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URBAN PARKS AND SOCIO-SPATIAL AND ENVIRONMENTAL JUSTICE IN A METROPOLIS IN THE GLOBAL SOUTH

Parques urbanos, justicia socioespacial y ambiental en una metrópolis del sur global

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ABSTRACT

This study discusses the urban park system in a metropolis of the Global, focusing on socio-spatial and environmental justice. We mapped urban parks in Recife, Brazil, and overlaid them with socio-economic indicators of the population, namely income, schooling, municipal human development index (MHDI), race, and sewage availability in census tracts. We also analyzed responses from 1,217 questionnaires applied to urban park users. We used QGis 3.10.12 software to build the maps and Excel and Intellectus to analyze the data. The correlation between the variables was analyzed using Kendall's and biserial correlation. The results showed that people with lower levels of schooling, income, and M-HDI live farther away from urban parks. We observed a negative correlation between distance to parks and schooling (-0.19), distance to parks and income (-0.24), and between race and frequency of visits to parks (-0.16). We concluded that the spatial distribution of parks reflects underlying inequalities, in which minority groups face greater barriers accessing and enjoying the benefits of green and leisure areas.

Keywords: Green areas; Inequality; Urban planning; Leisure.

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RESUMO

O objetivo deste estudo é discutir o sistema de parques urbanos em uma metrópole do Sul Global sob a ótica da justiça socioespacial e ambiental. Realizou-se um mapeamento dos parques urbanos na cidade do Recife, Brasil, sobreposto a indicadores socioeconômicos da população: renda, escolaridade, índice de desenvolvimento humano municipal (IDH-M), raça e presença de esgotamento sanitário nos setores censitários. Analisaram-se também respostas de 1217 questionários aplicados a usuários de parques urbanos. Utilizou-se o software QGis 3.10.12 para construção dos mapas e o Excel e Intellectus para análise dos dados. A correlação entre as variáveis foi analisada por meio da correlação de Kendall e da correlação bisserial. Os resultados mostraram que pessoas com menor escolaridade, renda e IDH-M residem em áreas mais distantes dos parques urbanos. Observou-se uma correlação negativa entre distância de acesso aos parques e escolaridade (-0.19), distância de acesso aos parques e renda (-0.24), e entre raça e frequência de ida aos parques (-0.16). Concluiu-se que a distribuição espacial dos parques reflete a desigualdade, na qual grupos minoritários têm mais dificuldade para acessar e usufruir dos benefícios das áreas verdes e de lazer.

Palavras-chave: Áreas Verdes; Desigualdade; Planejamento Urbano; Lazer.

RESUMEN

El objetivo de este estudio es analizar el sistema de parques urbanos de una metrópolis del Sur Global desde la perspectiva de la justicia socioespacial y medioambiental. Se cartografiaron los parques urbanos de la ciudad de Recife, Brasil, superponiéndolos a indicadores socioeconómicos de la población: renta, escolaridad, índice de desarrollo humano municipal (IDHM), raza y presencia de alcantarillado en los sectores censados. También se analizaron las respuestas de 1217 cuestionarios aplicados a usuarios de parques urbanos. Se utilizó el programa QGis 3.10.12 para construir los mapas y Excel e Intellectus para analizar los datos. La correlación entre las variables se analizó mediante la correlación de Kendall y la correlación biserial. Los resultados mostraron que las personas con menores niveles de escolarización, ingresos e IDH-M viven en zonas más alejadas de los parques urbanos. Hubo una correlación negativa entre la distancia a los parques y la escolaridad (-0,19), la distancia a los parques y los ingresos (-0,24), y entre la raza y la frecuencia de visitas a los parques (-0,16). Se concluyó que la distribución espacial de los parques refleja la desigualdad, en la que los grupos minoritarios tienen más dificultades para acceder y disfrutar de los beneficios de las zonas verdes y de ocio.

Palabras llave: Áreas verdes; Desigualdad; Planificación urbana; Ocio.

1 INTRODUCTION

The recent pandemic and social confinement, widely implemented in various parts of the world, have intensified people's demand for open, public, and green spaces (Larson et al., 2021). These spaces have been suggested as ideal for moments of relaxation from the social distancing that has been so widely endured in recent years (Lopez et al., 2021; Davis; Sanesi, 2022). Thus, there has been a growing need to understand the relationship between access and proximity to these spaces and their ability to generate benefits for the

surrounding populations (Shoari et al., 2020), with distributive justice playing a relevant role in these debates in several fields of knowledge (De Luca et al., 2021).

Thus, urban planners and managers must now develop policies that value public, open, and green spaces to respond to future scenarios of uncertainty arising from the intense environmental transformations of the current period. In particular, they face the challenge of promoting access to these spaces, considering the needs of different segments of urban populations (Feng et al., 2019; Heo et al., 2021). From this perspective, the concepts of socio-spatial justice (Soja, 2009) and environmental justice (Mohai, Pellow, Roberts, 2009) are relevant to this discussion, since there is no rule for uniformity in the distribution of public, open, and green spaces in different cities around the world (Rigolon, 2016; Enssle, Kabisch, 2020).

