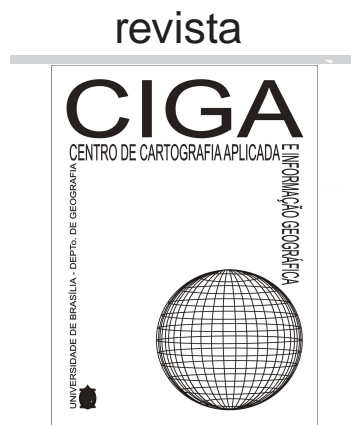


Artigo

MONITORING OF URBAN GROWTH IN BRASÍLIA

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Abstract: The urban Federal District (*Distrito Federal – DF*), like most Brazilian metropolitan spaces has shown similar problems, differentiating in degree and intensity of its spatial processes. One of the most relevant issues happens due to the quick paced and uncontrolled urban growth, a spatial fact that causes environmental, social, economic, institutional, and political damage, and mainly, compromises the territorial planning process. Amongst the main spatial components that stimulate expansion, the differentiated polarizing effect of the main locations, the great construction sites of the official process of real estate speculations and the private urban installment plans' consolidation are highlighted. The research seeks spatial representation and interpretation of Brasília's urban aggregate growth process from the 50's of the past century until the first decade of the XXI century, as well as graphically representing the expansion vectors of the urban historiography and tendencies of a close future. The work process shows that the assurance of survival of the preserved spaces is incompatible with territorial usage. These spatial observations, which are processed systematically in other Latin American urban areas, above all, point to the importance of a more effective management of territorial use and dynamics as a fundamental component to decrease territorial incompatibilities and incongruities. This research is one of the products and result of the *Projeto Instrumentação Geográfica e Dinâmica Territorial* (Geographic Instrumentation and Territorial Dynamics Project), processed in the monitoring program of territorial usage in Central Brazil.

Keywords: Brasília – Urban Growth – Monitoring – Territorial Conflicts.

Resumo: O Distrito Federal (DF) urbano, a exemplo da maioria dos espaços metropolitanos brasileiros têm exibido problemas parecidos, com diferenças no grau e na intensidade dos seus processos espaciais. Uma das questões mais relevantes se processa no crescimento urbano acelerado e descontrolado, fatos espaciais causadores de danos ambientais, sócias, econômicos, institucionais, políticos e, principalmente, comprometedores do processo de planejamento territorial. Dentre os principais componentes espaciais estimuladores da expansão, mostra-se em destaque o efeito polarizador diferenciado das principais localidades, os grandes canteiros de obras do processo oficial de especulação imobiliária e a consolidação dos parcelamentos urbanos privados. O estudo busca fazer uma representação e leitura espacial do processo de crescimento do conjunto urbano de Brasília dos anos 50 do século passado até meados da segunda década do século XXI, assim como, mostrar graficamente as densidades no espaço urbano, os espaços restritivos para urbanização e os vetores de expansão dessa historiografia urbana e as tendências para o futuro próximo. O processo de trabalho mostra que a garantia da sobrevivência dos espaços preservados está em processo de comprometimento e o monitoramento sistemático do crescimento urbano revela as incompatibilidades no uso do território. Estas constatações espaciais, que se processam de forma sistemática em outras áreas urbanas do Brasil, apontam para a importância de uma gestão mais

efetiva do uso do território e da dinâmica territorial, como componente fundamental para minorar as incompatibilidades e incongruências territoriais. Este estudo faz parte dos produtos e resultados do Projeto Instrumentação Geográfica e Dinâmica Territorial, operacionalizado no programa de monitoramento do uso do território do Brasil Central.

Palavras Chave: Brasília - Crescimento Urbano - Conflitos Territoriais.

