congreso internacional arquitectura y urbanismo

En tropico
REVISTA DE ARQUITECTURA Y URBANISMO

Article

Morphology and agents of urban transformation: a case study in the State of Mato Grosso, Brazil

Morfología y agentes de transformación urbana: un estudio de caso en el estado de Mato Grosso, Brasil

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Abstract: The study aims to propose a method of analysis that fosters a clearer understanding of the spatial transformation resulting from the actions of specific social groups in shaping urban space according to their interests. It investigates the territorial transformation related to the roles of different agents through urban morphology, aiming to understand the correlation between Brazilian urban forms, public management and the direction of public investments. To analyze how the city has evolved over time, the research was structured from a case study that mapped the urban transformations of the municipalities of Cuiabá and Várzea Grande during the 2006-2021 interval. The adopted method includes three tools for investigating the territory: a) the creation of thematic cartographies through the comparison of aerial images from Google Earth; b) the establishment of analysis categories that identify the predominant types of building transformations in urban blocks and the major interventions in the road system; and c) the assessment of significant events that occurred in the cities during the studied period. A quantitative analysis is presented, showcasing the approximate values of areas in hectares (ha) corresponding to the indicated categories of analysis. As a result, the maps revealed that the relationship between various forms of urban land occupation and the implemented road infrastructure reinforces the process of socio-spatial segregation. It is concluded that the proposed method, combined with historical and socioeconomic studies, effectively reconstructs urbanization processes enabling a better understanding to intervene in the reality of our cities.

Keywords: urban transformations; urban morphology; real estate market; public management; socio-spatial segregation.

Resumen: El estudio tiene como objetivo proponer un método de análisis que fomente una comprensión más clara de la transformación espacial resultante de las acciones de grupos sociales específicos en la configuración del espacio urbano de acuerdo con sus intereses. Investiga la transformación territorial relacionada con los roles de diferentes agentes a través de la morfología urbana, con el fin de comprender la correlación entre las formas urbanas brasileñas, la gestión pública y la dirección de las inversiones públicas. Para analizar cómo ha evolucionado la ciudad a lo largo del tiempo, la investigación se estructuró a partir de un estudio de caso que mapeó las transformaciones urbanas de los municipios de Cuiabá y Várzea Grande durante el intervalo 2006-2021. El método adoptado incluye tres herramientas para investigar el territorio: a) la creación de cartografías

Citation: Almeida Rodrigues Alves, L. C.; Pereira da Silva, J. M. Morphology and agents of urban transformation: a case study in the State of Mato Grosso, Brazil. *International Congress of Architecture and Urbanism.* **2024**, 2, 2. https://doi.org/10.33413/eau.2024.367.

Academic Editor: Heidi De Moya Simó y Gilkauris Rojas Cortorreal

Received: 21/07/2024
Accepted: 16/10/2024
Published: 01/11/2024

temáticas a través de la comparación de imágenes aéreas de Google Earth; b) el establecimiento de categorías de análisis que identifiquen los tipos predominantes de transformaciones edilicias en los bloques urbanos y las principales intervenciones en el sistema vial; y c) la evaluación de eventos significativos que ocurrieron en las ciudades durante el período estudiado. Se presenta un análisis cuantitativo que muestra los valores aproximados de áreas en hectáreas (ha) correspondientes a las categorías de análisis indicadas. Como resultado, los mapas revelaron que la relación entre las diversas formas de ocupación del suelo urbano y la infraestructura vial implementada refuerza el proceso de segregación socioespacial. Se concluye que el método propuesto, combinado con estudios históricos y socioeconómicos, reconstruye efectivamente los procesos de urbanización, lo que permite una mejor comprensión para intervenir en la realidad de nuestras ciudades.

Palabras clave: transformaciones urbanas; morfología urbana; mercado inmobiliario; gestión pública; segregación socioespacial.

1. Introduction

This work aims to contribute to the debate on the morphological transformation of urban territory within the Brazilian context and the reconstitution of the process of urban land occupation. By enhancing our understanding of this process, it allows for a deeper reading of the urban landscape over time. The landscape, shaped by the process of territorial occupation, reflects the dynamics and social conflicts of the space. When a specific social group occupies a territory, the landscape embodies its cultural, economic, ethnic, local, and political characteristics, resulting in changes to its morphological aspects.

The objective of this article is to present the application of the research method, which aims to promote a clearer perception of the spatial outcomes and the roles of different agents in the transformation of urban landscapes in Brazilian cities Through mapping, it identifies where and how these transformations occur. The analysis facilitates a discussion of urban processes in the light of the dispute among agents that shape the urban space, as well as the relationship between public urban interventions in road infrastructure and the fragility of low-income social groups, that depend on the urban location to achieve their degree of citizenship.

The urban areas of the municipalities of Cuiabá and Várzea Grande, in the State of Mato Grosso, Brazil, are taken as the territorial focus and subject of analysis for the period between 2006 and 2021. This time frame is justified by the relevance of the territorial changes that occurred in these municipalities in this period. Notably, it is at the beginning of this interval that national socioeconomic policy began to challenge the urbanization conditions of Brazilian cities through the expansion and democratization of public credit subsidies for housing production. This shift resulted in increased real estate activity and left enduring marks on various dimensions of the urbanization process in the country (Rolnik & Klink, 2011).

The contribution of the proposed analysis method to understanding the urban landscape is based on the development of various thematic cartographies, which map the locations that have undergone urban transformations using the visualization resource of historical aerial images available on Google Earth. The research proposes categories of analysis and adopts a qualitative examination carried out from two objects of analysis: a) the different types of buildings preponderant in the urban blocks that occupy the land; and b) the location of interventions in the road system (new roads, under construction, road widening, etc.). Finally, quantitative tables are created, presenting approximate values of areas in hectares (ha) corresponding to each established categories of analysis.

The article was structured in three sections, which describe: 1) the case study and the spatio-temporal frame of work; 2) the research method developed and applied in the study; and 3) the main

observations drawn from the analyses of the maps regarding the relationship between different forms of urban land occupation and public urban interventions in road infrastructure.