One of the most accessible types of public and green spaces in different contexts are urban parks, mainly because they are connected with nature and public use. Thus, when less affluent people's face restricted access, their right to the city is denied (Harvey, 2005), reinforcing processes of socio-spatial (Soja, 2010) and environmental (Mohai, Pellow, Roberts, 2009) injustice. This injustice is related to the use of space on a regional and local scale through public facilities and access to urban goods and services. It is necessary to build socio-spatial justice to ensure the right to the city and an equitable access to urban amenities (Harvey, 2005; Soja, 2010).

This topic has been widely debated in developed countries (Wolch, Byrne and Newell, 2014, Jennings et al., 2017; Larson 2018). Studies conducted in European and North American cities show that, even in conditions of lower social inequality, poorer populations and ethnic minority groups tend to live further away from urban parks (Rigolon, Browning, Jennings, 2018). Other studies indicate that these same groups also have less access to such public facilities (Zhang, Cheng, Zhao, 2021). In addition, some findings reveal that urban parks in more peripheral areas are less well equipped and attractive (Rigolon, 2016). Specifically, regarding race, the literature suggests that predominantly Black communities are either further away from parks or access these spaces less due to barriers and logistical difficulties in getting there (Dai, 2011; Wendel, Zarger, Mihelcic, 2012).

However, this topic remains little explored in the global south (Fernández-Álvarez, 2017; Montes-Pulido, Forero, 2021), except for studies produced in China (Xiao et al, 2017; Feng et al, 2019, Yu, Zhu, He, 2020; Zhang, Cheng, Zhao, 2021). Thus, there is still a gap in the production of empirical studies investigating patterns of distribution and access to urban parks in cities in the global south. In general, in cities located in peripheral countries,

the debate takes on other dimensions, such as the risks of "green gentrification" (Reed-Thryselius, 2023), which can be generated by the discourse of implementing parks at all costs, without considering existing structural inequalities (Torres et al., 2021; Mullenbach, 2022).

In this context, the metropolis of Recife, located in northeastern Brazil, has a system of urban parks that is the result of decades of planning and public policy. However, the historical construction of this system seems to reinforce that the most affluent areas of the city were privileged for the implementation of these amenities (Meneses, 2021). Nevertheless, systematic analyses that relate the location and use of the city's urban parks by comparing them with local demographic and environmental variables are unavailable. They would allow for an assessment of this situation of possible socio-spatial and environmental injustice.

Thus, the following questions guide this research: do Recife's urban parks form a system that reproduces a model of inequality in terms of access? Do poorer and non-white populations tend to access the city's parks less? To what extent does the variable of distance hinder access for populations who live further away from the parks? Is there a segmentation of social class or race in the city's different parks?

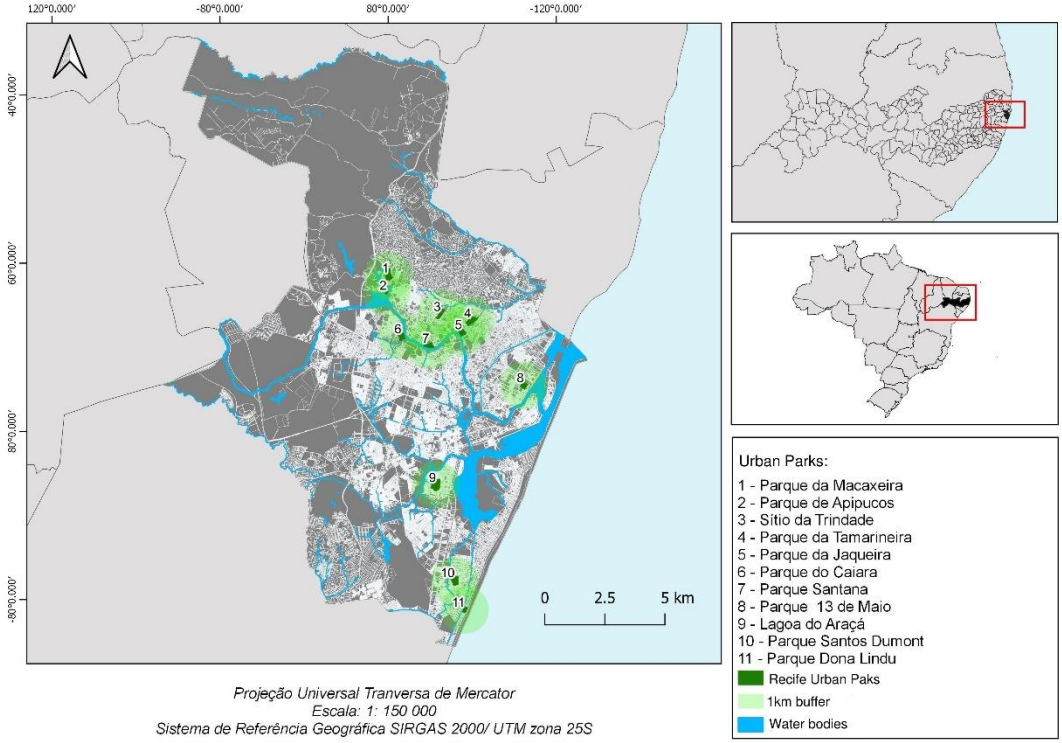
This study aims to analyze the distribution of parks in the city of Recife, comparing this distribution with socio-environmental variables of the territory and data on park users. The results present a general and unprecedented overview of the city's park system in different inequality settings and can contribute to the discussion of specific public policies for the area. They also foster debates among residents about access to these spaces by different social segments.