Résumé: Le District Fédéral urbain (Distrito Federal - DF), comme la plupart des espaces métropolitains brésiliens ont montré des problèmes similaires, en distinguant le degré et l'intensité de ses processus spatiaux. Une des questions les plus pertinentes se produit en raison de la croissance urbaine incontrôlée rythme et rapide, un fait spatial qui cause des dommages environnementaux, sociaux, économiques, institutionnels et politiques, et surtout, compromet le processus d'aménagement du territoire. Parmi les principales composantes spatiales qui stimulent l'expansion, l'effet polarisant différenciée des principaux sites, les grands chantiers de construction du processus officiel de spéculations immobilières et la consolidation urbaine tranche de plans' privé sont mis en évidence. La recherche vise la représentation spatiale et l'interprétation des processus de la croissance agrégée urbaine de Brasilia à partir des années 50 du siècle passé jusqu'à ce que la première décennie du XXIe siècle, ainsi que de représenter graphiquement les vecteurs d'expansion de l'historiographie urbaine et tendances d'un futur proche. Le processus de travail montre que l'assurance de la survie des espaces préservés est incompatible avec l'utilisation du territoire. Ces observations spatiales, qui sont traités systématiquement dans d'autres zones urbaines d'Amérique latine, surtout, pointez sur l'importance d'une gestion plus efficace de l'utilisation du territoire et dynamicsas une composante fondamentale pour réduire les incompatibilités et les incongruïtés territoriales. Cette recherche est l'un des produits et le résultat de l'e Projeto Instrumentação Geográfica Dinâmica Territorial (géographique territoriale Dynamics Project Instrumentation et), traitées dans le programme d'utilisation territoriale dans le Brésil central de surveillance.

Mots-clés: Brasilia - Croissance urbaine - Conflit territorial.

INTRODUCTION

We support the idea that geography is the science of territorial dynamics and this fundamental component, in a broad sense, is still the best instrument to observe what happened because it presents marks of spatial historicity of what is happening, in other words, it contains records of agents of the present geographic configuration and of what may happen - that is, it is possible to capture force lines of the spatial movement and point out possibilities of spatial structure for the near future. We cannot lose sight of the fact that this area of knowledge has the compromise of making the world and its dynamics comprehensible to society, of giving explanations for the territorial transformations and of pointing solutions for a better spatial organization. Geography, therefore, is a fundamental subject for the formation of the Brazilian people's citizenship, which presents a singular heterogeneity in its ethnic and social-economic composition and in spatial distribution. In this physical realm is where the cultural and symbolic references of the population are recorded, is where their territoriality is located (ANJOS, 2005).

An important fact to remember is that the Federal Union actions relative to territorial order have revealed and maintained themselves with little success, overall due to lack of a clearly defined

policy for the Brazilian territory. Particularly in the country's urban space, this situation has caused, amongst other social-spatial dysfunctions, a continuous anarchical expansion, be it in the vertical, horizontal or rural zone growth, in such a manner that the space density increases more and more, resulting in its deterioration. In this sense, most Brazilian cities show similar problems and present differences in degree and intensity of spatial processes. Expansion of urban peripheries and consequent swelling of the cities is doubtlessly one of the most evident processes in most medium and large sized cities, having various dimensions from economic, political and social mechanisms that take place in the urban space. Although expansion of urban peripheries is generally a common characteristic of most cities and can be explained, it does not form a homogeneous body and present specificities which requires viewing through a more accurate observation lens.

On the other hand, demand for comprehension and resolution of complex issues of society's dynamics are rising and cartography is one of the best placed instruments to answer and inform more seriously what occurred, what is happening and what can occur with territory. In this sense, representations of the monitoring process of the territory, latest generation remote sensing products (mainly satellite images), as well as graphic modeling of the territory (synthesis cartography), form a group of fundamental geographic tools for investigations of this nature. These allow a graphic revelation of what occurs in spatial dynamics and become each day more indispensable for representing, overall, a bridge between levels of observation of reality and a simplification, reduction and explanation and tips for decision making and problem solving (ANJOS, 1992).

This article has the objective of creating a spatial representation and interpretation of the growth process of urban *Distrito Federal*– DF (Federal District) in the last forty years of the past century, until the middle of the second decade of the 21st century. It also aims to graphically present the densities in the urban space, the soil sealing by urbanization, and the expansion vectors of this urban dynamics. In spite of Brasília's fifty years of existence, if we compare its historiography with the ones of most Brazilian cities, a lot has been written about its particular spatial organization. However, few studies approach the urban spatial dynamics contemplating many analytical dimensions and prospective views of the urban group from interpretation of real and operating tendencies.

