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Towards a progressive understanding of informal settlements: the contribution of the fringe-belt concept

Em busca de uma compreensão progressiva dos assentamentos informais: a contribuição do conceito de cinturas periféricas

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Abstract

Urban morphology is a body of knowledge concerned with the physical form of cities. It includes several theories, concepts, and methodologies. One of these is the fringe-belt. Fringe-belts are intimately related to the process of urban development: in a city, each period of growth is followed by a phase of slow growth or no growth, in which land is occupied by specific uses, mostly institutional, industrial, and open spaces. The concept was firstly proposed in Central Europe, and it has been recently applied into different geographical contexts to describe and explain this sequence of periods of expansion and stagnation of cities. However, the application of the concept into the Global South is less explored. The usefulness of fringe belts for planning practice (addressing conservation and transformation) and its ecological nature (including the recognition and maintenance of significant open spaces) has been discussed. Using the case study of Salvador, Brazil, this paper argues for an innovative dimension of the concept: its relation to informal settlements and its relevance to study the peripheral growth in Southern cities.

Keywords: Fringe-belts. Informal settlements. Salvador. Urban morphology. Urban planning.

Resumo

A morfologia urbana se dedica ao estudo da forma física das cidades. O campo de conhecimento engloba diversos conceitos, teorias e metodologias, dentre os quais, as cinturas periféricas. As cinturas periféricas estão intimamente ligadas ao processo de desenvolvimento urbano: em uma cidade, cada período de crescimento é seguido de uma fase sem crescimento ou de crescimento lento, na qual áreas são ocupadas com usos específicos, principalmente institucional, industrial ou espaços livres. O conceito foi inicialmente proposto na Europa Central e depois aplicado a diferentes contextos para descrever e explicar a sequência desses períodos de estagnação ou expansão. Entretanto, a aplicação do conceito no Sul global é menos frequente. O emprego do conceito de cinturas periféricas para o planejamento urbano, considerando a sua utilidade para a conservação do patrimônio ou a sua dimensão ecológica, já foi discutida. Com o estudo de

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caso da cidade de Salvador, Bahia, Brasil, este artigo debate uma dimensão inovadora do conceito: a sua relação com assentamentos informais e sua relevância para estudar o crescimento periférico das cidades.

Palavras-chave: *Cintura periférica. Assentamentos informais. Salvador. Morfologia urbana. Planejamento urbano.*

Introduction

Southern cities have been growing at a much faster pace than Northern cities, and most of these in an informal way. Informal dwellers are forecasted to be around 2 billion by 2030 (UN-Habitat, 2008). The presence of non-planned growth and the emergence of informal settlements remains a major challenge for planners in the next years. As such, informality has been a recurrent topic in urban studies (Acuto et al., 2019; Maricato, 2009; Roy, 2005). Yet, its physical character is rarely appreciated (Harris, 2018) and the physical constitution of informal development is less explored. Despite the availability of methodologies to map, model, and predict the growth of informal settlements using computational resources (Badwi et al., 2021; Sobreira, 2003), and to uncover their patterns and processes (Dovey et al., 2020; Iovene, 2018; Zappulla et al., 2014), the relational character between formal and informal settlements deserves further study.

In this paper, informality, refers to those areas of the city that have grown, most of the times rapidly and spontaneously, without normative and institutional planning. In the search of housing solutions, people, individually or in groups, occupy neglected areas of the city or those without clear ownership to build their houses. In this process, dwellers can implement, buy, or rent illegal land subdivisions, or subdivide officially approved plots into smaller ones and modify formal housing projects according to their needs. Informality is a fluid concept and most of the areas labeled as 'informal' are probably best understood as a mix of formal and informal (Dovey & Kamalipour, 2018).

This overlay of different conditions implies that certain areas are considered more formal or informal, if settlements are tolerated, recognized, or ignored. Overall, in the words of Roy (2009, p. 826) "informality lies within the scope of the state rather than outside it." The role of the state is essential in legitimizing certain areas whereas neglecting others (Rolnik, 2015). Despite all theoretical discussion and socio-economic issues arising from 'urban studies' on informality, this article is more interested in unveiling the spatial distribution of informal settlements across a city and in the impact (not always a successful one) of planning decisions in shaping a space over time. The role of agents and the characteristics of urban forms are analyzed for this purpose.

The influence of spatial planning into producing social segregation and perpetuating poverty needs broader investigation historically (Vaughan, 2018). In Brazil, this is a frequent theme highlighting the failure of strategic plans and discussing the role of planning as one of the main segregation agents (Arantes et al., 2002; Maricato, 2009). Scholarship indicates that innovation in the planning field have produced a variety of managerial tools (Vainer, 2000), but not alternative land use regulations (Watson, 2009).

This study has two main objectives. The first is to discuss the usefulness of a physical approach to analyze and offer a scientific basis for planning our cities – for different positions on the debate between research and practice see Holanda (2018) and Strappa (2018) – more specifically addressing informal settlements. The paper argues that urban morphology provides new knowledge about the physical form, the main agents, and the processes of change – of cities and their informal settlements. In particular, the article explores the use of the fringe-belt concept, conceived within the historico-geographical approach (Oliveira, 2019; Whitehand, 1981) to address informality. In the classic study on Alnwick, a town in Northeast England, Conzen (1960) defined the fringe-belt as a belt-like zone originating from the temporarily stationary or slowly advancing fringe of a town and composed of a characteristic mixture of land use units initially seeking peripheral location. Conzen (1960) took the concept proposed by Louis (1936) giving it a central role in his emergent morphological theory.

Since the late 1960s, Whitehand has progressively extended the scope of the concept, exploring new aspects of its spatial dimension – from city to conurbation, from static to dynamic (Whitehand, 1967), adding it an economic (Whitehand 1967), an agency and a planning perspective (Whitehand & Morton, 2004), and confirming its validity in different geographical contexts (Whitehand et al., 2011). The detailed understanding of fringe-belt formation and modification, and the economic perspective has been subsequently taken up by Barke (1974, 1990).