2 METHODOLOGY

Recife has 1.5 million inhabitants (IBGE, 2023) and ten urban parks. Six of these parks are located in the northern part of the city on the banks of the Capibaribe River (Macaxeira Park: 98,725 m^2, Apipucos Park: 11,755m^2, Sítio da Trindade: 46,313m^2, Jaqueira Park: 71,793m^2, Caiara Park: 68,746m^2, and Santana Park: 54,912m^2) (Figure 01). Only one of the parks is located in the central area (Parque 13 de Maio: 70,434m^2), while three parks are located in the southern zone (Lagoa do Araçá: 44,545m^2, Parque Santos Dumont: 89,000m^2, and Parque Dona Lindu: 35,473 m^2).

A hallmark of this metropolis is the social inequality in different territories. As a reflection of this situation, structural inequalities related to urban services also accumulate. For example, a serious problem is the historically precarious environmental sanitation infrastructure, with a significant impact on the population's quality of life. In contrast to this precarious situation, the green areas in the Recife metropolis can be seen as exceptional spaces, either because of their ability to provide well-being to their visitors or because of their capacity to socially integrate populations with different socioeconomic levels.

Figure 01 – Location of urban parks in Recife



Source: Authors (2024)

2.1 Data collection

This study's data were retrieved and analyzed in three stages: i) Collection of spatial data obtained from the Recife City Council's open data portal; ii) Collection of socio-environmental variables from the Brazilian Institute of Geography and Statistics (IBGE); iii) Analysis of data on environmental perception, use, and access to parks from 1,217 questionnaires administered to users of the city's urban parks (Silva et al., 2023). The research was approved by the research ethics committee under registration N°44427920.7.0000.0130.

The free software QGIS 3.10.12 was used for data processing and map generation. The variables used to characterize the parks' surroundings were education, income, longevity, and the municipal human development index (M-HDI) (Souza, et al. 2018). In addition to these, the variables of sanitary sewage and race (Black and brown population) were used, all by census tract (IBGE, 2023). These variables were selected to be part of this study because they reflect the socio-environmental characteristics of the city in terms of structural inequalities (Souza et al., 2018; Bitoun et al., 2020).

Data from census tracts were analyzed based on a one-kilometer radius from a centroid plotted within the parks. Thus, census tracts that intersected with the generated buffer were considered in the analysis. The distance of one kilometer was chosen because it represents a comfortable journey, corresponding to a ten-minute walk from the residence to the park (Meneses, 2018). The captions of the figures indicate that the darker areas correspond to the census tracts in the worst situation, while the lighter regions represent census tracts with the best conditions, regardless of the variable analyzed.

The data were tabulated in an Excel spreadsheet and presented in table format. Data from questionnaires administered throughout 2022 and 2023 were employed to build the tables. Questionnaires were adopted for the following parks: Dona Lindu, Santos Dumont, Lagoa do Araçá, 13 de Maio, Jaqueira, Sítio da Trindade, Santana, Caiara, Apipucos, and Macaxeira. We excluded Apipucos Park from the sample because it did not have any visitors during the field research days. The questionnaires were administered on different days and at different times from a random convenience sample.

2.2 Statistical analysis

To analyze the correlation between the variables of environmental perception related to park use and access and the socioeconomic variables, we used Kendall's correlation because it is appropriate for identifying relationships between categorical (ordinal) variables and continuous variables, requiring a monotonic relationship between the variables (Millard & Neerchal, 2000). The monotonicity of these relationships was tested using scatter plots created in Intellectus software.