Another relevant aspect is the fact that geographically, at the Brazilian *Planalto Central* (Central Highlands) is the synthesis of all "Brazils". This is where we find a young metropolis which already shows spatial contradictions, verified in the great and ancient cities of Brazil.

In this way, we intend, with this article being directed to the urban dynamics thematic, to circumscribe the phenomenon of geographic expansion in the territory, particularly urban, identify its specificities, quantify the problematic and overall, seek for an extensive interpretation. The paper is divided in four parts. Initially, there will be a discussion in relation to presumptions adopted for

territorial dynamics, urban expansion, spatial monitoring, urban spots, amongst other relevant references to the context of the thematic in question. The following part discusses the monitoring of urban expansion in the *Distrito Federal* and the spatial history of its growth vectors. Another portion discusses the aspect of the present and a near future's urban spot, the expansion vectors and references related to environmentally restricted spaces for urbanization in the *Distrito Federal*. The last section contains the conclusion and spatial recommendations directed towards two distinct segments: growth vectors and environmentally restricted spaces for urbanization. Through this structure, the aim is to effectively contribute to expand the knowledge of territorial dynamics in a more ample sense, in other words, to contemplate structural thematic axis in order to understand them in a geographic and cartographic perspective.

1. CURRENT CONTEXT OF THE TERRITORY OCCUPATION IN DF

Think Distrito Federal presently, from the proposal of the spatial density dynamics, is to think of space as a social product of the changes due to the transformations of rural areas in areas of predominantly urban use (very low density, low density, medium density and high density). Thus, one can see the opposite movement to what was originally proposed to build the capital of Brazil, based on the perspective of modernist planning and territorial planning, in order to overcome the common problems of socio-spatial inequalities of Brazilian cities, from control use of the territory. This experience was consolidated only in the core area of the capital, the Pilot Plan and its surroundings. In other locations, even with attempts to follow the model in the center of the capital, territorial planning was ineffective and in some cases non-existent, as this research has shown.

The DF despite having a Director Plan of Land Management as a legal instrument to control and monitor the use of the territory failed to apply it efficiently throughout its territory. The influence of groups linked to real estate capital led to changes over the years, listed in the previous section, where profound changes in land use of Brasilia consolidate without involving the legal mechanisms of control and territorial monitoring, with rapid population growth associated the increased density of the urban area, resulting in environmental and social imbalances with consequent territorial conflicts.

The mosaic of DF urban morphology has been marked increasingly by a process of transformation of extensive areas and essentially rural in small farms allotments with propensities to formation of condos with urban characteristics. These scenarios of greater spatial integration, marked by smaller interspatial discontinuities with function or propensity to urbanization, are increasingly evident and located close to the most urbanized areas of the capital. This fact highlights the procedural reality of space overhead through increasingly dense agglomerations and segregated of Pilot Plan, being represented by different social groups. In the case of Brasilia we can observe

the process of metropolization characterized by greater integration between urban areas due to the occupation of the consolidation process of rural areas increasingly urbanized, the most urbanized centers of the federal capital, mainly consisting by the Administrative Regions. Some of them are becoming less subordinated to the central area of the city, having own social and economic characteristics, which are represented in the reality of the development of these locations. This is the case, for example, of administrative regions of Taguatinga and Ceilândia, which have rhythms and dynamics of their own urban spaces, with a large concentration of services, intense flow of capital and high population density. This area of influence of Taguatinga and Ceilândia, which includes the Administrative Regions of Samambaia and Recanto das Emas, form an axis of population concentration in the western portion of DF territory. Together, they concentrate a population of 1,085,604 inhabitants (Taguatinga: 361,063 inhabitants; Ceilândia: 402,729 inhabitants; Samambaia: 199,533 inhabitants; Recanto das Emas: 122,279 inhabitants) (CODEPLAN, 2014).