The origins, developments and main characteristics of the concept have been reviewed in two papers published in the last 12 years (Conzen, 2009; Ünlü, 2013). These reviews, and the analysis of additional papers published after 2013, make evident that the concept has been explored mostly in Europe and in the global North. On the contrary, its applications to Southern cities are few, including studies in Central and South America, Middle East, Africa, and Asia: Morelia (Rodrigo-Cervantes, 1999), Ouro Preto (Conzen, 2007), Maringá (Meneguetti & Costa, 2015), Lusaka (Whitehand, 2009), Baghdad (Al-Ashab, 1974), Mersin (Ünlü, 2013; Ünlü & Baş, 2016), Pingyao (Whitehand et al., 2011) and Nanjing (Whitehand & Gu, 2017).

Informality seems to be absent from these fringe-belt studies, except for some reflection of the relation between fringe belts and informal housing areas (see Ünlü & Baş 2016). Given the specificities of Southern cities, including the fast rhythm of growth, the large presence of informality, the immense peripheral expansion, and the noticed lack of spatial data, an updated fringe-belt application is a challenging and inspiring task.

The second objective is to present the application of the fringe-belt concept in a case study to verify the possibilities of using the concept to describe, explain and plan peripheral growth. While rigorous description and explanation are two scientific activities, it is argued that they can inform planning, even if the later involves other dimensions – including values and ethics – which are not scientific. The case study, Salvador, is a coastal metropolitan city of Portuguese foundation in Bahia, Brazil. To address the urban patterns of Salvador, it is important to clarify the context in which the city has been developed. The article discusses the processes of physical transformation that impacted in the resultant urban form configuration with an elevated presence of informal settlements. The proposed analysis relies on the investigation of elements of urban form – street, street-blocks, plots, and buildings –, the articulation between them, on social issues and political decisions with a spatial impact. The historical development of urban forms, the geographical composition of the city, the sequence of spatial plans and the colonial legacy of the public land lease regime will be explored to understand the extent to which they contributed for the peripheral informal growth.

The fringe-belt analysis proposed by this paper encompasses the administrative borders of the municipality of Salvador and gives a processual perspective of the city formation. This is offered as an important tool for planning, identifying potentialities and issues such as the process of growth of informal settlements. Compared to other fringe-belt studies, applying the concept to Salvador is a challenging task due to the lack of data on the plot structure – until today the city does not have a full cadastral map – and the absence of clear cycles of development led by different plans and projects (as, for instance, in British cities where the concept has been developed, after the seminal application to Berlin). The analysis benefited from the availability of data obtained from the Municipality of Salvador, digital archives, and academic sources.

After this introduction, the paper is divided into three parts. Firstly, the social background of Salvador is delineated, including a brief historical, social, and urban description. Essential characteristics of society, urbanization and the main planning instruments in Brazil and Salvador are presented. Secondly, the legal and spatial parameters of planning showing the decisions and actors that shaped the current physical form of the city are presented. The third section describes the morphological analysis and the fringe-belt application.

The paper presents a general fringe-belt scheme, explaining the process of development of the city, indicating the different periods of transformation, including growth or stagnation. Most importantly, the concept reveals the difference of development between informal settlements and formal housing areas. The analysis indicates a strong connection between peripheral industrial plots, that are part of fringe-

belts, and informal settlements. Fringe-belt alienation (loss of plots from the fringe-belt to residential uses) shows how it might happen in different ways, in formal and informal parts of the city.

The last section of the paper stresses the essential contributions of this case study. It discusses a relevant unfolding of this research: a reinterpretation of the fringe-belt concept. Whereas the importance of open spaces and green belts have been analyzed from an ecological perspective (Whitehand, 2019) and from a built heritage conservation point of view (Whitehand, 2009), the analysis indicates other fringe-belt characteristics that are relevant for planning: the relation to informal settlements and its usefulness to study and plan peripheral areas of Southern cities.

Salvador: socio-spatial background

Salvador is the third largest city in Brazil, after São Paulo and Rio de Janeiro (IBGE, 2019a). The capital of the state of Bahia, in the Northeast Region, Salvador is a city founded by the Portuguese in 1549. From the mid-16th century to 1763, Salvador was the first capital of the country. It started losing resources and commercial importance with the transfer of the capital to Rio de Janeiro. Its historical center was developed from the 16th to the 18th centuries, a period in which the city was under Portuguese rule.

By 1822, Brazil became independent and in 1850 the first Land Regime Law (*Lei de Terras*) ended the process of free allocation of land. Public land was allocated to private owners, impacting on the capitalist development of the future land and real estate market (Maricato, 1996). In 1888, slavery was abolished, and a major portion of the population was left unattended, without jobs and living in poverty. The first urban expansion took place in the 19th century, a period in which the city spread outside the historical center. The city stagnated in the early 20th century, and it has grown exponentially in the second half of the century led by the rural exodus (Santos, 2008a).

Today, the historical center is a small portion of a city with almost 3 million inhabitants (Figure 1). The latest census data indicates that approximately 40% of these live in subnormal housing conditions (IBGE, 2019b). This section of the paper describes the socio-spatial background behind Salvador's urban form. From a geographical point of view, both topography and the shoreline defined the scenic spatial set. From a socio-political perspective, the inherited land regime, racial clashes, and urban plans driven by political and economic interests led to a segregated, unequal, polycentric and fragmented city (Benfatti & Tângari, 2017; Gordilho-Souza, 2008; Santos, 2008b).

The state is pointed as the main agent influencing urban transformation, even if, landowners and real estate agents were instrumental in enabling the implementation of projects (Santos, 2008a). However, an immense transformation of space lays outside the scope of formal planning. The role of popular mobilization – individually or in groups – was essential in the formation of the urban space of Salvador. Autoconstruction was essential in the provision of housing, and racial segregation, stigmatization and land disputes contributed for the constant expansion and consolidation of this informal growth.