The following variables were analyzed:

a) education = Continuous variable measuring the number of schooling years of the respondents;

b) distance_parks = Ordinary categorical variable with the classes of distances travelled by users to the parks (1 – Up to 500m; 2 – Between 500 and 1000; 3 – Between 1000 and 2000; 4 – More than 2000m)

c) tempoatfis_cat = Ordinal categorical variable with classes referring to the time spent by users engaging in physical activity in parks (0 – Does not engage in physical activity; 1 – Up to 30 min; 2 – Between 30 and 60 min; 3 – Between 60 and 120 min; 4 – More than 120 min)

d) freqvis_cat = Ordinal categorical variable with classes referring to the number of visits to parks per month (1 – 1x; 2 – Between 2x and 7x; 3 – Between 8x and 14x; 4 – Between 15x and 20x; More than 20x)

e) tempoestad_cat = Ordinary categorical variable with classes referring to the length of time users spend in parks (1 – Up to 60 min; 2 – Between 60 and 120 min; 3 – Between 120 and 150 min; 4 – Between 150 and 180 min; 5 – More than 180 min);

f) age = continuous variable from 18 years old;

g) saudefis = Ordinary categorical variable with classes referring to respondents' self-perception of physical health (1 – Very poor; 2 – Poor; 3 – Fair; 4 – Good; 5 – Excellent); h) White = Dichotomous categorical variable with the self-declared race of respondents (1 – White; 0 – Non-white (Black; Asian; Brown; Indigenous).

Considering the transformation of the results of self-declared race into a dichotomous variable: white. A biserial correlation analysis was performed for white and distantep, freqvis, renda, and tempostad. A biserial correlation is a special case of Pearson's correlation. Cohen's standard was used to assess the strength of the relationships, in which 0.1, 0.24, and 0.37 represent small, medium, and large effect sizes (Cohen, 1988).

The Kendall correlation coefficient analysis ranges from ±1, with a value of 0 indicating no relationship. Positive values indicate that as one variable increases, the other variable also increases. Negative values indicate that one variable tends to decrease as the other increases. Cohen's standard was used to assess the strength of the relationship, in which coefficients between 0.10 and 0.29 represent a small association, coefficients between 0.30 and 0.49 represent a moderate association, and coefficients of 0.50 or more indicate a large association (Cohen, 1988). Regarding the biserial point analysis, these

effect size limits are based on the assumption that both values of the binary variable are equally likely to occur (Rice & Harris, 2005; McGrath & Meyer, 2006).

3. RESULTS AND DISCUSSION

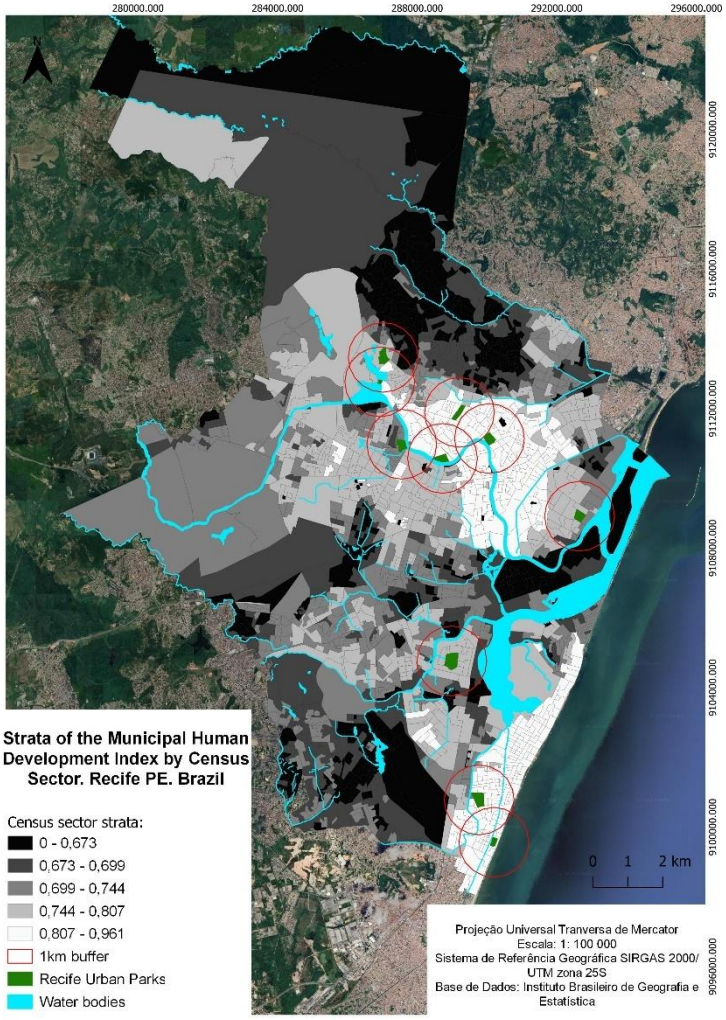
In general, the uneven distribution of urban parks in Recife can be observed from their spatial distribution in the city's political-administrative regions (PARs). The largest number of urban parks is located in PAR 3. Also, urban parks do not extend beyond the flat, higher-income areas of the city. There are no urban parks in PAR 2 and 5, and there is only one urban park in each of PAR 1 and 4.