As could be seen, Brasília is characterized by a metropolitan logic and large urban and population concentrations in its territory. It is worth remembering that Brasília is treated as a whole, that is, the entire urban area of the DF, not just the Pilot Plan, Lucio Costa Architect design. In addition, Brasília as the country's capital and main city of the Brazilian Midwest has influence beyond its border limits. We can point out two regions representing the materiality of this influence. The first, the Integrated Region of Economic Development of the Distrito Federal and surrounding areas (RIDE / DF), created by Complementary Law 94 of February 19, 1998, which is composed of the Distrito Federal, nineteen municipalities in the state of Goiás and three of Minas Gerais, totaling a population of 4,124,974 inhabitants (IBGE, 2014). Its main objective is to develop joint plans about common public services to Federative Units involved primarily in job creation and infrastructure.

Even having direct influence in these municipalities, Brasília does not exercise polarizing metropolis function with all municipalities of RIDE / DF and therefore it was necessary to propose another region that aggregates the cities directly linked to the Distrito Federal. Thus was created the Metropolitan Area of Brasília (AMB) taking into consideration the municipalities of RIDE / DF that have more relations with Brasília.

These municipalities bordering the Distrito Federal promote flows of population, goods, information and capital, expressively with the Federal Capital. (CODEPLAN, 2014).

Many of these municipalities, especially those on the southern border of the Distrito Federal, configure conurbations between the urban area of the DF and the urban areas of these neighboring municipalities, and the AMB concentrates a population of 3,937,493, according to the IBGE's projections for the year 2014 (CODEPLAN, 2014).

The current Brasilia must be analyzed and, especially, planned from a metropolitan territorial perspective. Brasilia should be understood from all its influence and regional importance, mainly in Central Brazil.

2. MONITORING OF THE DYNAMICS IN DF URBAN EXPANSION(1940 – 2014) AND DYNAMICS OF EXPANSION VECTORS

Monitoring of urban expansion of DF, in other words, graphic representation of urban spatial dynamics, arises from the search of a more ample interpretation, seeking minimization of fragments and directs itself to a practical application, without any intention of exhausting the theme. It is symptomatic that the urban space of the *Distrito Federal* has not been deserving of a great number of group studies, be it because of the interdisciplinary coverage, be it due to the necessity of technologies and sophisticated tools with great capacity for data integration, or even for the challenge of dealing with territory as lens that allow a view of the whole. Making predictions for the urban space is also fearful. However, not dealing with the future of the city is desertion.

The execution of the process of interpreting territory usage with remote sensing products, which provide a view in distinct spatial resolutions, the spaces considered as urban involve the following activities: residences, commerce, industry and institutions, in other words, constructed areas of the territory, identification conditions in the form of spots in the working scale.

The fieldwork was used as terrestrial basis, checking and defining that showed problems of separation with other uses. The result is a sequence of thematic maps that constitute the monitoring of urban expansion in DF, showing successive incorporation of new areas in the city cluster, result of a collective creation, recording temporary features of the urban space, with different forms and rhythms. The eight spatial configurations registered in **Figure1** and **2** represent the concrete expression of urban dynamics in the geographic space, in other words, a synthesis of the historical processes acting on the formation and consolidation of each moment. The spatial data of expansion on the urban territory in DF show the successive incorporation of new areas to the urban cluster, registering momentary features of space, with different shape and rhythm. The interpreted spatial expressions approach distinct phases with different conceptions of a city, especially in the form by which power is exerted and the means of production of the space.

This chronological sequence expresses, cartographically, that the urban space is never organized in a definitive manner, that it is not static; on the contrary, it modifies and moves permanently. The syntheses of the main historical-spatial-environmental conjectures of territorial monitoring are the following:

1958 –This is the period of physical implementation of the *Distrito Federal*; **1964** - With a spot of 4.588 ha, we verify a city with scarce and small spots, evidencing a spatial pulverization process

of the implanted urban cores; **1977** -Brasília reveals an urban group, representing the first favorable process of urban expansion, increasing 11.526 ha in its urban spot; **1990** – This is the phase of exhaustion of spaces for expansion in the *Plano Piloto* and in most of the denominated “satellite cities” that were implemented.; **2000** – With a surface of approximately 64.690 ha, therefore more than twice the urban area of 1990, a more assumed metropolitan urban cluster is verified; **2010** – The urban spot of metropolitan expression, a fast-paced rhythm of territorial transformation (rural-urban and agricultural-urban) and a significant amplification of environmental problems, the concrete result of a young metropolis is an urban cluster of 90.000 ha.