The first occupation of peripheral, neglected areas is reported by the early 20th century, even though the origins of the first occupations outside the city – at that time, the current historical center – date back to the time in which the first *quilombos* (resistant territories founded by people in condition of slavery that escaped from the regime) were established (Fernandes et al., 2019b). From 1940s onwards, many popular subdivision initiatives emerged close to the suburban railway system, but they remained empty due to the low capacity of the population to purchase land (Gordilho-Souza, 2001).

Housing rent in central areas was raised due to the development of infrastructure projects and hygienist works, involving the demolition of many buildings and the construction of new streets. Therefore, many inhabitants were reallocated, or found a housing solution in collective occupations – “invasion” – in peripheral areas, through self-building processes (Brito, 2008). In 1944, 75% of the population was living in slums or under slum tenement conditions (*cortiços*) in crowded spaces whereas the formal, richer city expanded towards the coastline (Vasconcelos, 2016).

A series of projects in the 1930s and 1940s designed a parkway system, using the valleys of Salvador as transport channels. Since the 1950s, the city has gone through major changes, driven by political and economic projects that implemented new infrastructures and facilities, and have redefined the centralities of Salvador (Santos, 2008a). In 1964, a military coup took place in Brazil. During this period, many infrastructure projects were realized, including social housing projects (Vasconcelos, 2016). They were mostly located in peripheral areas, far away from the city center, with few facilities and poor infrastructure, expanding the limits of the city and reinforcing segregation. The formal housing market targeted mostly the middle class and did not solve the problem of informal growth (Gordilho-Souza, 2001).

The federal Land Subdivision Law of 1979 established strict rules for land development and imposed severe penalties for illegal land developers. At the same time, it left room for flexibilization of urban parameters for areas of social housing and urbanization experiments of informal settlements. Yet, recent advances in urban legislation have not been followed by the Land Subdivision legislation, making rule commitment a difficult task. Planning standards have always been based upon formal patterns, giving an illegal or exceptional status to other design solutions (Araujo & Carvalho, 2011). A possible review for the 1979 subdivision law, the Spatial Responsibility Law, has not yet been approved after 20 years of legal developments.

The military regime ended in 1985 and a new Constitution was approved in 1988. The emergent social movements were fundamental for raising an urban agenda centered on the 'right to the city' that culminated on the approval of the Statute of the City in 2001 (Todtmann et al., 2010). Many urban plans followed this progressive law, establishing the use of new planning tools, like the *Zonas Especiais de Interesse Social* (ZEIS) (Special zones for social interest) for informal settlements and slums. The ZEIS is an essential instrument to fulfill the social function of the city. It encompasses slums and low-income housing areas, as well as empty buildings and plots with central location, and sets specific indexes and flexible rules for building. However, the flexibilization of rules has made integration difficult: they are too demanding to be achieved by low-income housing initiative (Araujo & Carvalho, 2011).

In 2009, the federal government approved the program *Minha Casa, Minha Vida* aiming at producing social housing to address the housing deficit. The initiative was subject to many criticisms as it enabled the construction of many housing units in peripheral areas with few, or no, infrastructure (Caldeira, 2017).

As the urban history of Salvador demonstrates, the legacy of colonialism – very large plots assigned to single families and religious institutions (Santos, 2008a) – together with the emphyteusis, the public land lease regime (Gordilho-Souza, 2001), and a series of planning decisions assured that few people had access to land (Brito, 2008). This resulted in the maintenance of empty plots in central areas, for the privilege and profit of the real estate market (Gordilho-Souza, 2008), whereas peripheral areas and self-building processes have been the available solution for poor people to have a house.

In addition, the topography of Salvador played a major role in conditioning the streets and buildings. In his thesis about racial contact in Brazil, Pierson (1942) discussed how the spatial distribution of population by classes and ethnicity followed closely the lay of land. The main streets are laid along the ridges and occupied by the upper class (mostly white) whereas the valleys formed the less expensive housing location and were occupied by the poorer black people. The valleys were less comfortable, healthful, and convenient for occupation.

Salvador had few comprehensive urban plans to address these issues. The implemented urban plans for Salvador have not done much to embrace the different living conditions and a number of projects has excluded the poor population to peripheral locations (Soares, 2009). Frequently, the lack of unity among projects prepared by different levels of decision-making led to urban discontinuity and negative environmental consequences (Benfatti & Tângari, 2017).

For instance, the urban plans prepared for Salvador in the 1940 (the EPUCS, *Escritório do Plano de Urbanismo da Cidade de Salvador*) and then in the 1970s (the PLANDURB, *Plano de Desenvolvimento Urbano de Salvador*), have included important socio-spatial analysis, considering the informal and formal areas of the city, but their full application has always been constrained by political interests (Fernandes et al., 2019a). Further on, the sequence of municipal masterplans for urban development (PDDU - *Plano Diretor de Desenvolvimento Urbano*) were also criticized.

The Brazilian planning legislation is very progressive. It has framed initiatives such as slum upgrading and land titling programs which have assured urbanization to peripheral areas and have been pioneer in setting new standards for planning and for housing the poor. Yet, in general, planning efforts have been ineffective to achieve spatial justice because these laws are not effectively applied (Maricato, 2009). In Salvador – as in other cities – the establishment of regulations imposed by land-use plans has rendered some parts of the city illegal and neglected others. The judicial system became an obstacle for self-building initiatives that do not have conditions to comply with the legal demands (based on the construction standards of formal areas).

The actual picture is that Salvador is mainly a city built by the low-income population (Pedrão, 2009): at least 50% of it is considered informal (Gordilho-Souza, 2001) and around 33% of the population lives in slums (IBGE, 2019a). This resembles a constant land dispute in which the political arena sets the rules for the legitimization of some whereas penalizing others (Rolnik, 2015). In the case of Salvador, it is actually documented that subnormal standard housing could occupy only peripheral areas – as it is explicit in the urban code (*Código de Posturas*) from 1926 (Gordilho-Souza, 2008). Planning used as a system of political domination (Watson, 2009) has acted to reinforce segregation in cases where land assignment legislation and the elaboration of land-use plans could be essential to assure access to the city for the whole population. In this case, the low-income residents had to seek for their housing solutions ‘in between’ the regulations and in neglected, distant, or even prohibited, areas of the city.