There are three urban parks in PAR 6. Two of them are located near the coastline, where income levels are higher, while only one park – Lagoa do Araçá – is located slightly further west of the coastline. It should be noted that the further west of the city, the lower the income levels and there are no urban parks, which means that users who live in this region have to travel to access these spaces in other regions of the city, or use other green and open spaces that are not characterized as parks.

Analyzing the spatial distribution of Recife's urban parks superimposed on the M-HDI strata (Figure 02), we observe a concentration of parks in areas predominantly inhabited by populations with higher HDIs. The historical location of these facilities in flat and older areas of the city has favored this relationship, as these were the areas initially populated by the city, which over time have consolidated themselves as formal spaces for the middle and upper income population. One exception is Macaxeira I Park, most of whose surrounding population is located in census tracts with M-HDI reaching a maximum of 0.699.

On the other hand, 95% of the census tracts surrounding Jaqueira Park are inhabited by populations in the highest M-HDI stratum in the city, ranging from 0.807 to 0.961, which is considered above the city average. Another park with the same representation of the surrounding population with a high M-HDI is Dona Lindu Park in the Boa Viagem neighborhood. These results corroborate most studies on environmental and socio-spatial justice regarding access to urban parks in cities located in developed and developing countries, in which populations with higher income and education levels are closer to these collective facilities that promote leisure and well-being (Rigolon; Browning; Jennings, 2018; Yu; Zhu; He; 2020; Heo et al., 2021).

Figure 02 – Overlap of urban parks with census tracts



Source: authors (2024)

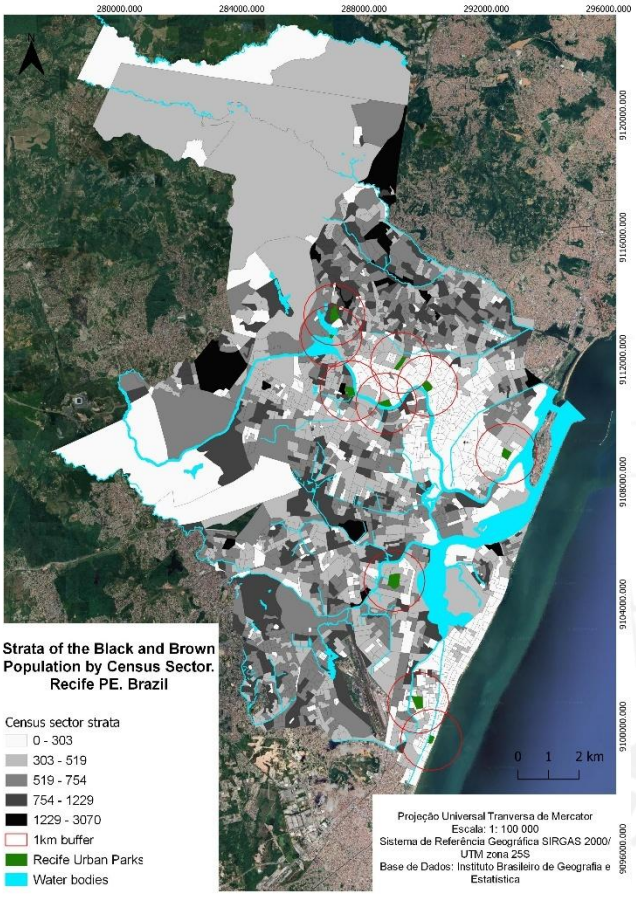
Two other cases stand out in this context: Caiara Park, which, despite apparently having 40% of its surroundings inhabited by populations in the high HDI stratum, does not translate into effective use by this population, since the buffer of influence generated does not consider geographical barriers, such as the Capibaribe River. In this case, there is no connection between the two banks of the river, which restricts access to Caiara Park for populations in the lower HDI strata. The literature shows us that geographical or social barriers restrict the use and sociability of different segments of society in these spaces (Dai, 2011; Wendel; Zarger; Mihelcic, 2012).

In another sense, Santana Park, despite being located on the bank with the highest HDI levels, has a surrounding population that lives in areas with predominantly medium or low HDI, but which visits the park because there is a bridge that provides access. This is a good example of how this type of public space can attract a greater diversity of visitors. The

presence of diverse social groups is reported in the literature as beneficial for enabling social cohesion (Jennings and Bamkole, 2019; Clarke et al., 2023).