In this research, the public or private interests of specific social groups involved in the process of urban land occupation are problematized. Historically in Brazil, this association of interests has been characterized by the dynamics between individuals and the State in shaping space to benefit particular segments of the population, often through the concentration of various types of benefits in specific urban locations (Villaça, 1998). This relationship, marked by the differentiation based on private land ownership and political and economic interests, is reflected in mechanisms that control the territory and regulate access to the land market by those in power.

From 2005 onward, new territorial transformations have emerged in Brazilian cities, prioritizing large economic groups and addressing the right to the city under the responsibility of the market and the pricing of urban land, in which the value of the land conditions the buyers' ability to pay in the face of real estate market offers and deepens the process of socio-spatial segregation (Abramo, 2007; Fix, 2011; Maricato, 2001; Silva, 2016).

Therefore, although the territorial cut has specific characteristics, the proposed analysis method allows for the observation and understanding of a contemporary urbanization pattern present in the constitution of the urban landscape of major Brazilian cities. This form of appropriation of the urban fabric served as a strategy for social, political and economic domination through space, shaping how agents and their respective urban instruments contribute to the physical expansion of recent urban occupations and their associated social costs.

2. A case study in the State of Mato Grosso, Brazil, covering the period from 2006 to 2021

The work was structured from a case study that examined recent urbanization processes driven by different agents of urban development. The territory analyzed consists of two cities in conurbation: Cuiabá and Várzea Grande, as illustrated in Figure 1. Cuiabá, the capital of the State of Mato Grosso, has its territorial and urban limits defined by the Cuiabá River, which forms its border with Várzea Grande. Together, these cities constitute the only metropolitan region in the State of Mato Grosso, located in the Midwest region of Brazil.

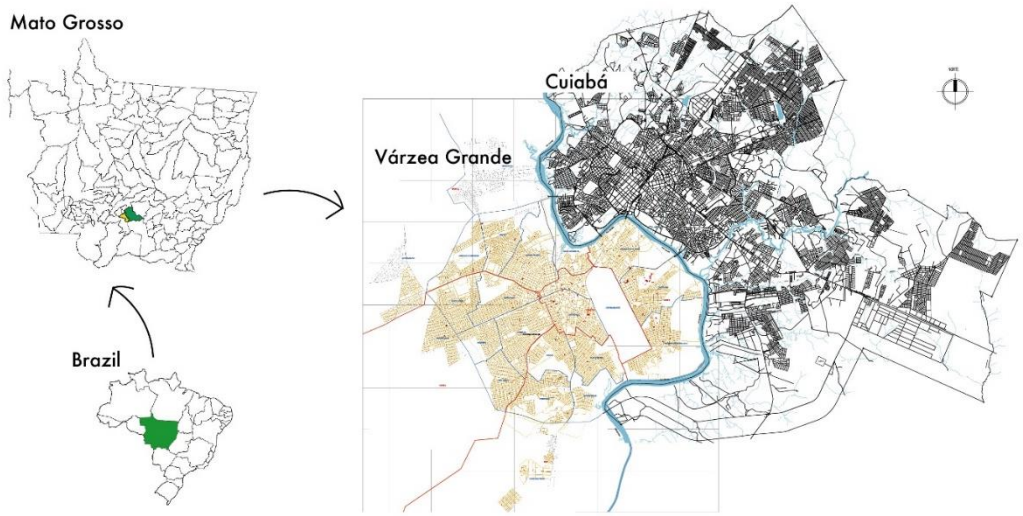

Figure 1. Location of Cuiabá and Várzea Grande. Source: prepared by the authors, 2024.

Through a literature review primarily based on the studies of Azevedo (2006, 2015), it is evident that the State of Mato Grosso has a history of urbanization driven since the 1970s by federal plans and programs. These initiatives played a fundamental role in the physical structuring of the State, implementing actions aimed at opening the economic frontier in Mato Grosso, modernizing agricultural production for export, and intensifying soybean cultivation as the primary agricultural product.

To interconnect the North and Northeast regions of Brazil, the construction of road infrastructure became a priority for the flow of agricultural production and the direction of the migratory movements to selected areas. This effort resulted in the creation and emancipation of several urban centers in the State and fostered the emergence of many new cities (Azevedo, 2015; Vilarinho Neto, 2007). Since the 1980s, the number of municipalities in Mato Grosso has more than doubled, increasing from 55 municipalities in 1980 to 141 municipalities today (Brazilian Institute of Geography and Statistics [IBGE], 2022). Thus, cities developed through a migratory process driven by workers who sought to enter the labor market, alongside policies of access and distribution of land that emerged, leading to a rapid increase in the urban population.

As stated by Azevedo (2006), the development of urban equipment and services resulting from public policies aimed at the economic integration of the territory in Mato Grosso linked the cities of Cuiabá and Várzea Grande to the role of economic center of the State. The municipalities experienced significant public interventions, coinciding with the intensification of the capitalist mode of production, which favored large landowners and the cultivation of monocultures for export. Consequently, at the end of the 1990s, this modernization brought several socio-environmental challenges, along with economic and territorial impacts.

The rapid urbanization of cities across the territory of Mato Grosso, accelerated by territorial policies, prompted an examination of the urbanization patterns and the socio-spatial dynamics identified in the municipalities in question. These aspects and dynamics are consistent with those observed in other cities throughout the national territory, where urban development has prioritized high-income families, often disadvantaging populations with limited access to land.

