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Environmental Justice: A comparison between Budapest (HU), Fortaleza (BR), and Goiânia (BR).

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1. Introduction

Nature was always closely and universally present during the beginning of the construction of urban areas. It is possible to exemplify in many cases cities with nearby forests, which became essential for creating parks, gardens, and urban forests. The Biophilia hypothesis shows this need for humans to stay close to the natural environment. The theory indicates that many of us live in a manufactured environment, which is not our natural setting as humans, meaning that the human mind has an inherent inclination to affiliate with nature as an example of plants and other living things.

According to Grinde & Patil, 2009, “Adding elements of Nature to living spaces can presumably induce positively valued changes in cognition and emotion, which again may impact stress level, health, and well-being.”. Grinde & Patil also reports that plants’ visual presence gives pleasure to the mind giving a positive experience as potent aesthetic stimuli, and unconsciously our brain understands that a place without plants is “unnatural” and potentially unsafe. During these COVID-19 pandemic years, it was possible to see the human need to connect with nature.

Due to confinement and the restriction of human contact, cases of mental health problems were increasing in the population of several cities. “Studies of hospital staff found that having been quarantined was the most predictive factor of acute stress disorder or of posttraumatic stress symptoms even three years later. Globally, findings showed that the most of Chinese people, from 7% to 53.8%, experienced psychological distress during the initial stage of the CoViD-19 outbreak.”(Talevi et al., 2022).

In view of the fact that natural environments are directly crucial for mental health and well-being, they are areas that play a vital role inside the cities. Examples include preventing environmental disasters, rainwater absorption, microclimate control areas, thermal adjustment, and biological protection. Many cities are not interested in developing these areas.

Cities in Brazil suffer from several problems related to green infrastructure, not only with its maintenance but also with the neglect of actions that the government fails to provide. Furthermore, it is possible to notice several differences in the treatment given to different areas of most large Brazilian cities, indicating contrasting gentrification, environmental injustice, and inequality to the population in some cases.

As reported by Brulle & Pellow, 2006, Environmental Justice definition according to The Environmental Protection Agency (EPA), is “the fair treatment and meaningful involvement of all people regardless of race, color, national origin, or income concerning the development, implementation, and enforcement of environmental laws, regulations, and policies. Fair treatment means that no population, due to policy or economic disempowerment, is forced to

bear a disproportionate share of the negative human health or environmental impacts of pollution or environmental consequences resulting from industrial, municipal, and commercial operations or the execution of federal, state, local and tribal programs and policies.”

Through observations and exchange of experiences in different countries, it was noticed a difference in the quality and quantity of green spaces within Brazilian cities. In this regard, this article aims to collect information regarding the quality of green infrastructure in urban parks in Brazilian cities, Goiania and Fortaleza, for the analysis related to Environmental Justice and make a comparison to Budapest and its present situation.

2. Methodology

The present work was made through a comparative analysis of three distinct cities, based on data collected from reports and documents from the municipalities, regarding mapping and information on urban green infrastructure and legislation. Maps were also produced with the use of available GIS. It was utilized biography related to afforestation, availability, accessibility of urban green areas, their geographic presence, and socio-economic impact.

3. Analysis of the Cities

3.1. The city of Budapest

Budapest, the capital of Hungary, has a population of 1,756 million and 525 square kilometers, has an urban structure that dates back to the early 19th century, having particular value regarding heritage sites, including the historic urban fabric in which it is possible to find a negligible proportion of green spaces.

Data from reports of the Municipality of Budapest shows that approximately 65% of the area of Budapest is covered with vegetation, including the canopy of trees, in other words, the biologically active green area, but its green area intensity is only around 50%, it is noticeable the great number of green spaces in the city, the central districts had less than 10% of the value from the green area intensity. From this amount, the green spaces are scattered, isolated and distant from each other. “While in the capital, the average size of a green space is 6 square meters of public green space per capita, in inner-city areas, this ratio is only 0-5 square meters/per capita.” (Municipality of Budapest, 2019).