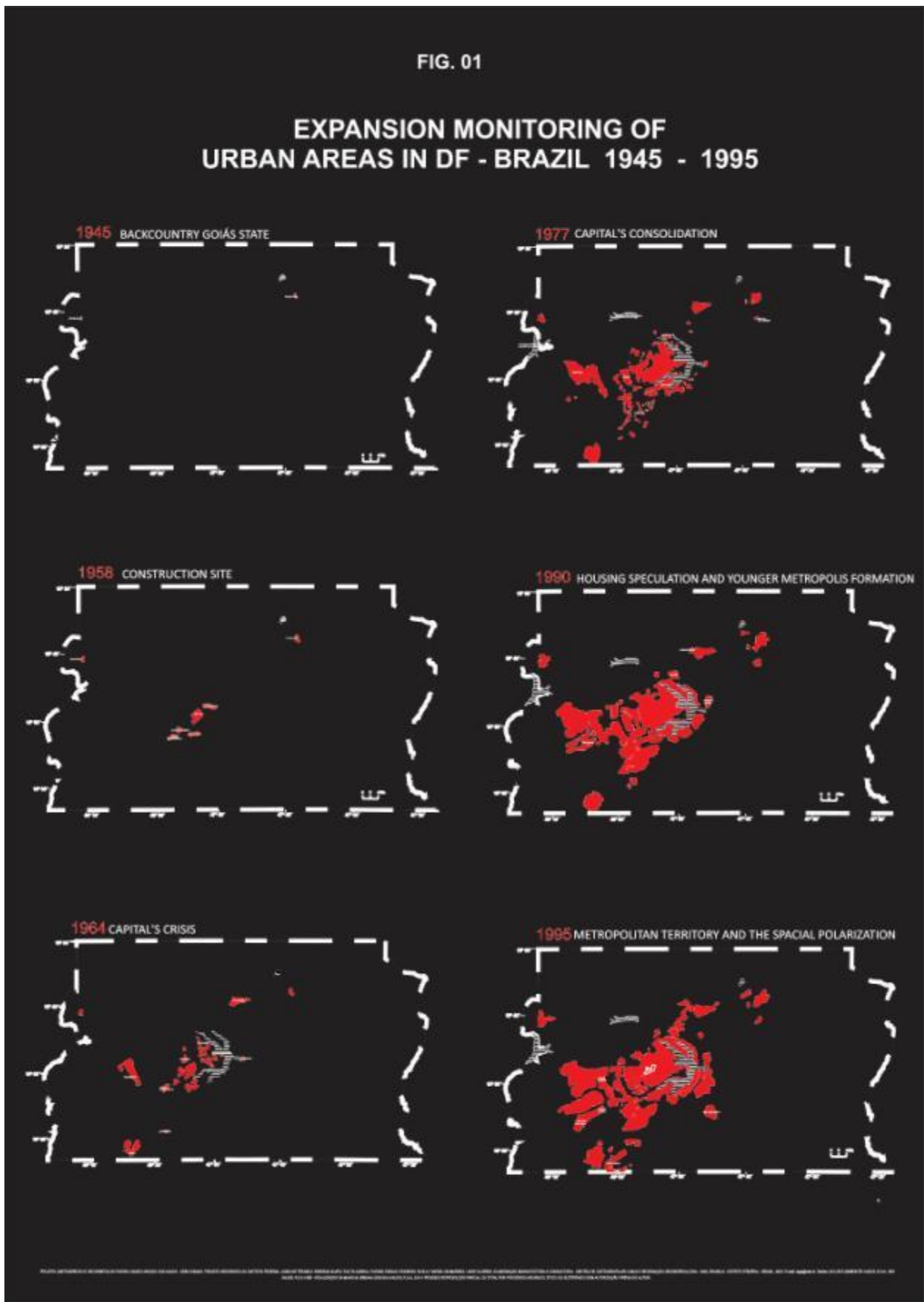


Fig. 1: Expansion Monitoring of urban space in DF – Brazil. 1945 – 1995.