2.1. Development of the time frame

The research focuses on the time interval between 2006 and 2021, divided into three periods marked by the impact of significant events that occurred in the territorial cut:

1. **Base period (from 2006 to 2010):** this period begins with the resumption of national socioeconomic policies addressing the housing issue during the administration of President Luiz Inácio Lula da Silva (2003 to 2011). His administration introduced public housing financing policies alongside structural changes in private capital aimed at serving low-income segments with limited payment capacity. During this time, the urban landscape of Brazilian cities began to reflect the impacts of local economic policies, with the advance of the real estate market and a milestone in relation to urban growth (Fix, 2011).
2. **Second period (from 2011 to 2015):** this period significant due to the transformations that occurred four years after the revision of urban instruments aimed at establishing premises and strategies for growth and development in the urban areas of Cuiabá and Várzea Grande. Notably, the legacies left by the implementation of major road infrastructure projects and their consequences for integrating the urban networks of the two cities, particularly in response to the requirements of the International Football Federation (FIFA) for the 2014 World Cup, stand out.
3. **Later period (from 2016 to 2021):** during this period, there is a notable increase in urbanization and a significant population growth in the municipalities.[1]

[1] Between 2010 and 2022, the municipalities under study experienced notable population increases: 1) Cuiabá's population grew from 551,098 inhabitants in 2010 to 650,877 in 2022; and 2) Várzea Grande saw an increase of 47,482 inhabitants during this period, rising from 252,596 inhabitants in 2010 to 300,078 in 2022 (Brazilian Institute of Geography and Statistics [IBGE], 2022).

The investigation of the process of urban land occupation and transformation, shaped by both physical-spatial characteristics and the historical, social, economic, political and cultural aspects mentioned, considers that the urban form and the morphological elements of the urban fabric reveal the processes that gave rise to it, as noted by Lamas (1993). Thus, the identification of urban transformations through morphological analysis allows us to connect these changes to the actions of public and private actors. The cartographies developed in this research provide a deeper understanding of the phenomenon of socio-spatial segregation.

3. Developed research method

The study of territorial disputes and intense socio-spatial segregation across the vast Brazilian territory – primarily linked to urban morphology – has been advanced by scholars such as Abramo (2007), Macedo et al. (2012), Silva (2016), Tângari (2022) over recent decades. The identification of the interests of specific social groups, the various stages of transformation and the processes of valorization that urban land undergoes adds to the complexity of this research. The primary objective is to understand the spatial outcomes resulting from different patterns of urban land occupation and the conflicts that arise among various agents.

The research method employed is based in a qualitative analysis of the urban areas of the municipalities of Cuiabá and Várzea Grande, aimed at identifying the urban transformations that occurred from 2006 to 2021. The analysis begins with the examination of aerial images related to the three periods defined by this timeframe, utilizing the historical image visualization resource available on Google Earth.

Each block was identified and delineated using polygonal drawings. Those exhibiting divergences in building typology or land subdivision were assigned numbers. It should be noted that the polygons encompass both entire blocks and portions of blocks, as well as significant sets of blocks that share the same typological characteristics. The analytical criteria established in previous studies (Silva et al., 2021) were utilized, as illustrated in Figures 2 and 3.

Next, public urban interventions in road infrastructure were analyzed. It was observed that the main roads in both cities underwent three significant changes: a) the expansion of road lanes; b) the extension of existing roads; and c) the opening of new roads. These alterations have created inherent conflicts. This analysis indicates a process of urban expansion in both cities along and around the main roads and highways that structure the road system, as well as the implementation of targeted road interventions in specific areas of the cities.

Our study focused on two primary objects of analysis: a) the different types of buildings preponderant in the urban blocks that occupy the land; and b) the location of interventions in the road system (new roads, under construction, road widening, etc.). Considering when these urban transformations occurred, we defined 12 distinct patterns of urban land occupation, based on two major scales of analysis: a) urban transformations into plots, which occurred in areas not yet subdivided in 2006; and b) transformations in the blocks, which took place in previously parceled areas at the beginning of the period studied.

Figure 2. Demarcated areas showing land in Cuiabá, 2006. Source: Google Earth, edited by the authors, 2023.

Figure 3. Demarcated areas showing changes in the subdivision of urban land, in Cuiabá, 2006. Source: Google Earth, edited by the authors, 2023.

From these 12 standards, the following categories for analyzing urban land occupation were established:

1. **Public building** – enclosed public spaces owned by the public sector.
2. **Large land parcel: self-construction** – a significant set of blocks established by the most vulnerable populations, characterized by a concentration of low-income occupations.
3. **Large land parcel: condominium of lots** – a significant set of blocks characterized by the subdivision of large lots, which are enclosed and feature controlled access, forming residential condominiums. This category is defined by the sale of only the lot, with the construction left to the buyer.
4. **Large land parcel: autonomous horizontal** – a significant set of blocks characterized by the presence of small or medium-sized lots occupied by horizontal buildings of varying characteristics. These developments are predominantly found in areas of urban expansion and feature small and medium-sized buildings. The construction is typically managed by a construction company or developer.
5. **Block: autonomous horizontal** – this category is similar to the previous one, key distinction being the scale of the transformation; the changes occur in a block rather than across a set of blocks.
6. **Large land parcel: condominium of lots and horizontal construction** – a significant set of blocks characterized by the subdivision of lots occupied by horizontal buildings that are walled and feature controlled access, forming residential condominiums. This category involves both the sale and construction under the responsibility of the construction company or developer prior to the sale of the lots and the final construction, which is carried out by the construction company or developer before the sale to the final customer, following a standardized architectural design.
7. **Block: condominium of lots and horizontal construction** – this category resembles the previous one, with the difference being that the transformation occurs on smaller plots with greater density, often due to limited available space.
8. **Large land parcel: vertical with more than one tower** – this category is defined by a block of large proportion, equivalent to more than two average-sized blocks within the municipalities, containing multiple vertical buildings, following a standardized architectural design. These developments are walled and feature controlled access, forming condominiums. They may be implemented by either the private sector or public authorities and exhibit varying characteristics in terms of setbacks between towers, density, afforestation, landscaping treatment and areas of common use.
9. **Block: vertical with more than one tower** – this category resembles the previous one but differs in scale; the transformation occurs within a single block located in an already consolidated urban area.
10. **Block: autonomous verticals** – these blocks are primarily characterized by the presence of vertical buildings, resulting in no repetition of the architectural project across the units.
11. **Public spaces** – open public areas owned by the public sector, identified as squares and parks designated for leisure, recreation, conservation and preservation. These spaces exhibit various characteristics and implementation processes, and also include flowerbeds and roundabouts that remain from the road system, separate from the roadway.
12. **Large buildings** – public or private spaces with restricted access, characterized by large, autonomous horizontal buildings or those in functional association. This category includes hotels, event spaces, schools, shopping malls, community centers, large commercial units, warehouses, industries and aerodrome, among others.