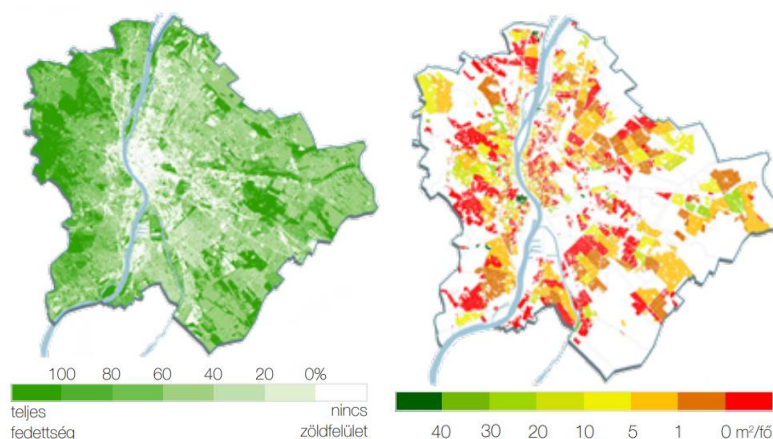


Figure 1 and 2 - Total green surface map and Size of green space per capita in residential area calculated for urban development districts (Source: Municipality of Budapest, 2019)

The municipal government has proposals for themes that refer to the environment and sustainable development, aiming to conclude its operations by 2030, it is the Budapest 2030

strategy. In reports found on the Budapest municipality website, it is possible to identify several proposals such as increasing the green area, increasing the leaf area index in public spaces through the implementation of green walls, interventions in the existing courtyards to increase the drainage surface, and plant species and also projects for some streets to increase their green infrastructure.

3.2. The city of Goiânia

Goiânia is the capital city of the State of Goiás, located in the midwest region of Brazil. Designed in 1933 for 50,000 inhabitants and based on garden cities, the city had several green areas initially established. Although, in the 1950s, the city already reached the mark of 53,389 inhabitants (IBGE, 1950), demonstrating the accelerated growth suffered, above its planning. From the 1990s onwards, Goiânia began to promote the renovation of existing urban parks and the creation of new ones (Streglio, 2013).

The estimated population for the municipality of Goiânia alone in 2021 was 1,555,626 people (IBGE). The city is part of the Metropolitan Region of Goiânia, formed by 20 municipalities (according to the legislation LCE nº 78/2010), showing an average urbanization rate of 98% (BORGES, 2017).

According to studies carried out by AMMA (Municipal Environment Agency of Goiânia), the city presented a rate of 94 square meters of green areas per inhabitant and an index of 0.79 planted trees on public roads per inhabitant (Goiânia Urban Afforestation Master Plan, 2007). Despite this finding in 2007, studies still demonstrate the loss of vegetation due to urban occupation through maps until 2010 (Figure 4). According to Nunes (2020) the percentage of the green area in relation to the total area of the municipality is 28.09%. The green areas in the city are distributed in 191 parks and forests (AMMA), apart from squares, gardens, and others. A considerable amount of those is riparian forests of watercourses Permanent Protection Areas (PPAs), that can be found in good conditions or completely uncharacterized (NUNES, 2020).

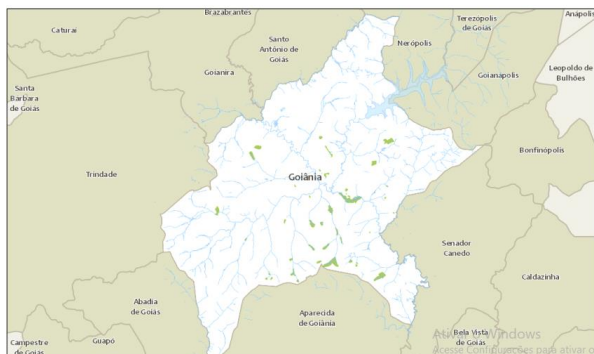


Figure 3: Digital Basic Urban Map of Goiânia (SIGGO)
- <https://portalmapa.goiania.go.gov.br/mapafacil/>

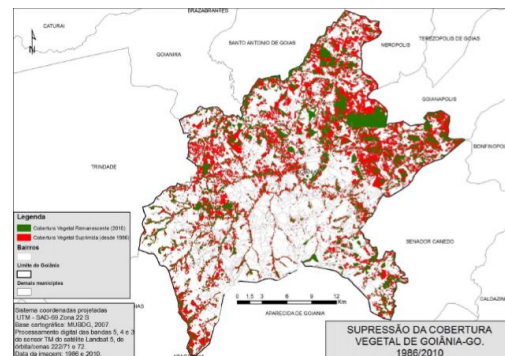


Figure 4: Suppression of vegetation cover in Goiânia, from 1986 to 2010 (Streglio, 2013).

The afforestation rate of public roads in the city is about 89.3% (IBGE, 2010), reaching first place among cities in the country. Considering this number as a high rate, and the benefits of implementing trees along streets and pedestrian zones, the debate about this data is based on the choice of species to be used, since depending on the type of roots, the height of the trees, in addition to the production of flowers and fruits, the species can damage sidewalks, walls, vehicles or compromise pedestrian safety.