When analysing the spatial distribution of parks based on the variable of race, we observe that approximately 50% of the population of the city of Recife is composed of Black and brown people (Bitoun et al., 2020). However, we see a clear inequality when we analyze the relationship between this racial composition and the proximity of parks. For example, parks whose neighborhoods are inhabited by predominantly white populations already show that Black and brown populations are further away from parks and therefore have greater difficulties in accessing them. Thus, the Jaqueira, Dona Lindu, Treze de Maio, Santos Dumont, and Santana parks have significant percentages of a predominance of white people in their surroundings. On the other hand, Macaxeira, Apipucos, Caiara, and Lagoa do Araçá parks have some tracts with a greater presence of Black and brown people in the surrounding areas (Figure 03).

Figure 03 – Overlap of urban parks in census tracts classified by race

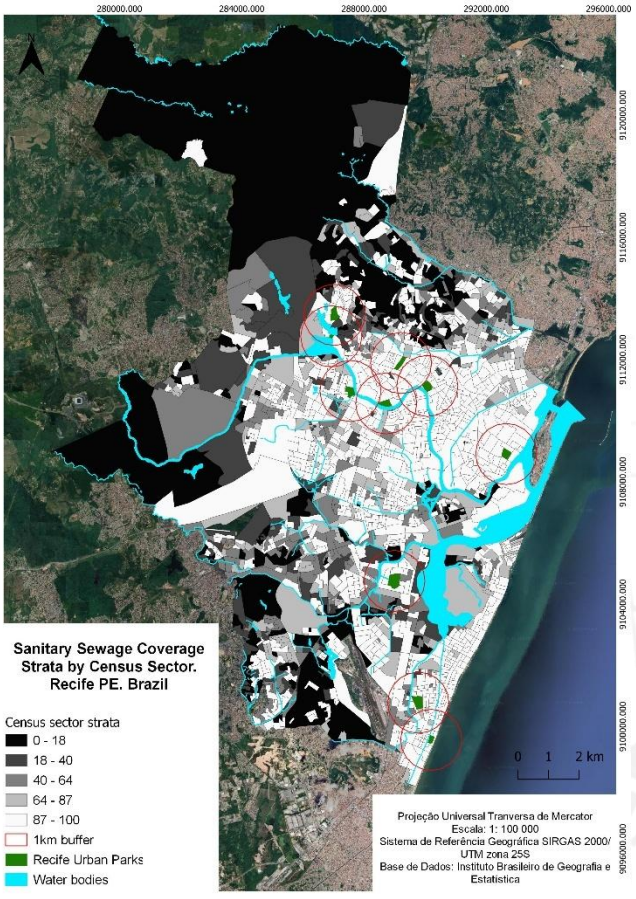


Source: Authors (2024)

Thus, we can observe that the most recent parks implemented in the city, except for Dona Lindu Park, favored Black and brown people's access, based on the criterion of proximity. This fact may suggest that successive municipal administrations have somewhat been concerned with expanding access to these facilities in order to foster greater socio-spatial and environmental justice (Mohai, Pellow, Roberts, 2009; Soja, 2009). However, other factors, such as land availability and price, may have been more significant in the decision-making process.

When we compare the location of the parks with the sewage coverage conditions, we observe that the areas surrounding the Macaxeira, Lagoa do Araçá and Apipucos parks have the worst coverage in this regard. This situation does not mean, however, that the other parks are located in areas with adequate environmental sanitation services. For example, Caiara Park and Sítio da Trindade have a significant presence of census tracts with low sanitation coverage levels (Figure 04).

Figure 04 – Overlap of urban parks in census tracts classified by sanitation service provision



Source: authors (2024)

This reinforces the role of parks as public facilities, which in some way guarantee a positive presence of the State in the face of so many other structural adversities, such as the issue of sanitation. In general, parks surrounded by populations with higher HDI and white skin color also have better results in terms of sanitation. This fact corroborates the literature, which suggests that populations living in better-structured areas also have easier access to and use of urban parks (Rigolon, 2016).

3.1 Profile and perception of urban park users

Statistical analysis of the data from the questionnaires allowed us to observe other aspects related to the use of urban parks in Recife, which complement the analyses based on the secondary data presented. It was clearly evident that a higher percentage of Black (75%), brown (70%) and Indigenous (67%) people travel greater distances to access the city's urban parks compared to self-declared white people (54%). Considering the assumption that access is facilitated by the distance variable (Wendel, Zarger, Mihelcic, 2012), the primary data obtained in the questionnaires reinforce the spatial analysis that shows a higher percentage of white population in the vicinity of the parks.

Distance and access to parks affect the population's perception of these spaces and, consequently, the level of well-being provided (Latinopoulos, Mallios, Latinopoulos, 2016; Sabyrbekov, Dallimer, Navrud, 2020). Studies show that the ideal maximum distance would be 1600m and a distance above 4800m would drastically reduce the perceived benefits (Meneses, 2018; Mertes; Hall, 1995). Furthermore, it is estimated that the perception of loneliness is lower among people who live less than 1600m from green areas (Astell-Burt; Feng, 2021). On the other hand, living within 500m of green areas has been identified as responsible for a significant reduction in premature deaths in Europe (Barboza et al., 2021). These aspects associated with our data highlight that the poor distribution of these spaces in Recife affects different ethnic groups in different ways (Dai, 2011). This fact reinforces that the greater distance travelled to access parks by Black and brown people is not only an inconvenience for leisure, but also affects their physical and mental health (Rigolon, Browning, Jennings, 2018).