Figure 1 - Urban area of Salvador today and the borders of the municipal administrative area: historic center boundaries indicated with red color.

Planning practice in Salvador: plans and urban projects

Despite being founded in the 16th century, having a strong heritage value, Salvador was left many years without a comprehensive plan to guide transformation and control urban growth. On the early 20th century, several urban regeneration projects targeted the historical center and changed the original

layout of streets and the coastline, through land reclamation. Many land subdivision projects were approved and implemented by private agents for different parts of the city from 1925 onwards. In 1926 the first regulatory planning framework is designed. A functional zoning scheme is proposed, dividing the city and assigning specific areas for the location of “proletary houses” (Gordilho-Souza, 2008). In this normative frame, permits and restrictions for use and occupation follow the typologies of housing: ‘rustic’ wooden houses are not allowed in central areas, but are tolerated on the hills of suburban and rural areas. This initiated a sequence of planning actions that, on the one hand, tolerates the presence of substandard housing, and on the other hand, pushes poverty into the outskirts of the city.

In general, however, those projects were not part of integrated plans and were realized as isolated solutions. Salvador did not have a municipal masterplan (*Plano Diretor Municipal*), a land use and occupation plan, until 1985.

The EPUCS was the first comprehensive plan prepared for Salvador; it was elaborated between 1942 and 1947, yet it was never fully implemented. The project was interrupted by the early death of its designer, Mário Leal Ferreira. More than just a plan, the EPUCS included an analysis of the city, and offered an interdisciplinary survey, describing the different building types and materials and relating these to fundamental social aspects (Fernandes et al., 2019a). It was a pioneer qualitative study of the living conditions of poor populations.

Fernandes et al. (2019a) presented the findings of reports elaborated for EPUCS: at that time, Salvador was a poor and horizontal city; 90% of the buildings had one story, 54% were made of wood, 60% of the population was living on rented dwelling, and 85% of the population was living below the poverty line. Housing is a central theme to this study, and the house unit is taken as a key element of analysis. With a special attention to the poor houses, three main typologies were identified: *avenidas*, *cortiços* and *mocambos*. *Avenidas* are proletarian row houses with some sanitary conditions; *cortiços* are large previously single-family houses or buildings that were subdivided into many units, with no sanitary conditions, low ventilation and light, located in the historical center; and, finally, *mocambos* are similar to *favelas*, with poor structure and located in neglected areas or subjected to flooding. The study indicates also a racial spatial division: the poor population was mostly composed by black people, however, the poor population living in central locations are mostly white.

The plan, inspired by the Town Planning approach (Sampaio, 1999), included a roadway system – the “clover scheme” – that explored the city topography, using the valleys for embedding the main roads and avenues (as above mentioned). The plan was synthesized into a radial concentric model in a reference to the Garden City model. The idea of ‘neighborhood unity’ was also explored, in which every leaf of the clover would represent one neighborhood united by one civic center. In addition, it proposed the separation of activities and population through zoning – a dubious approach considering the social concerns brought up by the plan.

A plan for the articulation of the metropolitan region of Salvador was drawn on 1973. With a developmental approach, the CIA Plan, designed by the economist Rômulo Almeida with the participation of the architect Sérgio Bernardes, proposes a decentralized metropolis with new industrial poles on neighboring cities (Gordilho-Souza, 2008). In this plan, the historical center of Salvador remains with tourism activities and the Cabula region becomes a new centrality. Partially implemented, this plan positioned Salvador as a city focused on the provision of services and as a commuter town for the workers of the industrial poles located in other cities of the metropolitan region.

Another relevant plan made for the city was the PLANDURB, elaborated in 1978. It remains the only comprehensive plan made for the city in the past 40 years. It was composed by four types of studies: exploratory, informative, central and special ones (Salvador, 1977b). It predicted a model for territorial occupation and defined areas for management and studies, outlining a proposal for a land use and occupation legislation, that, at this time, have not yet been carried out. The PLANDURB also included analysis of many areas of the city, describing the variety of building types, the presence of services and the number of inhabitants living in different settlements. This plan had a valuable morphological basis, establishing construction indexes and building regulations upon the existing standards: height, plot

occupation ratio and setbacks (Salvador, 1977a). Also this plan was never fully implemented, and its most important legacy remains the analysis made.

Other plans elaborated for Salvador are the *Municipal Plans* and they are composed by a document of guidelines and main goals (PDDU-Plano Diretor de Desenvolvimento Urbano) and a masterplan related to a Land Use and Occupation Ordinance Legislation (LOUOS). In the past years, five different plans were prepared to Salvador, in 1985, 2004, 2008, 2012 and 2016. Even though Municipal Plans are only supposed to be submitted for revision after 10 years, the plans elaborated in 2004, 2008, 2012 were immensely contested which resulted in the approval of different plans every four years that culminated in the 2016 plan. The current plan establishes indexes according to zoning based on land use. There are no morphological standards. Informal settlements are classified as ZEIS areas, with few defined parameters for transformation and some prescribed guidelines.

The planning history of Salvador shows that spatial studies provided the city with analysis and diagnosis of its urban area. Previous plans had an analytical framework that described the housing stock and conditions, the street system, and the social character of the city. Most recently, municipal plans do not have an analytical document but have been informed by reports done by private institutions that contributed with diagnosis of the most relevant issues of the city, portraying the current condition of streets, housings, and land uses – see for instance the report made for the Salvador 500 Plan (FIPE, 2015). The impact for the city, however, has not been always positive as many issues listed by reports over the years have not been fully addressed by plans. Spatial segregation, violence, traffic, lack of accessibility and affordability, lack of concerns with the environment have been some topics addressed by recent critiques (Gomes et al., 2019).

