001$).

This gradient illustrates how racial inequalities are spatially manifested through access to basic urban infrastructure, particularly adequate housing (Abdulhadi *et al.*, 2024; Raupp *et al.*, 2017). The concentration of non-white populations in municipalities with higher housing deprivation levels reflects not only socio-economic disparities but also the enduring effects of structural racism in the configuration of Brazilian territory (Boing *et al.*, 2021). In this context, race operates as a structuring dimension of inequality, influencing the distribution of rights and services across space. This dynamic also reflects processes of environmental racism, which expose racialised populations to disproportionate infrastructural neglect and environmental risk, rooted in a colonial legacy of territorial exclusion (Jesus, 2020).

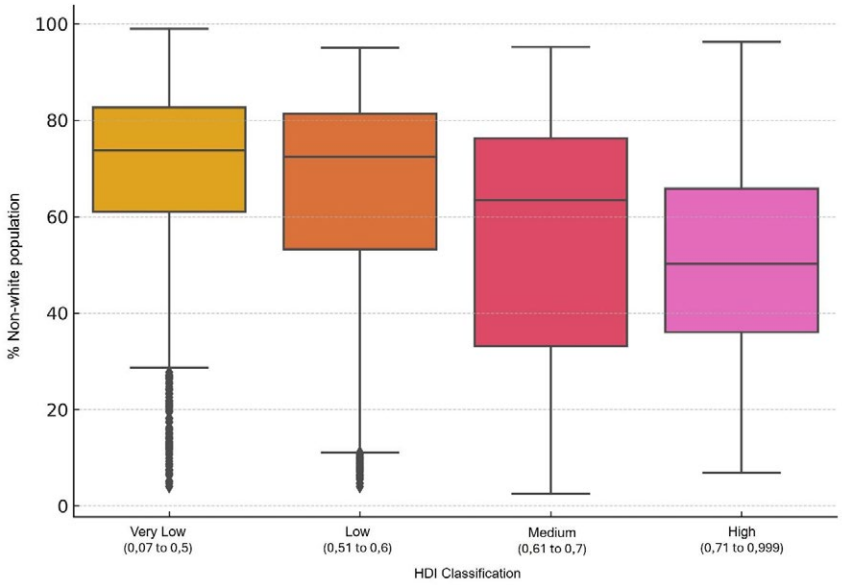

Figure 2 – Distribution of the percentage of non-white population by Housing Deficit Index (HDI) classification across Brazilian municipalities

Source: Authors (2025)

Figure 3 presents the correlation matrix between the HDI, its subdimensions, the Municipal Human Development Index (MHDI), and the distribution of urban and rural populations. The results indicate that all HDI subdimensions are positively correlated with each other and with the overall index, with values ranging from 0.30 to 0.86, suggesting that municipalities with deficiencies in one dimension tend to exhibit deficits in others. The strongest correlation with the overall index is observed for HDI-Sewage ($r = 0.86$, $p < 0.01$), indicating that deficiencies in sewage treatment are strongly linked to general housing precariousness in municipalities. HDI-Water ($r = 0.74$, $p < 0.01$) and HDI-Waste ($r = 0.71$, $p < 0.01$) also show high correlations with the overall index, reinforcing that deficiencies in these services are associated with higher levels of housing vulnerability.

The strong correlation between HDI-Sewage and the overall index highlights the importance of this service for population well-being and its role as a key social determinant of health (Neves Silva; Heller, 2016; Sobral; Freitas, 2010). Municipalities with deficient sewage systems tend to exhibit greater social vulnerability, as inadequate sanitation directly contributes to disease transmission and environmental

contamination (Arruda-Juliano *et al.*, 2012; Guimarães *et al.*, 2014). In contrast, the weaker correlation between MHDI and HDI suggests that human development, while relevant, is not the sole determinant of housing conditions, requiring an examination of structural and political factors that influence access to basic services.

The relationship between MHDI and HDI exhibits negative correlations, ranging from -0.29 to -0.71, indicating that municipalities with higher human development levels tend to have lower housing deficits. The weakest correlation occurs between MHDI and sewage deficiencies ($r = -0.44$, $p < 0.01$), while the strongest is found between MHDI and inadequate waste disposal ($r = -0.71$, $p < 0.01$), suggesting that structured waste management services are more directly associated with municipal human development. The correlation between MHDI and the overall HDI ($r = -0.62$, $p < 0.01$) indicates that Municipalities with better social indicators tend to provide greater access to basic infrastructure.

Population distribution variables exhibit correlations of lower magnitude. The urban population shows a positive correlation with MHDI ($r = 0.16$, $p < 0.01$) and HDI ($r = 0.15$, $p < 0.01$), suggesting that more urbanised municipalities tend to have higher human development levels, but without a clear relationship with housing precariousness. In contrast, the rural population presents negative correlations with all analysed dimensions, ranging from -0.16 to -0.31, with the strongest correlation observed for waste disposal deficiencies ($r = -0.31$, $p < 0.01$). This result suggests that municipalities with a higher proportion of rural population face greater challenges in waste collection and disposal. Additionally, the negative correlation between rural population and MHDI ($r = -0.29$, $p < 0.01$) indicates that more rural municipalities tend to have lower levels of human development, possibly due to restricted access to basic services, limited administrative capacity, and regulatory frameworks that do not always align with rural realities (Akaishi, 2011).