For the analysis of interventions on the road system, three categories were established:

1. **New roads.**
2. **Qualified or expanded roads.**
3. **Roads under construction.**

In the next stage, the QGIS tool was used to create maps representing each of the three periods defined by the time frame, along with a main map that synthesizes the entire morphological transformation process[2]. Finally, quantitative tables were prepared, providing approximate areas values in hectares (ha), for each of the established analysis categories.

Using a concrete case study, we can analyze specific locations where patterns of urban land occupation are repeated. This allows us to establish relationships between the elements discussed in the literature on socio-spatial segregation and the findings from the empirical analysis.

This approach allowed us to identify the forms of urban land occupation and public interventions in road infrastructure present in the cities studied and to relate them to policies directing public investments that aligned with the interests of specific agents. Concurrently, we mapped the municipalities' expansion during this period by surveying all new land subdivisions observed. As a result, we were able to identify certain social groups involved in urban expansion, locate and quantify the associated enterprises and establish the actors linked to these groups.

Considering the dynamics of urban and social transformation in the studied cities, the influence of land value and the vectors of the road system becomes evident. In this context, we can draw on Gottdiener (1996), who points out that due to the unique nature of land, its valuation constitutes a significant source of economic power, grounded in three fundamentals: a) there is a finite amount of land in each country; b) land does not operate according to the law of supply and demand; and c) the value of land that generates wealth is inherently tied to its location. Then, if there is something peculiar about urban land, it is its unique location and value, which do not depend on the owner's investments, as public investments in the city assign certain values to it (Silva, 2016).

Consequently, the proposed morphological analysis of the urban landscape over time, considering the specific case study, highlights the relationship between the locations of the different building typologies and the roles of various agents in the territorial transformation of urban space. This analysis may reveal transformation processes similar to those observed in other Brazilian cities facing comparable contexts.

4. Analysis of urban land occupation maps and areas table for the established categories

The initial goal of creating maps that depict the locations of public urban interventions in road infrastructure, along with the types of buildings occupying urban land, is to identify the roles of various agents in transforming the urban landscape. Locations marked by precarity, resulting from the process of socio-spatial segregation, are predominantly located in peripheral regions This situation is driven by a latent demand for housing, with hinders access employment, public services and recreational facilities, thereby reflecting the broader process of urban socio-spatial segregation.

Below, we present Maps 4, 5, 6, and 7, along with Table 1, which displays the area values in hectares (ha) representing each of the 12 analysis categories in descending order.

[2] In this article, four maps are presented. The others can be found in Alves (2023).

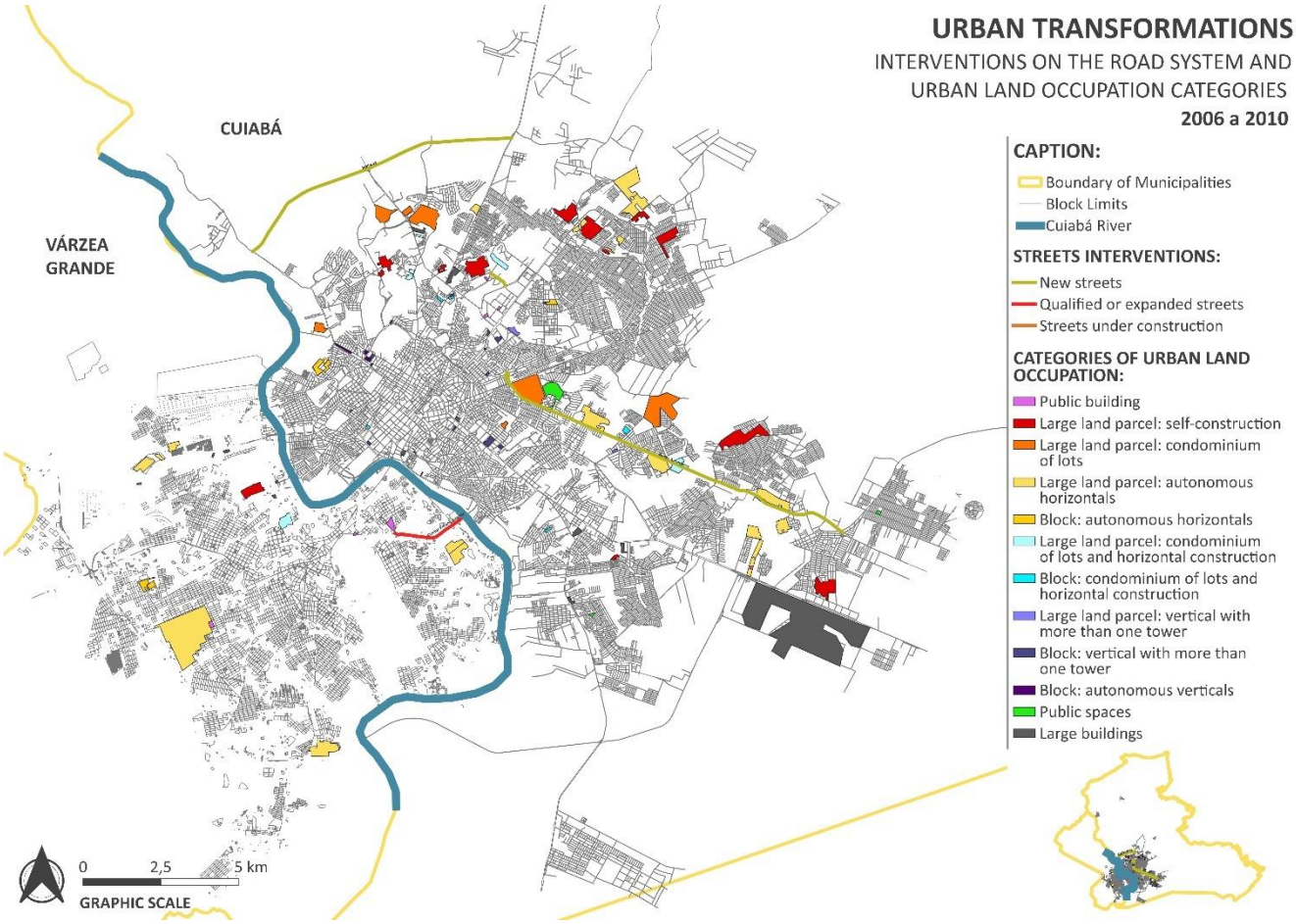

Figure 4. Urban Transformations Map: interventions in the road system and categories of urban land occupation (2006-2010). Source: prepared by the authors, 2023.