Among the parks studied, the only one with the highest percentage of visitors travelling a maximum of 400m is Parque da Lagoa do Araçá, characterized as a typical "pocket park". The parks of Sítio da Trindade, Caiara, and Santos Dumont stand out with the highest percentage of visitors travelling between 400m and 800m, characterized as

"neighborhood parks". The parks of Jaqueira (86%), Treze de Maio (85%), Dona Lindu (75%), and Santana (56%) have a higher percentage of users who travel more than 1,600 meters to visit the park, which labels them as "community parks" (Mertes and Hall, 1995) (Table 01).

The size of parks is a variable that helps explain the frequency of visits. There is evidence that larger parks generate a greater effect on people's satisfaction (Liu; Xiao, 2021; Zhang; Zhou, 2018). The size of parks is significantly related to the number of activities they offer to the public. Evidence shows that people use larger parks more often, even if they are a reasonable distance away (Zhang; Zhou, 2018). This seems to be the case in Recife, where the most visited park with the highest percentage of visitors travelling longer distances is Parque da Jaqueira, which, although not the largest, is the most wooded park with the best infrastructure for attracting visitors.

Table 01 - Percentage (%) of park visitors against distance from place of residence

Park	Up to 400m	Between 400 and 800m	Between 800 and 1660	> 1600
13 de maio	1	11	3	85
Jaqueira	0	9	5	86
Caiara	0	49	1	49
Lagoa Araçá	42	15	7	36
Lindu	0	23	3	75
Macaxeira	0	29	25	46
Santana	6	10	28	56
Santos Dumont	0	57	7	36
St. da Trindade	11	41	21	28

Source: Field research, 2023.

Regarding race and color characteristics self-declared by park visitors, only the Sítio da Trindade (36%) and Santos Dumont (41%) parks had a majority of respondents who self-declared as white. The parks of Santana (41%), Lagoa do Araçá (55%), and Caiara (39%) had higher percentages of respondents who self-identified as Black. The 13 de Maio (50%), Jaqueira (43%), Lindu (48%), and Macaxeira (35%) parks had higher percentages of respondents who self-identified as brown (Table 02).

Concerning average income, the results showed that the parks 13 de Maio (59%), Jaqueira (48%), Caiara (33%), Lagoa do Araçá (48%), Lindu (38%), and Macaxeira (58%) had the highest percentage of respondents with an average income of 1 minimum wage. On

the other hand, Santos Dumont (41%) and Sítio da Trindade (46%) parks had a higher percentage of users with an average income of 4 minimum wages or more (Table 03)

.

Table 02 – Percentage of respondents by race/color per park

	White	Black	Asian	Brown	Indigenous
13 de Maio	23	22	4	50	1
Jaqueira	11	40	4	43	0
Caiara	11	39	15	31	4
Lagoa do Araçá	9	55	0	23	14
Lindu	23	21	4	48	3
Macaxeira	26	34	0	35	2
Santana	13	41	2	39	3
Santos Dumont	41	13	4	41	2
St. Trindade	36	13	1	10	0

Source: Field research, 2023.

Table 03 – Percentage of respondents according to income per park

	Number of minimum wages			
PARKS	1	2	3	4
13 de maio	59	25	4	13
Jaqueira	48	23	7	23
Caiara	33	20	17	30
Lagoa do Araçá	48	35	2	16
Lindu	38	25	11	25
Macaxeira	58	27	5	10
Santana	35	19	8	38
Santos Dumont	20	24	15	41
Sitio da Trindade	18	25	11	46

Source: Field research, 2023

The results of Kendall's correlations were examined using Holm's correction to adjust multiple comparisons based on an alpha value of 0.05 (Table 4). We observed the following:

- A significant negative correlation between the variables schooling and distance_parks, where distance travelled to parks tends to decrease with increasing schooling level.
- A significant positive correlation between schooling and income, where income tends to increase with increasing schooling level.
- A significant negative correlation between distance_parks and income, where income tends to decrease with greater distance travelled to parks.

- A significant negative correlation between education and time_spent_in_parks, revealing that time spent in parks tends to decrease with higher education level.
- A significant positive correlation between distance_to_parks and time_spent_in_parks, suggesting that the time spent in parks tends to increase with greater distance travelled to parks.
- A significant positive correlation between tempoatfis_cat and freqvis_cat, where the frequency of visits to the park tends to increase with increasing time spent on physical activity.
- A significant negative correlation between income and tempoestad_cat, where time spent in parks tends to decrease with higher income.