An historico-geographical reading of Salvador: fringe-belt analysis

A comprehensive analysis of the formal structure of Salvador has been the theme of study by other scholars (Gordilho-Souza, 2008; Sampaio, 1999; Santos, 2008a). Yet, the latest transformations of the city and the acknowledgment of the metropolitan scale demands for an updated study of Salvador. This study is informed by a morphological perspective, contributing to a better understanding of the city structure and, hopefully, to more effective planning solutions. An historico-geographical reading of Salvador provides a general view of the city formation and change, considering both urban forms and uses.

In this analysis, the differences in the emergence and growth of formal and informal settlements are presented, recognizing the variations of location and characterizing the spatial features and its transformation. The fringe-belt concept is useful to describe the process of ‘peripherization’. The fringe-belt analysis highlights the presence of large empty plots in central areas, dominated by the real estate market and the occupation of interstice and expansion of peripheral areas towards metropolitan scales (Valladares, 1991).

This analysis is based on an exercise of layering of maps from different historical periods to tell the story of Salvador. Maps from the 16th (1551), 17th (1624), 18th (1715, 1730), and 19th (1850) centuries, and a sequence of maps from the 20th century (1940, 1956, 1969, 1976, 2000), and from 2017 and 2020, were analyzed and redrawn. They were obtained from different sources: the municipality of Salvador and archives with digital collections, like the *Arquivo Nacional do Brasil* and the *Fundação Mario Leal Ferreira*. Additional data was collected from municipality reports and plans, and from previous research including a few PhD thesis (Pierson, 1942; Santos, 2008a) and books (Fernandes, 2014; Gordilho-Souza, 2008; Simas, 1998; Vasconcelos, 2016).

These maps enabled the reading of the development of built-up areas. For the best visualization of this analysis in this format, the period between the 19th century and 2017 was selected. This exercise has faced the lack of resources on the evolution of settlements emerging in a non-planned context. Generally, those settlements are not recorded on maps, as they tend to be neglected by plans, and are not included in cadastral maps.

The maps presented in this article are, therefore, an effort to reconstruct the history of settlements. The informal settlements of the 1930s were drawn from textual information collected from different sources (Fernandes et al., 2019a; Pierson, 1942). The settlements represented by the 1956 map are based on the PhD thesis by Milton Santos (2008a). The map of the 70s is based on material from Salvador Geoportal (Salvador, 2019) and PLANDURB. The most recent map used data on the subnormal settlements of Salvador available from the census agency (IBGE, 2019b).

Another important aspect of this analysis is that the urban form of Salvador has a different development process compared to those observed in European fringe-belt studies. The fringe-belt concept is based on the idea that cities have intertwined periods of growth and stagnation. As described before, periods of slow growth or no growth are characterized by the emergence of specific urban forms forming a belt-like shape – a sparse network of streets, large street-blocks and plots, buildings of an institutional or industrial use. However, Salvador has a very fragmented area surrounding each phase of development of the city. This is related not only to the topography of the city, but also to the dynamic nature of its urban forms and to the fact that fringe belts are likely to lose their continuous form and character over time. Industrial plots, for instance, tend to develop into retail spaces, like shopping mall and supermarkets (Pedrão, 2009). A strong population growth over short periods of time has led to the alienation of open spaces (fringe-belt features) into residential use.

The fringe belts of Salvador: 19th century - 2020

Using the designation proposed by Conzen (2009), the fringe-belt features identified in Salvador are classified into the following uses: institution, open space, industrial, recreation and villas. Fringe belts were identified according to their emergence in different time periods. The original concept addresses a belt-like zone emerged in the period in which the city has witnessed economic stagnation or slow growth – this corresponds to the presence of the mentioned uses. Over a further period of growth, new housing development will leapfrog this belt, that will keep its main features. These continuous belt-like formations over time are usually labeled Inner Fringe Belt (IFB), Middle Fringe Belt (MFB), and Outer Fringe Belt (OFB).

In Salvador, however, the presence of non-planned settlements is always observed in the outskirts of the city. This indicates that the formation of fringe-belt zones can be associated to the emergence of non-planned settlements. In different periods, it is possible to identify the formation of those settlements that are continuously expelled outside the built-up area. This does not mean that there was no available space for construction. On the contrary, it reflects the need of the poor population to search for housing solutions outside the land market.

In the following maps three main elements of urban form are represented: the limits of the built-up area, the fringe belts associated with that period, and the boundaries of unplanned settlements. Planned and regulated settlements (formal) are included in the built-up area. The analysis shows the emergence of the new housing areas is associated with the occurrence of three factors: the lack of State control, strategies of 'invisibility' from the formal housing areas, and the existence of large areas with unprecise land ownership.

All these factors are to be found in fringe-belt areas. Figure 2 represents the built-up area in the late 19th century and the IFB. A moment of economic stagnation has occurred in the early 19th century. Back then, most of the transformation took place through the renovation of the historical center. The lack of cartography for this period suggests that the existing built area has not expanded significantly. However, the first poor settlements are located outside the city center and pointed out in the literature only in the 1930s. Figure 2 shows a very fragmented IFB, mainly composed of institutions and open spaces.

The presence of fringe-belt features – open spaces, industrial zones, and neglected spaces such as damp areas – is a new opportunity for settling. Open spaces represent the possibility of hosting many families as these usually constitute large plots where land property is unclear. Land owned by the State

or one single owner are more difficult to survey and protect, becoming targets for occupation. Some of these are areas neglected by the land market, like river margins. This is not a problem for settlers that are already living in the thresholds of legality/illegality.