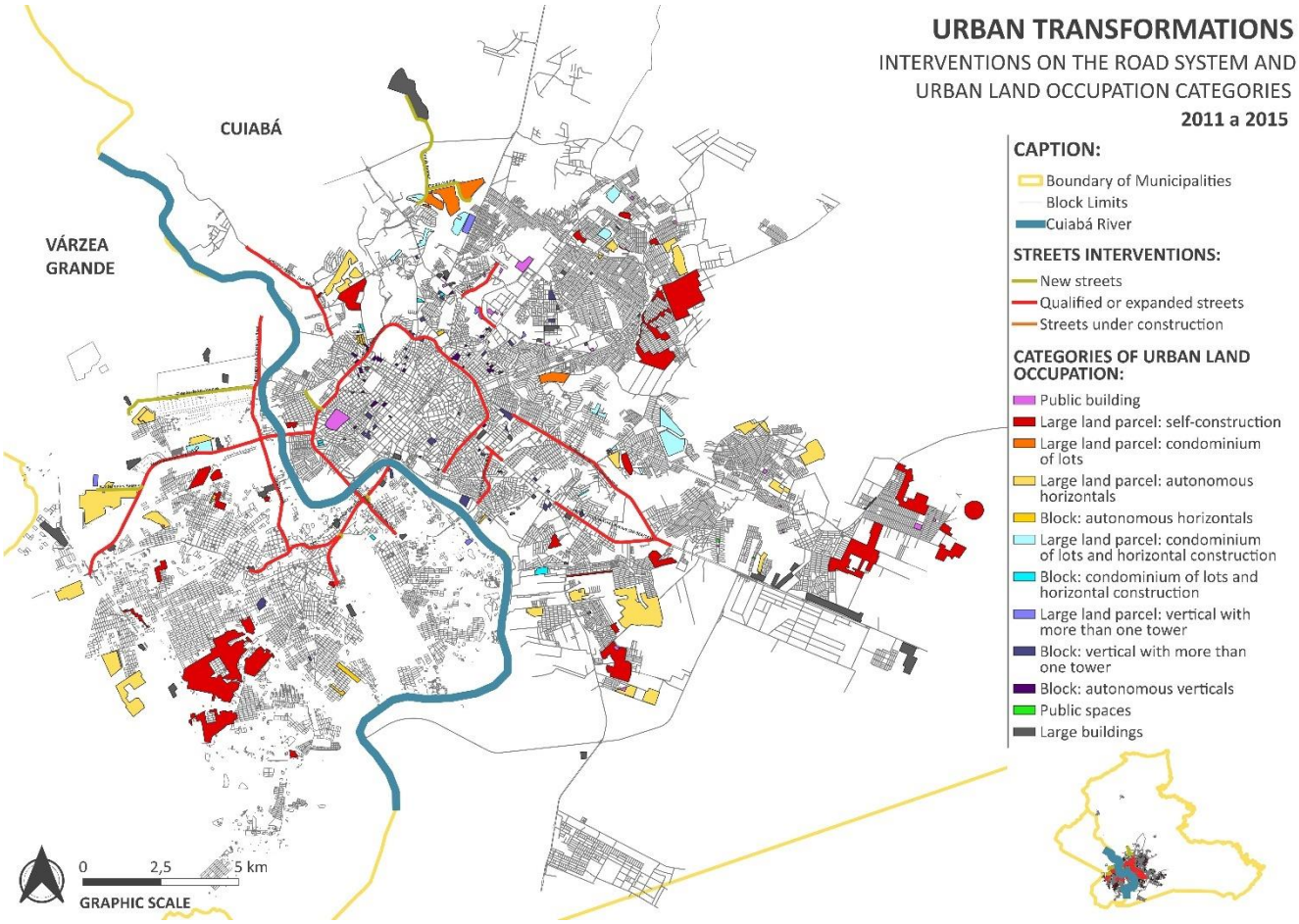

Figure 5. Urban Transformations Map: interventions in the road system and categories of urban land occupation (2011-2015). Source: prepared by the authors, 2023.