Figure 3 – Correlation between the Housing Deficit Index (HDI), the Municipal Human Development Index (MHDI), and urban/rural population distribution across Brazil

Source: Authors (2025)

A statistically significant negative correlation was observed between the Housing Deficit Index (HDI) and the Brazilian Deprivation Index (IBP) (Spearman's $\rho = -0.676$, $p < 0.001$), indicating that municipalities with higher deprivation levels tend to present more severe housing inadequacies. This result reinforces the consistency of the HDI and its convergence with other measures of socio-economic vulnerability. Table 2 presents the descriptive statistics of the HDI across IBP quintiles.

Table 2 – Descriptive statistics of the Housing Deficit Index (HDI) by quintiles of the Brazilian Deprivation Index (IBP), with Spearman's correlation coefficient between the two indices (ρ = –0.676; p < 0.001)

IBP Quintile	*Mean HDI*	*Median HDI*	*Standard Deviation*	*Minimum HDI*	*Maximum HDI*
Q1 (least deprived)	0,845	0,91	0,142	0,301	0,999
Q2	0,744	0,761	0,133	0,255	0,991
Q3	0,634	0,621	0,132	0,182	0,962
Q4	0,613	0,62	0,12	0,108	0,92
Q5 (most deprived)	0,507	0,529	0,118	0,07	0,869

Source: Authors

Figure 4 highlights distinct regional patterns. In northern Brazil, a predominance of municipalities with low HDI values is observed, particularly in the interior regions of Amazonas, Pará, Acre, and Rondônia. This distribution suggests a greater housing deficit in these areas, likely related to limited access to basic infrastructure, such as water supply, sewage disposal, and solid waste collection. However, certain urban centres, such as Manaus (AM) and Belém (PA), exhibit higher HDI values, indicating better housing conditions in these cities, corroborating the previous analysis.

In the Northeast, the presence of municipalities with low HDI values is significant, particularly in semi-arid regions, covering parts of Bahia, Piauí, and Ceará. The map suggests that these regions face challenges in accessing adequate housing services. In contrast, capitals such as Recife (PE), Fortaleza (CE), and Salvador (BA) present higher HDI values, revealing an intra-regional inequality pattern, where larger urban centres tend to have better housing conditions.

In the Centre-West, HDI values exhibit a heterogeneous distribution. While municipalities in the interior of Mato Grosso and Goiás display moderate to low HDI values, capitals such as Brasília (DF), Goiânia (GO), and Cuiabá (MT) record higher values, reflecting a more consolidated urban infrastructure. However, in more remote areas, a transition towards intermediate or low HDI values is observed, highlighting regional disparities within states.

In the Southeast, higher HDI values are predominant, particularly in the states of São Paulo, Minas Gerais, and Espírito Santo. The metropolitan regions of São Paulo (SP), Rio de Janeiro (RJ), and Belo Horizonte (MG) exhibit better housing conditions. However, municipalities in the interior, especially in less developed areas of Minas Gerais and northern Espírito Santo, show lower HDI values, underscoring intra-regional inequalities.

In the South, a predominantly positive scenario is observed, with most municipalities showing high HDI values, reflecting better infrastructural standards. States such as Santa Catarina, Paraná, and Rio Grande do Sul have a significant proportion of their municipalities within the highest HDI ranges, particularly in metropolitan areas such as Curitiba (PR), Florianópolis (SC), and Porto Alegre (RS). However, some interior municipalities still exhibit intermediate values, indicating persistent challenges in accessing housing infrastructure in more remote regions.

Brazil comprises five macro-regions (North, Northeast, Central-West, Southeast, and South), each with distinct socio-economic characteristics. The regional disparities reflect the concentration of infrastructure investments in consolidated economic hubs, to the detriment of peripheral areas, as evidenced by the contrast between the Centre-South and North-Northeast. This pattern reinforces the dual nature of Brazil's territorial occupation and development model, which remains marked by socio-spatial inequalities (Diniz, 2001). The persistence of deficiencies in the North and Northeast

calls for coordinated actions among federal, state, and municipal governments, aligned with the Basic Sanitation Legal Framework.