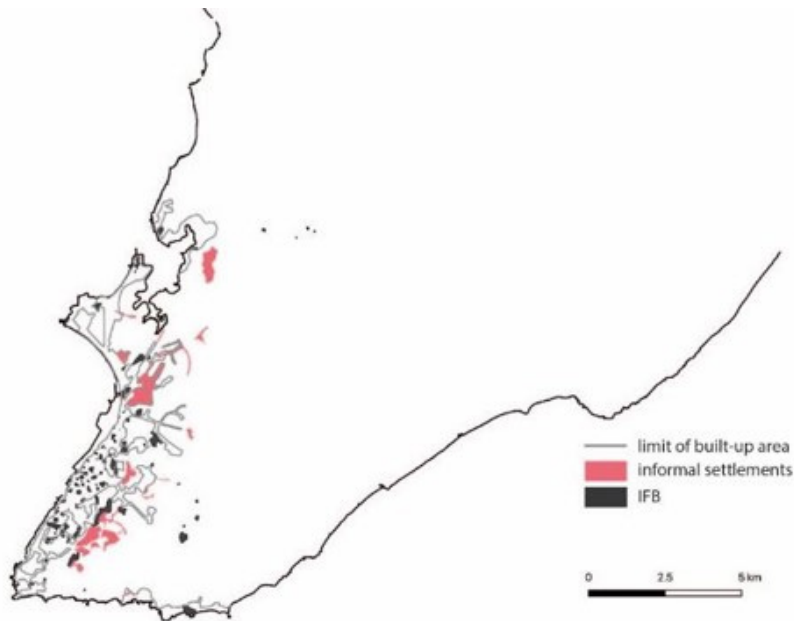


Figure 2 - Limits of the built-up area, the Inner Fringe Belt and informal settlements in the early 20th century (around 1930s).

Figure 3 portrays the limits of the built-up area, the emergence of the MFB and the informal settlements identified in the 1950s. Unplanned settlements follow the peripheral development of the city and are connected to the middle fringe, which is composed by institutional, open spaces, and industrial plots. Planned settlements grow along the coastline, driven by the implementation of land subdivision plans, occupying the south of the peninsula.

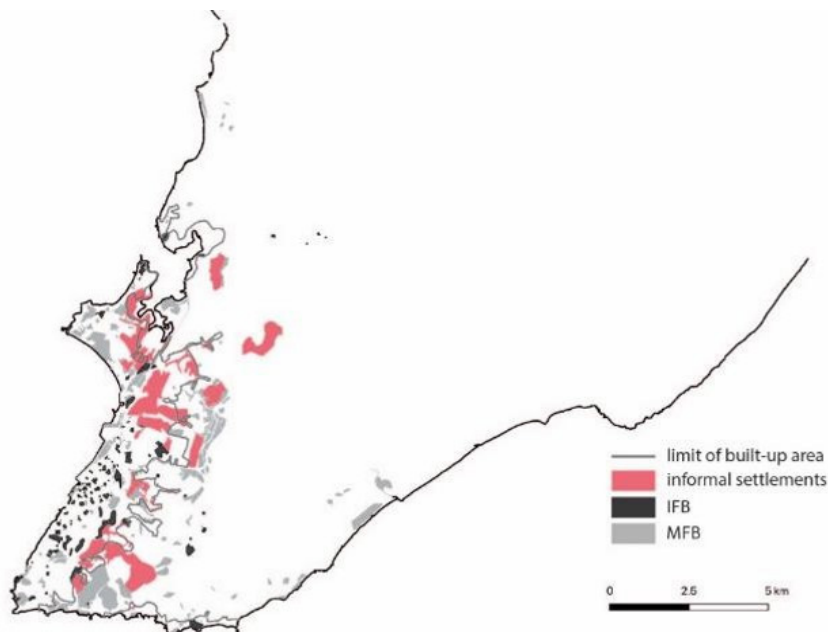


Figure 3 - Limits of the built-up area, Inner and Middle fringe belts and informal settlements around 1950s.

The concentration of informal settlements on this fringe, not only creates a different shape of fringe-belt but also an elastic and dynamic area of continuing expansion of the fringe. Figures 4 and 5 show the expansion of the built-up area (mainly non-planned) in the 1960s and 1970s. During this period, there is a large expansion of fringe-belt features, following the construction of the valley highways, reserving these newly created well-connected plots for industrial or commercial uses, forming the OFB. In the southeast of the city there is an expansion area, mostly spread along the coastline, contained by the presence of the existing fringe belts (institutions and open spaces, in this case). Here, informal settlements are the exception and the fringe belt plays an important ecological role, conserving the quality of open space for public use or for the future development of the real estate market.

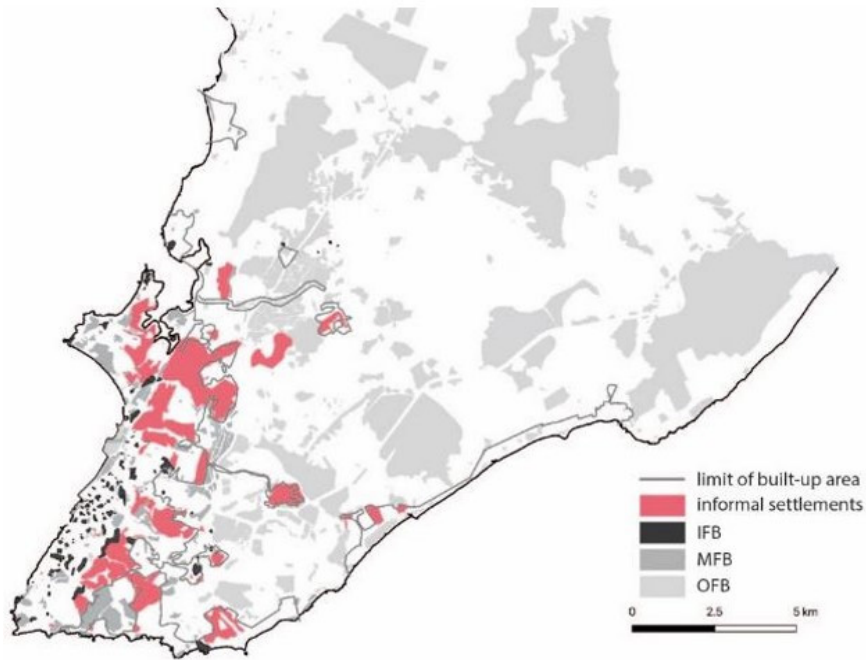


Figure 4 - Limits of the built-up area, Inner, Middle, and Outer fringe belts and informal settlements around 1960s.