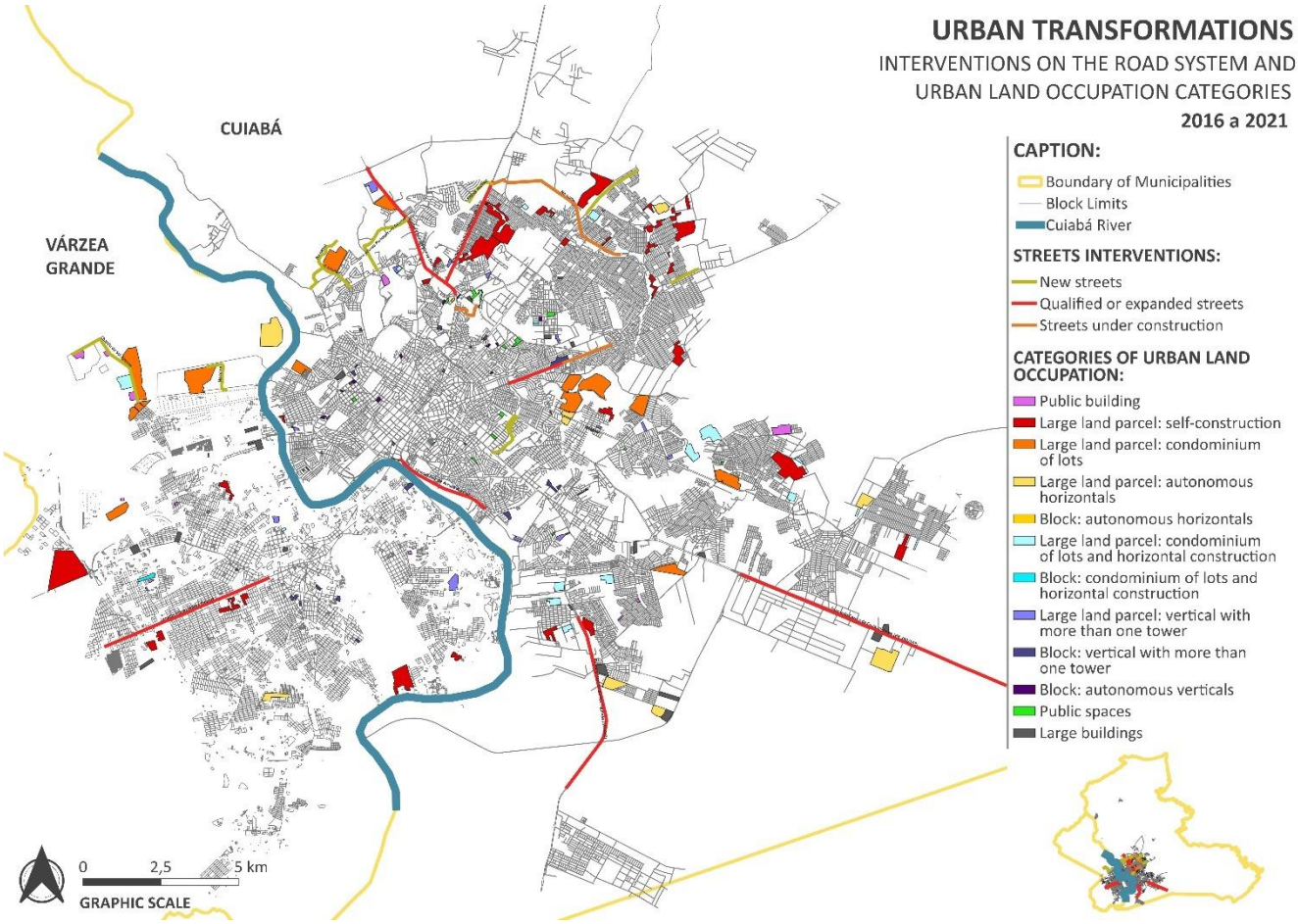

Figure 6. Urban Transformations Map: interventions in the road system and categories of urban land occupation (2016-2021). Source: prepared by the authors, 2023.

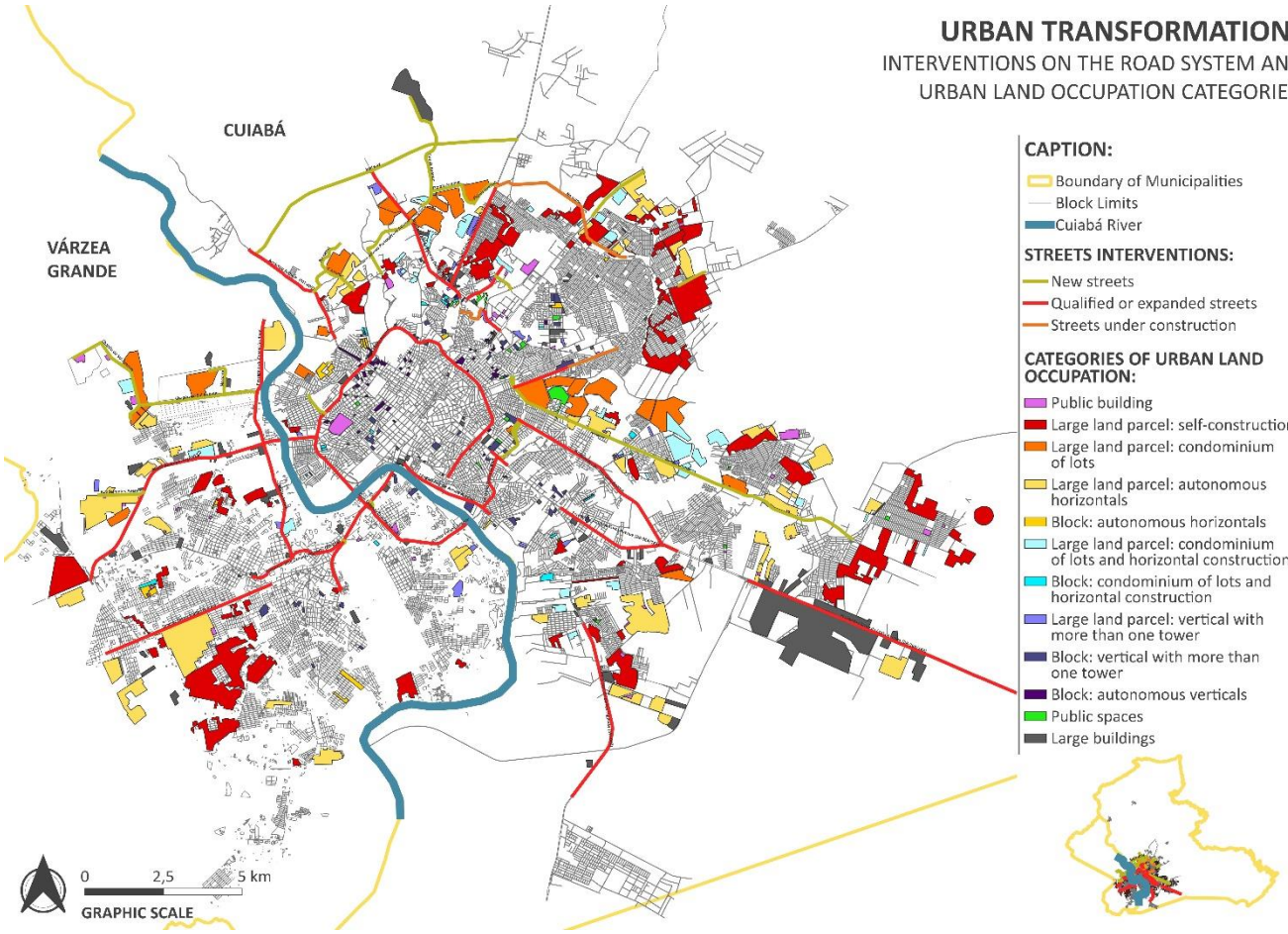

Figure 7. Urban Transformations Map: interventions in the road system and categories of urban land occupation (2006-2021). Source: prepared by the authors, 2023.