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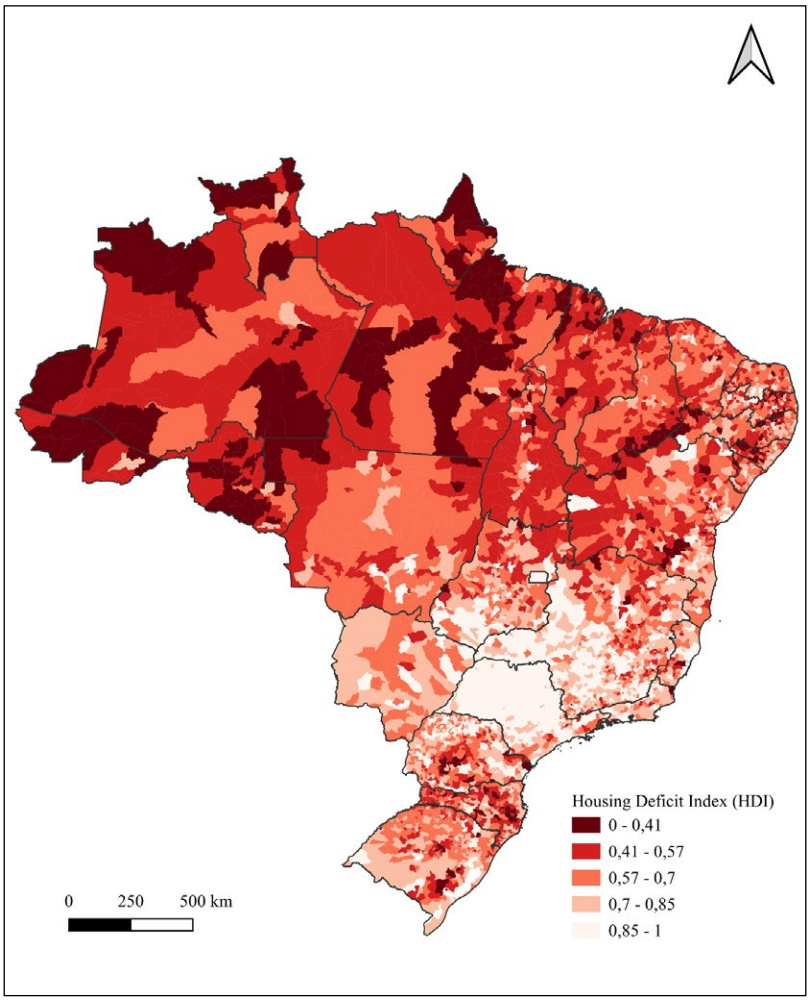

Figure 4 – Housing Deficit Index (HDI) across Brazilian municipalities (2022)

Source: Authors (2025)

In the Northeast, municipalities such as Gado Bravo (Paraíba state) (HDI = 0.07), Betânia do Piauí (Piauí state) (HDI = 0.08), and Caldeirão Grande do Piauí (Piauí state) (HDI = 0.09) stand out as having the worst indicators in the country. These localities face severe structural challenges, with extremely low access rates to water supply (≤ 4%) and sewage disposal (≤ 2%), underscoring the persistence of precarious conditions in rural areas of the Northeast. In the North, a similar pattern is observed in Governador Jorge Teixeira (RO) (HDI = 0.11).

Conversely, municipalities with the best housing conditions are concentrated in the Southeast, such as São Caetano do Sul (HDI = 0.999) and Águas de São Pedro (SP) (HDI = 0.999), in the state of São Paulo,

Southeast Brazil, and Vitória (HDI = 0.997), the capital of Espírito Santo state, Southeast Brazil, which exhibit near-universal access to sanitation services. These cities report water supply coverage exceeding 99.7%, alongside almost total coverage of sewage disposal and solid waste collection, reflecting the concentration of infrastructure in more developed regions.

4 CONCLUSIONS

The study results highlight the persistence of socio-spatial inequalities in access to basic housing services in Brazil, with significant implications for housing precariousness. The application of the Housing Deficit Index (HDI) enabled the quantification and spatialisation of these inequalities, revealing distinct regional patterns and their relationship with structural factors, such as human development and the urban–rural population distribution. The findings indicate that basic sanitation, particularly sewage disposal, remains one of the most pressing challenges, reinforcing the urgent need for effective public policies aimed at universalising these services. Furthermore, the analysis of racial composition by HDI classification revealed statistically significant disparities, with municipalities exhibiting greater housing deprivation also showing higher percentages of non-white populations. This result highlights the role of structural racism in the territorial production of precarious housing conditions, reinforcing the need for urban and housing policies that explicitly address racial inequalities.

In this regard, the HDI emerges as a robust analytical tool, leveraging standardised census data from IBGE, available since 2000. This feature facilitates comparative analyses over different periods, allowing for the monitoring of infrastructure deficiencies in Brazil's sanitation system. Additionally, its methodological structure supports multi-scale approaches, uncovering territorial inequalities and contributing to the assessment of public policy effectiveness across census cycles. With spatially detailed and historically comparable information, the index stands out as a strategic instrument for informing territorialised policies, guiding more precise interventions in vulnerable areas. The incorporation of sociodemographic dimensions such as race further strengthens the potential of the HDI to support intersectional and equity-oriented public policy design.

Furthermore, by incorporating analytical dimensions such as race/colour, the HDI proves to be an instrument that promotes territorial equity, allowing for the identification of intersectional inequalities. This approach enables the formulation of public policies that articulate sustainability and social equality, recognising that overcoming housing precariousness requires integrated actions across multiple scales and fronts—such as infrastructure, financing, social participation, and the guarantee of rights. Social equality, in this context, should not be treated as a residual variable, but as a structuring axis of housing justice.

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