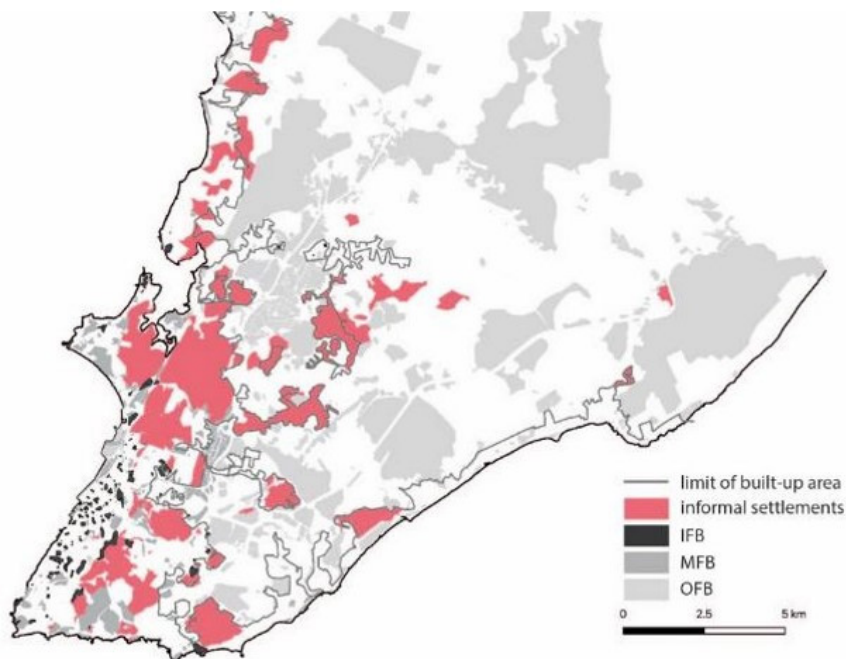


Figure 5 - Limits of the built-up area, Inner, Middle, and Outer fringe belts and informal settlements around 1970s.

Further fringe-belt alienation taking place in this mostly regulated and planned area, transformed open spaces into administrative centers and retail spaces. In this case, fringe belts located in well-off areas of the city established new centralities, concentrating the allocation of resources, the offer of transports and investments of real estate market, confirming the peripheral status of areas located on other parts of the city.

On the other hand, the occupation of the west coast, facing the *Todos os Santos* Bay, is mainly composed of non-planned settlements. Plots located on fringe belts are more inclined to change. Open spaces tend to be occupied, villa estates transformed into residential use and industrial areas. Industries have been closed (after an early textile industrialization in the late 19th century) and transformed into warehouses and commercial spaces. In this area, occupation has high density and lacks open spaces.

Figure 6 shows the current city. The built-up area occupies the entire peninsula; as such, its limits are not identified in the map. Informal settlements have become pervasive in the city, occupying the whole inner part of the peninsula, being concentrated in the western part. Informal expansion has occurred especially around the fringe-belt plots facing the highway (BR-324) connecting Salvador to other metropolitan municipalities. The implementation of the CIA plan has confirmed the position of Salvador as a commuting city, and the presence of informal settlements around this highway is probably connected to job opportunities in other municipalities and the ease to access public transportation from this axis. The continuous implementation of the valley's avenues – as planned in the EPUCS project – has reinforced this formal/informal binary, creating homogeneous areas of formal housing whereas keeping them separated from the informal areas.

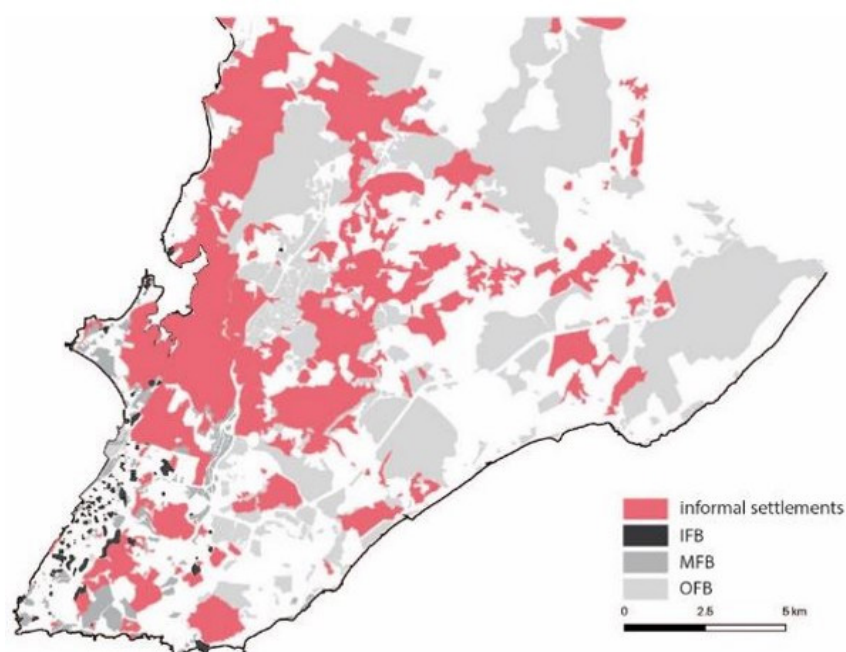


Figure 6 - The current city (2020). Most of the territory is occupied, and informal settlements become pervasive. The limit of built-up area is no longer traceable.

Important conclusions can be drawn from this analysis. Peripheral growth is evidenced by the maps since the early moments of city expansion. This urbanization process is mostly poor, self-build and constructed outside the scope and control of planning authorities. Literature has demonstrated that this model of growth is reinforced by the State's planning framework, accentuated by the topographical composition of the city, and influenced by the legacy of the inherited land regime of colonial times, as well as by social and racial segregation.

The fringe-belt analysis characterizes and locates this spatial occupation within the whole city and enables a comprehensive reading of the relation between non-residential uses and housing settlements

and the different cycles of development of the city. The analysis also enabled a systematization of this occupation process into three main phases of development, highlighting the relation established between the natural context and urban growth. Figure 7 presents a scheme that identifies the sequence of occupation of ridges and valleys.