Table 04 – Kendall's correlation: results between escolar, distant_parks, tempoatfis_cat, racacor, renda, freqvis_cat, and tempoestad_cat

Combination	*r*	95.00% CI	*n*	*p*
school-distant_parks	-.19	[-.27, -.10]	494	< .001
school-timeatfis_cat	.09	[.00, .18]	494	.289
school-income	.43	[.35, .50]	494	< .001
school-time_state_cat	-.15	[-.23, -.06]	494	.002
distant_parks-timeatfis_cat	-.11	[-.19, -.02]	494	.191
distant_parks-racacor	.10	[.01, .18]	494	.396
distant_parks-income	-.24	[-.33, -.16]	494	< .001
timeatfis_cat-freqvis_cat	.17	[.08, .26]	494	< .001
income-freqvis_cat	-.02	[-.11, .06]	494	1,000
income-time-state_cat	-.15	[-.24, -.07]	494	< .001

Source: Authors, 2024.
Note: p-values adjusted by Holm correction.

For the results of the dichotomous variable correlations, Holm's correction was also used to adjust multiple comparisons based on an alpha value of 0.05. There was a significant negative correlation between white and freqvis. This fact suggests that the change from category 1 to category 0 of white is associated with a decreasing frequency of visits to parks. Therefore, category 0 of white tends to be associated with lower values of freqvis. We observed a significant negative correlation between white and income. This situation suggests that moving from category 1 to category 0 of white is associated with a decrease in income (Table 05).

Table 5 – Biserial Point Correlation for: white and distantp, frqvis, income, and tempoestad

Combination	*r*	95.00% CI	*n*	*p*
white-distantp	-.01	[-.06, .04]	1492	1.000
white-freqvis	-.16	[-.21, -.11]	1536	< .001
white-income	-.18	[-.23, -.13]	1528	< .001
white-weather	.01	[-.04, .06]	1534	1.000

Note: p-values adjusted by Holm correction.

The first three correlation results between park user profiles confirm the data presented in the spatial analysis. People with lower education and income levels tend to travel further to access Recife's urban parks. Another noteworthy aspect is the correlation between time spent in parks, distance travelled, and social variables. The results show that people with higher income and education, who tend to live closer to parks, use these spaces for less time. This situation seems to highlight the lack of other leisure and sports facilities distributed throughout the city. Thus, people with lower socioeconomic status travel further to use urban parks as a free leisure option.

Regarding the correlation analyses with the binary variable related to self-declared race, the results show that non-white people visited parks less often (Dai, 2011; Larson et al 2021). This situation may reflect the distance from their homes to the parks, means of transport, and even discriminatory aspects, which highlights the barriers for certain ethnic groups to use these facilities and draws attention to the consequences of this reality. A study conducted in some North American cities showed that inequality in access to urban parks between different social segments goes beyond intra-urban differences. For example, some evidence showed that cities with minority populations of Black and Hispanic people have a higher proportion of parks per inhabitant than cities where Black and Hispanic people are in the majority, which reinforces the issue of inequality in access beyond the intra-urban issue (Rigolon, Browning, Jennings, 2018).

In the case of Recife's parks, there is no explicit race-based segmentation of the public. Parks located in higher-income areas with a predominantly white population are also visited by Black and brown people, because the diversity of facilities these parks offer attracts users from further afield (Lindsey; Maraj; Kuan, 2001; Sherer, 2006). However, the opposite does not apply in the same way. Parks surrounded by more impoverished Black and brown people tend to be appropriated by these populations, and users who live further

away only travel to the park for a specific attraction or event. Macaxeira and Caiara parks are good examples of this.

4. FINAL CONSIDERATIONS

The results obtained in the analysis of spatial data and of data from user questionnaires shed light on the socioeconomic inequalities associated with access to and use of urban parks in Recife. Although the distribution of parks is concentrated in regions with higher income, human development, and a predominance of white people, this situation does not prevent any social group from using the parks. However, non-white people with lower income and education levels need to travel longer distances to access the main parks in Recife, which reinforces inequality in access to parks as yet another adversity to which minority groups are subjected.

This poor distribution of parks, which forces non-white and lower-income populations to travel further, is correlated with longer stays in these spaces. Considering the many benefits of urban parks for human health, people with less opportunity to spend more time in these urban green spaces may have less opportunity to benefit from the positive aspects provided by these areas.

In addition to distance, other city connectivity elements can increase or decrease the difficulty of accessing public facilities, such as urban parks. In this regard, this study stands out as one of the first to analyze the entire urban park system in a metropolis in the global south.

Nevertheless, we should underscore the need for complementary studies that analyze the mobility aspects associated with greater or lesser ease of access to parks. Similarly, it is necessary to advance the research with a refinement regarding more specific income, race and occupation groups. Analysing aspects related to social cohesion in these spaces is also a promising avenue for future research.

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