3.3. The city of Fortaleza

Fortaleza is the fifth most populous city in Brazil and the capital of the State of Ceará. The Municipality has around 2,687 million inhabitants and has 314,930 km². According to the

Fortaleza 2040 informative booklet, the following percentages of land use occupation were found: Built / under construction area (72.01%), which has the highest occupation in its territory; Anthropized vegetation with an irregular pattern (15.45%) - more significant occurrence in the eastern portion of the Municipality; Natural mangrove / apicum vegetation (3.29%) - highest occurrence in the fluviomarine plains of the Cocó and Ceará rivers.

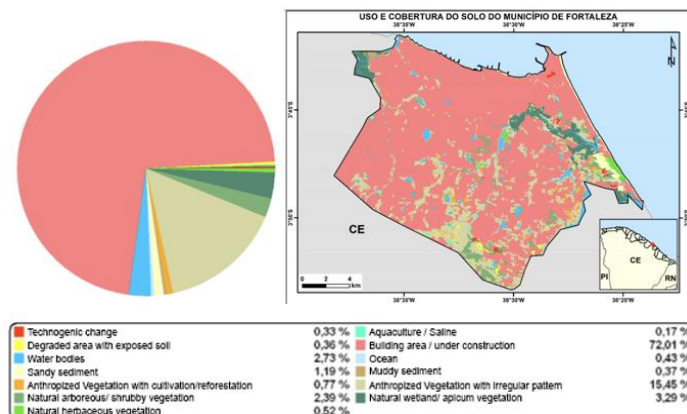


Figure 6- Land Use and Coverage in the Municipality of Fortaleza (Secretaria do Meio Ambiente do Estado do Ceará (SEMACE), 2016.)

The city is carrying out projects related to the FORTALEZA 2040 program, which is planning for the city with strategies to be implemented in the short, medium, and long terms, aiming at urban development that is based on sustainability. The reports from Fortaleza’s Municipality show the progress of green coverage in the city. The interventions that were made were little explored in relation to biological diversity, perhaps related to implantation aimed only at mainly improving the visual quality or the sense of security.

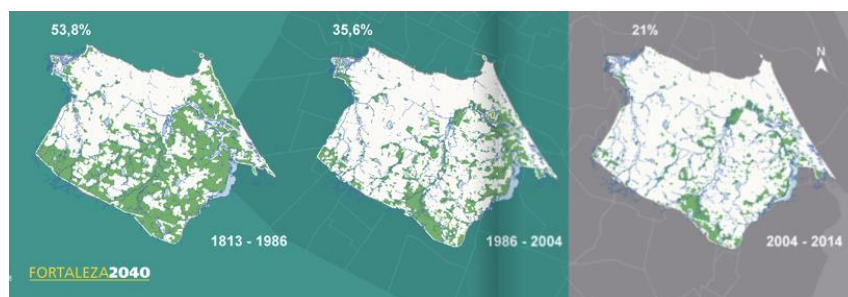


Figure 7- Fortaleza 2040 informative booklet – Green Coverage evolution (Fortaleza 2040 report. Municipality of Fortaleza).

Regarding the planting of trees in the Municipality, a project of urban green structure, in 2014, also is part of the Fortaleza 2040 project, the city's Arborization Plan, with a participatory nature of civil society and private initiative companies and City Hall organizations. The actions take part in amplifying the arboreal coverage area in the city's sidewalks through the incentive and population interest in having a tree and being responsible for it together with the town hall and donation of tree seedlings to the citizens through different ways in addition to educational actions.

Fortaleza has the most extensive urban park in Brazil's north/northeast region of Brazil, the Cocó Park, a public park with a linear greenspace structure, located on the lower course of the Cocó River. It has 1155 ha, in which the hydrographic basin is completely inserted in the

Metropolitan Region of Fortaleza, draining about two-thirds of the area of the Municipality. It is an area identified as an estuarine complex in which the ecosystem found is represented by mangroves which are of great importance for regulating environments in the tropical coastal region. This active biological surface comprehends around 542 km and embraces 13 neighborhoods. Because it is the largest urban park in the city and because the mangrove is an ecosystem that is difficult to access physically, its use for leisure is restricted to only a few portions. It is possible to find trail areas and ample spaces for the community, and even boat trips on the river.