Table 1. Area calculations for urban land occupation categories (2006-2021).

Category	Area in hectares (ha)	Percentage
Large land parcel: self-construction	1,928.22	32.39%
Large land parcel: autonomous horizontals	1,425.95	23.95%
Large buildings	973.51	16.35%
Large land parcel: condominium of lots	757.89	12.73%
Large land parcel: condominium of lots and horizontal construction	329.28	5.53%
Public building	127.68	2.14%
Block: vertical with more than one tower	121.42	2.04%
Large land parcel: vertical with more than one tower	81.13	1.36%
Block: autonomous horizontals	64.09	1.08%
Public spaces	58.68	0.99%
Block: autonomous verticals	49.19	0.83%
Block: condominium of lots and horizontal construction	36.21	0.61%
Total Area	**5,953.26**	**100.00%**

Source: prepared by the authors.

In light of this objective, cartographic studies facilitate the identification of precarious settlements dispersed across the urban territory, as well as the implementation of allotments and condominiums targeting high- and middle-income populations – areas shaped by real estate market dynamics. These maps, therefore, help identify the various stakeholders involved in the occupation of urban land and assess the extent to which specific social groups access particular urban areas. Additionally, they illustrate how opportunities for accessing different rents markets vary according to location within the urban territory.

In the comparative analysis of maps from three distinct periods within the selected time frame, we identified the impact of various political, social, and economic events on the territory. Our goal is to determine whether these events reveal specific aspects of the urban form.

Figure 4, which covers the base period from 2006 to 2010, highlights the implementation of the Beltway as a catalyst for urban growth beyond the urban perimeter, extending into rural areas. Among the interventions in road infrastructure, the Beltway stands out for promoting development toward its vicinity. This area, known as the Floral Essences region[3] in Cuiabá, was shaped by the need to establish highways and their intersections for urban traffic, serving as key structuring elements that drive urban segmentation.

In this area, between 2011 and 2021, the opening of Florais Avenue and its extensions, along with the expansion of nearby highways, stands out. The creation of new roads and the improvement of existing ones have been essential to meet the needs of the local population, encouraging the use of private vehicles. Although urban transformations are driven by various economic forces, in this particular area, the real estate market has played a dominant role, evidenced by the development of

[3]This name originates from the development of three condominiums by the same real estate company, Ginco Urbanismo: Florais Cuiabá, Florais dos Lagos and Florais do Valle.

new projects, such as “large land parcel: condominiums of lots” targeting the high-income population’s lifestyle.

In the same context, Chapéu do Sol Avenue, located in Várzea Grande, was implemented during the later period, between 2016 and 2021, as shown in Figure 6. In this area, a real estate company developed an urbanization project for a planned neighborhood. Although the project is not yet visible in satellite images, it occupies a predominantly rural area through the construction of both horizontal and vertical condominiums aimed at high-income residents, as illustrated in Figure 8. The map of Várzea Grande, with an aerial image from Google Earth, provides a detailed view of the project’s location. It is also worth noting that the planned road infrastructure for this new neighborhood will enhance direct access to the central area of Cuiabá, bypassing the need to pass through downtown Várzea Grande.

Figure 8. Location of the planned neighborhood in Várzea Grande. Source: adapted from the Grupo Quatro website and Google Earth. Prepared by the authors, 2023.

This dynamic is one of the main characteristics of the cities studied and reflects a common pattern in the relocation of high-income populations through the development of new neighborhoods in other Brazilian cities. As Villaça (1998) discusses in his studies of other cities, high-income families, in their pursuit of socio-spatial distinction and social homogenization, tend to concentrate in specific urban areas. These locations attract important structuring routes, driven by the need to control the time and effort spent on commuting, which intensifies segregation by income across different city regions.

During the base period, from 2006 to 2010, Torres Avenue was also implemented, connecting the central area of Cuiabá to the Pedra 90 neighborhood in the eastern direction. Pedra 90 consists of former housing complexes built by the government in the 1990s, in what was originally a rural area incorporated into the urban perimeter only in 1994. Along Torres Avenue, the patterns of urban land occupation vary depending on the distance from the central, more developed area of Cuiabá.

At Torres Avenue, near the central area of Cuiabá, Tia Nair Park was established, featuring an extensive green space and good infrastructure for users. In the surrounding area, condominiums with adjacent or closely situated lots targeting the high-income population have been developed over the three periods studied, driven by certain real estate groups. This trend highlights the formation of significant land banks.

The real estate dynamics between landowners and developers, in collaboration with the Government, emerge during economically opportune times for implementing real estate projects. This occurs when large land parcels are acquired with the expectation of future returns, particularly through the expansion of road infrastructure, thereby promoting real estate speculation. The development of new projects, such as condominiums of lots around Tia Nair Park, intensified during the subsequent period from 2016 to 2021. This surge followed significant public investments in road improvement made during the previous period, from 2011 to 2015, which led to an increase in property values near the central area of Cuiabá.

Through the quantitative analysis of areas in the cities influenced by the real estate market reveals that the category "large land parcel: condominium of lots" holds a higher value than other areas where real estate interest is present, accounting for 12.73%. This is followed by "large land parcel: condominium of lots and horizontal construction," which represents 5.53%, primarily occurring along the edges of the urban perimeter.