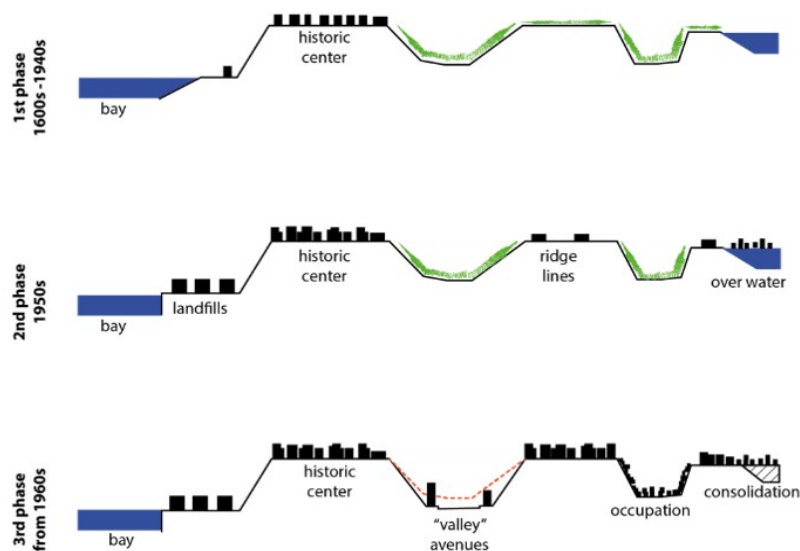


Figure 7 - Schematic occupation of Salvador.

Regarding informal occupation, industrial areas and isolated planned settlements represented job opportunities, being quite attractive for dwellers to establish their homes close to their work. In addition, the presence of zones with large plots assured a 'hiding strategy' for dwellers to build 'outside the law' (Figure 8). The surroundings of industrial plots are composed by quite open and low dense occupation, usually separated from housing settlements due to nuisance and pollution generated by industrial activities, with low or no human activity or interaction on its borders. In this way, informal dwellings grow, leaning on the walls of factories, using the open spaces in between them or, sometimes, occupying the plant of abandoned factories (Figure 9).



Figure 8 - Industrial areas and informal settlements in Salvador. Source: aerial view, Google Earth (2021).



Figure 9 - Buildings leaning against the wall of a previous industrial area in Rua Clóvis de Almeida Maia, Ribeira, Salvador. Source: Google Street View (2021).

This analysis had made possible to discuss one crucial aspect of fringe belts: its relationship with the establishment of informal settlements. In countries like Brazil, the transformation of fringe belts can be much more dynamic than in global North, and the conservation of its fringe-belt features is seen mostly around formal housing areas. As such, the shape of the fringe belt is very fragmented. Research shows that the identification of fringe belts can address the development process of the city, establishing a relation between planned and non-planned settlements. Moreover, the concept can be used to analyze and inform the planning of peripheral settlements. The identification of fringe belts including open spaces and abandoned industrial areas provides an understanding of a possible land resource to contribute to the identified lack of public spaces in informal settlements or possible areas for reallocation or redevelopment of settlements with very low housing standards.

Conclusions

The formation of informal settlements is conditioned by a set of socio-economic and political circumstances. However, the location of informal settlements is not random. The geographical context, a biased planning agenda, the inherited land lease regime, the control of the real estate market, and the articulation of urban tissues of the city conditions the emergence and growth of informal settlements in the fringes of the city. The planning agenda controlled by political interests has performed an important role in perpetuating the constant conflict over land rights, benefiting some actors while denying the participation and inclusiveness to others. In this context, inhabitants had to conquer their space to live, overcoming a resistance battle, to assure their proximity to the city center, while guaranteeing a certain protection from relocation. An analysis of their formation and growth over time shows how they relate to some specific features of the existing urbanization: i. the presence of industrial plots to assure the proximity to job opportunities; ii. the availability of open spaces – especially those neglected by the formal market – to attract the occupation of many families; and iii. the presence of large plots to enable the hiding strategies, assuring low visibility from the planned city.

This paper argues for a different perspective on fringe belts. The debate focuses mostly on a conservation approach, arguing for their ecological and built heritage relevance. However, this analysis shows that fringe belts have continually been transformed on the peripheral areas of the city into housing settlements. Extant fringe-belt features can be active resources for the improvement of these settlements, enabling low-density reconstruction and public spaces, and strengthening the connection of isolated neighborhoods with more central and consolidated areas.

In fact, the analysis has demonstrated that informal housing settlements are concentrated on the borders of the built-up area becoming an important constituent of the urban fringes. This is a phenomenon largely observed in other large cities of the global South. Even if those settlements represent an infringement of plans, they are informally sanctioned by the state and become part of the urban landscape. In comparison to studies of European cities, in which fringe-belt features are preserved, in this case study it is observed a largely dense occupied area in constant expansion.

The fringe belt concept offers a synthetic and structural view of history and human geography of a city. Bearing this in mind, when walking through the streets of a city both the researcher and the planner can identify its fundamental periods of urban development – from the historical kernel, to the first fringe belt (corresponding to a first period of stagnation and made of different urban forms), to the second residential area (clearly different from the fringe belt, but also holding some differences in relation to the historical kernel), and so on. While residential areas are usually more consolidated, fringe belts tend to concentrate most of the opportunities for the future development, as such they are of key importance to planning. The knowledge on their formation and logic of organization – including the different areas for leisure, institutional and industrial use – is crucial. This knowledge can be translated to informed action through the decisions about the conservation or transformation of fringe belt plots – particularly those of industrial use which seem to be more exposed to change in the last decades. This can involve the structuring of a network of public open spaces or the definition of a system of singular buildings. The paper made evident the relation between fringe belts and informal settlements, bringing to debate a more systematic way of understanding informal settlements as a part of the city, indispensable for the understanding of the whole city.

Data availability statement

The dataset that supports the results of this paper is available at SciELO Data and can be accessed via <https://doi.org/10.48331/scielodata.W1LFGM>

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