The east side today is the newest axis of economic and urban development of the city as it is an area that is getting denser, and this is a factor for the strategic and sustainable urban project plus the concern for the protection of the green spaces that still exist related to this extensive green system of the Cocó and its physically following area, the Natural Sabiaguaba Park. In this scenario of the progressive development of the east side, the ecosystem of the preservation area has been excessively pressured by the resident population in its surroundings due to precarious settlements in risk areas and real estate speculation, being possible to identify vast regions in floodplain altered by the construction of condominiums, commercial buildings, subdivisions, leisure areas, among other attacks the quality of the water system such as disposal of domestic and industrial waste and sewage and landfills.

4. Discussion

In the city of Goiânia, one encouraging idea is the “Plant the Life” (Plante a Vida) Program. Based on the idea of voluntary afforestation, it consists of the free distribution of endemic species seedlings to the population. It encourages citizens to actively participate in voluntary planting on sidewalks of public roads, islands, roundabouts, valleys, parks, as well as in backyards and other private areas (Goiânia Urban Afforestation Master Plan, 2007). Green and leisure spaces represented in Figure x are in its majority of parks, forests, ecological reserves, squares, gardens, streets afforestation, and streams riparian forests (NUNES, 2020).

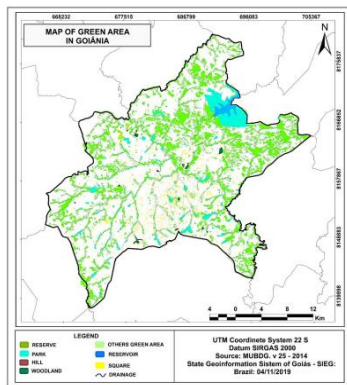


Figure 8: Goiânia green and leisure areas (NUNES, 2020).



Figure 9: Flamboyant Park in Goiânia, in 2002 and 2018 (SAKATA, 2018).

According to Figure 8, a significant portion of Goiânia's green spaces are those along with water bodies, consisting of riparian forests, protected by environmental law as Permanent Preservation Areas. The city also has 7.7% of its territory (56.56km²) regulated as Conservation Units, defined by the city as protected areas with caution on biodiversity conservation (NUNES, 2020).

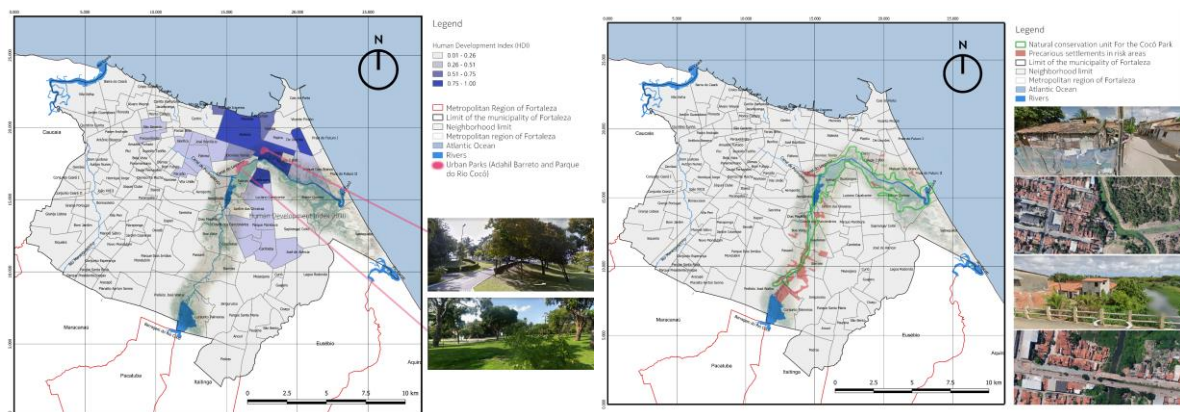
Real estate speculation must be involved in the investment equation in parks, as it influences the development of the regions surrounding the green areas. As well, the lack of investment

and the abandonment of green areas can generate an increase in the population's feeling of insecurity and real estate devaluation in the region. It is possible to understand that a significant number of parks are created and improved to enhance the image and developments of the neighborhoods after they have already been chosen for the expansion of the higher income strata. (SAKATA, 2018).

In Goiânia, real estate development can be associated with the planning of open spaces in high-income neighborhoods, with parks without closures, and utilized by the general population, from different income groups. In addition to vegetation and leisure facilities, the presence of lakes was a real estate attraction factor, symbolically representing power over water access (SAKATA, 2018).

In relation to Fortaleza, it is possible to notice that the State Natural Park, even though it is very extensive, few parts are used for the enjoyment of the local population, the most used points for leisure are considered in maps of the city master plan as urban parks, they are found on the developed map by the authors, called Parque Adahil Barreto, and Parque do Rio Cocó. Around these can be seen better quality on the neighborhoods' Human Development Index (HDI) from 2019, data collected from the Fortaleza Planning Institute website.