Analysis of Figure 5, which pertains to the second period from 2011 to 2015, reveals a significant number of public urban interventions in road infrastructure within the central region of Cuiabá and the connections between Cuiabá and Várzea Grande. These efforts were made to meet FIFA requirements and prepare the cities for the 2014 World Cup. This process accelerated the verticalization of Cuiabá's central area through the development of new projects, such as vertical condominiums and autonomous high-rise buildings, to accommodate the population with higher purchasing power that settled there.

The central region of Cuiabá features urbanized and well-established morphological patterns; however, it possesses significant potential for transformation due to the implementation of new developments driven by the real estate market. These transformations align with the appreciation of urban land through verticalization.

In this context, the categories representing vertical buildings established in blocks, commonly referred to as vertical condominiums, account for 2.87% of the total transformations. Although this may seem like a small area (170.61 ha) compared to the other plot areas in the market (1,168.30 ha), it is important to emphasize that these vertical building typologies, located on central land—typically more expensive than peripheral areas—aim to increase the intra-block utilization coefficient. This strategy is justified by the high potential sale value of all units within a single development.

Additionally, the appreciation of already consolidated urban areas triggers a process of social substitution and real estate pressure, which progressively displaces original residents to cheaper locations farther from the central area, carrying poverty and social issues along with them.

This process of renewal in central locations, aimed at revaluing urban space to support emerging tourist activities, promote mega-events, and restore the economic strength of commerce and services, does not benefit all citizens and excludes social representation from the shaping of the urban landscape. As Maricato (2001) explains, the change in land use due to new service facilities and commercial networks displaces small local businesses and the resident population, primarily due to the significant real estate appreciation that accompanies this process.

From one perspective, peripheral location—areas lacking infrastructure and connected to the urban fabric and central regions by narrow transport routes—witnessed an increase in neighborhoods designated for low-income residents during the second study period, between 2011 and 2015, as

illustrated in Figure 5. These locations are categorized into "large land parcel: autonomous horizontal buildings", characterized by neighborhoods developed in large blocks, and "large land parcel: self-construction".

This context is not new in Cuiabá and Várzea Grande, nor in other Brazilian cities, where popular housing aimed at the low-income population has been implemented since the 1970s through public investments in peripheral areas. This approach has condemned residents to live in areas unsuitable for rational urban development while placing the burden of infrastructure expansion on other taxpayers (Maricato, 2001; Rolnik & Botler, 2003).

The growing concentration of nuclei in peripheral agglomerations and precarious urban settlements in the studied cities, primarily formed around neighborhoods of popular housing established before 2006, reflects the logic of necessity among those lacking economic resources in areas rejected by the real estate market (Maricato, 2001). These locations suffer from a lack of tertiary activities that generate local services and jobs, leading to significant pendulum movements as residents seek employment opportunities through precarious urban mobility.

The analysis of urban land occupation categories representing the most vulnerable and low-income populations accounts for the largest area, totaling 3,354.17 hectares, which constitutes more than half of the total area at 56.34%. The category "large land parcel: self-construction" corresponds to 32.39% of the total area, while the category "large land parcel: autonomous horizontal" represents 23.95%. This highlights the imbalance associated with the implementation of public facilities, which account for only 2.14% of the total area.

Reis (2006) and Rolnik and Klink (2011) highlight the seriousness of low-income housing dispersion and the extensive occupation of dense, precarious peripheral locations, which are increasingly distant from the central area. These areas often exist in discontinuity with the surrounding urban fabric and lack essential services, adequate urban infrastructure, and effective urban mobility, as well as mechanisms for collective management.

The analysis and cross-referencing of the maps and data in Table 1 reveal the evolution of urban form over time and the trends associated with the occupation of urban land. They also illustrate the influence of socioeconomic interests and the strategic positioning of various agents involved in shaping urban space. Through the review of the literature, it becomes evident that the relationship between different forms of urban land occupation and the allocation of public investments in road infrastructure—favoring individual transport—prioritizes the interests of the real estate sector and reinforces socio-spatial segregation and inequalities in physical space.

5. Final considerations

The research method presented and the analysis of the case study of the cities of Cuiabá and Várzea Grande, in the State of Mato Grosso, Brazil, provided a deeper understanding of the processes involved in the constitution of urban form and urban expansion within the studied territories. The occupation of urban land in these cities, characterized by social disputes, was marked by the pursuit of private advantages and the connections between Government and market forces, particularly regarding the valuation of land near public interventions in road infrastructure.

By cross-referencing information from the maps of the three different periods with the table of urban land occupation categories, we demonstrated that public investments primarily benefited areas and agents with closer proximity to those holding decision-making power. The implementation and enhancement of road infrastructure have been pivotal in driving changes in urban use and occupation, land valuation, and gentrification processes, all shaped by policies that align with the interests of the real estate market. This situation exacerbates the State's inability to address social issues effectively.

However, it is important to recognize that the observations and descriptions resulting from the morphological analysis of the urban fabric reveal obstacles and raise questions and challenges related to urban form and the characteristics of socio-spatial segregation. The answers to these issues must be sought through alternative means, encompassing a broader diversity of Brazilian municipalities and fostering greater interdisciplinarity.

It is also noteworthy that, despite the necessity of working with case studies that represent different Brazilian contexts, the case study presented here highlights trends in urban transformation that are observed as processes of territorial constitution in other Brazilian cities.

Financing: This study was financed in part by the Coordenação de Aperfeiçoamento de Pessoal de Nível Superior – Brasil (Capes) – Finance Code 001.

Declaration of data availability: other data can be found in the master's thesis Alves, L. C. A. R. (2023) *Urban transformations occurred in Cuiabá and Várzea Grande/MT: a morphological reading aiming at the characterization of spatial results in the process of land occupation between 2006 and 2021*. (Master's thesis). Pontifical Catholic University of Campinas, Campinas.

Thanks: To the Pontifical Catholic University of Campinas and the Postgraduate Program in Architecture and Urbanism for providing the opportunity to conduct this research. I also extend my thanks to Prof. Dr. Doriane Azevedo from the Federal University of Mato Grosso (UFMT), for her support and valuable contributions throughout the process.

Conflicts of interest: "The authors declare that they have no conflict of interest".

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