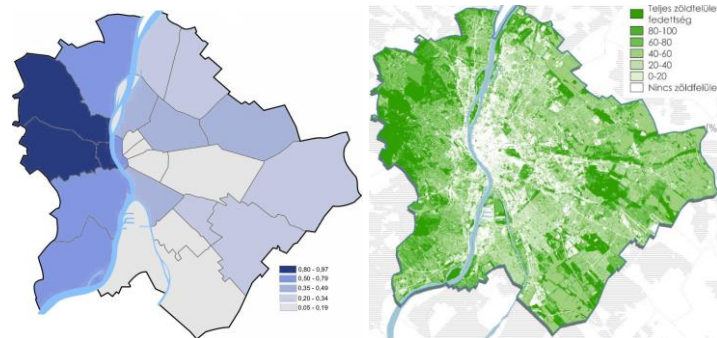
In other regions that the park reaches, the reality is different. At some points, it is possible to notice the pollution by debris, the lack of demarcations and maintenance of its limits, and the incidence of precarious housing in areas of potential flooding by the river bed, being possible to understand the situation of a worse Human Development Index (HDI) scenario on the closest neighborhoods. With the collection of data translated into maps, it is possible to identify more problematic areas in the socio-economic context and relate this to the situation observed regarding the quality of green environments in the region, indicating an inequity in environmental justice regarding the urban park in the city.



Figures 10 and 11 - HDI map from the Municipality of Fortaleza and Map of precarious settlements in the Cocó Park region. Maps made by the authors. (Source: Secretaria do Meio Ambiente do Estado do Ceará (SEMACE), 2016)

There is a clear difference between all the cities analyzed. It is possible to perceive differences between the portion of green areas in a city with modernist plans such as Goiânia, with design principles found in the garden city concept of a city such as Fortaleza. Furthermore, looking at the green coverage of Budapest together with its HDI map, and comparing this with the other cities analyzed, some differences are noticed. The three cities have considerably different percentages of vegetation cover, and the extent of their urban areas should be considered for this analysis, even if the populations are in similar parameters (Goiânia: 729,296 km², Fortaleza: 312,353 km², Budapest: 525,2 km²).

Firstly in relation to its HDI map, demonstrating a contrary situation found commonly in Brazilian cities, there are more areas with a better HDI situation than with a low index, and secondly in relation to green coverage, in which the green areas occupy a bigger percentage and it is more spread in Budapest than in the Brazilian cities analyzed. It is not only possible to understand that there is great social inequality but also access to green for the population of Brazilian cities. It is possible to see that a city like Budapest also has room for improvement in terms of urban green infrastructure, especially in the city center, but it is still possible to see more projects which have more technical explanations and more variety than the projects of Brazilian municipalities, as an example is possible to download the five Green Infrastructure Booklets from the Budapest Municipality website.



Figures 12 and 13- HDI map from Budapest and the total green surface map (Source: Izsák, Éva & Probáld, Ferenc & Uzzoli, Annamária. 2022. EXAMINING THE FACTORS OF QUALITY OF LIFE – A CASE STUDY IN BUDAPEST/ Municipality of Budapest, 2019.)

5. Conclusion

It is possible to notice that the analyzed cities show interest in increasing and improving their urban green areas, worrying about the population's access to them. With extensive evidence of the positive impact of green areas' presence on the quality of life of the urban population, Budapest, Goiânia, and Fortaleza follow the international indication of the need for planning and investment in urban parks, gardens, and the presence of green areas in general.

When studying the evolution of parks in Brazil between 2000 and 2015, it is observed that they are a factor in real estate appreciation and improvement in the quality of life in high-income neighborhoods. In urban peripheries, however, they can be seen as a matter of management, maintenance, and security problem for public authorities (SAKATA, 2018). Thus characterizing the different investments in green areas that each region of the city will receive over time and the consequent access or not of the population to them.

There is still a vast field of research on what environmental justice means for each of these cities and on the possibilities for solutions. Furthermore, the availability of Brazilian cities maps could be improved, for updated data on green infrastructure. For future purposes of continuing this research, it is recommended to conduct a questionnaire survey in Brazil and in Budapest to compare the physical, socio-economic and cultural aspects of the respondents, as well as their impressions and feelings about the characteristics of public parks. The questionnaires can be collected online regarding each city, the results can be analyzed by SPSS software and mapped by GIS software. The survey results would be assessed based on data collected from publicly available statistical databases and from the municipalities.

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