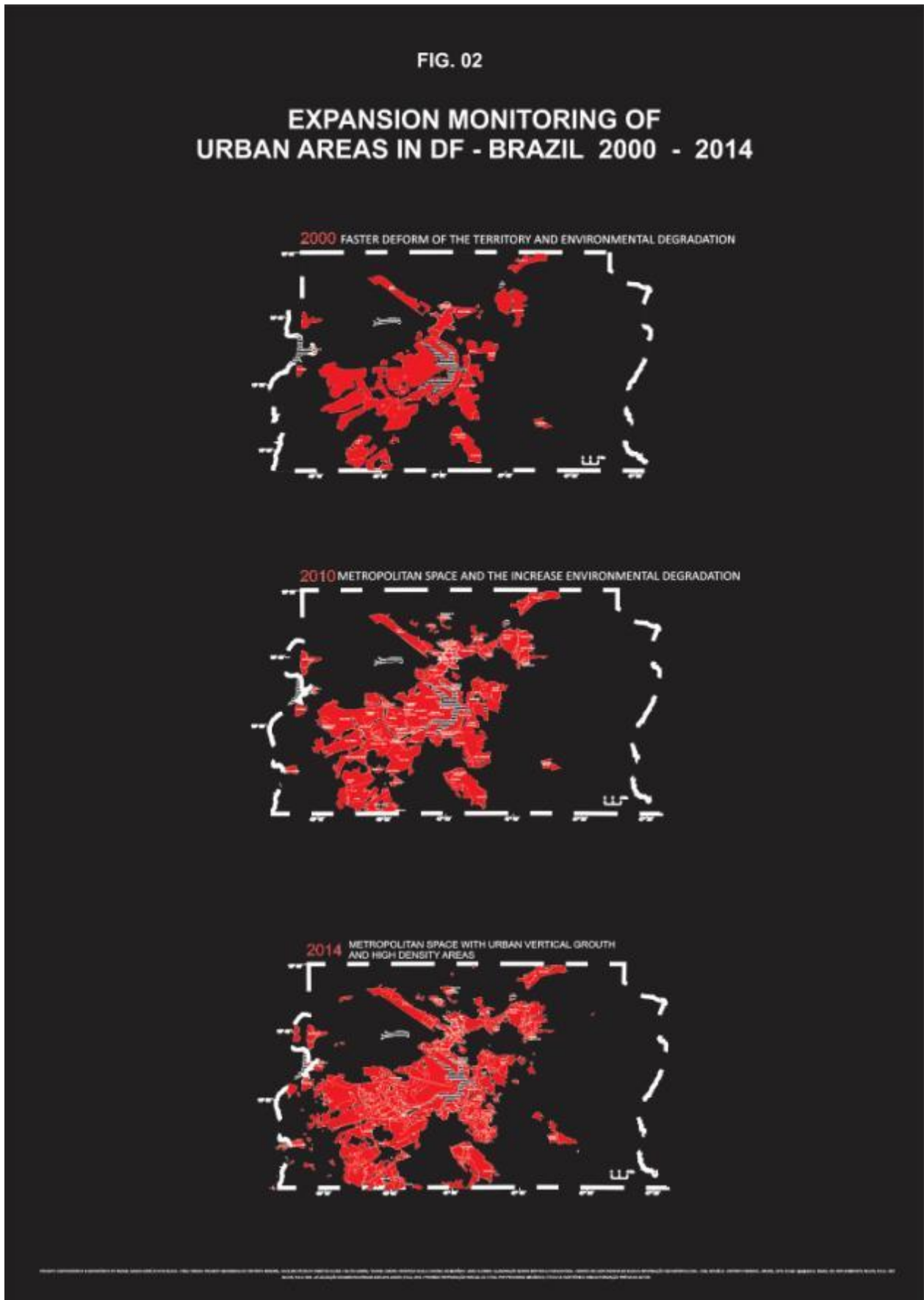
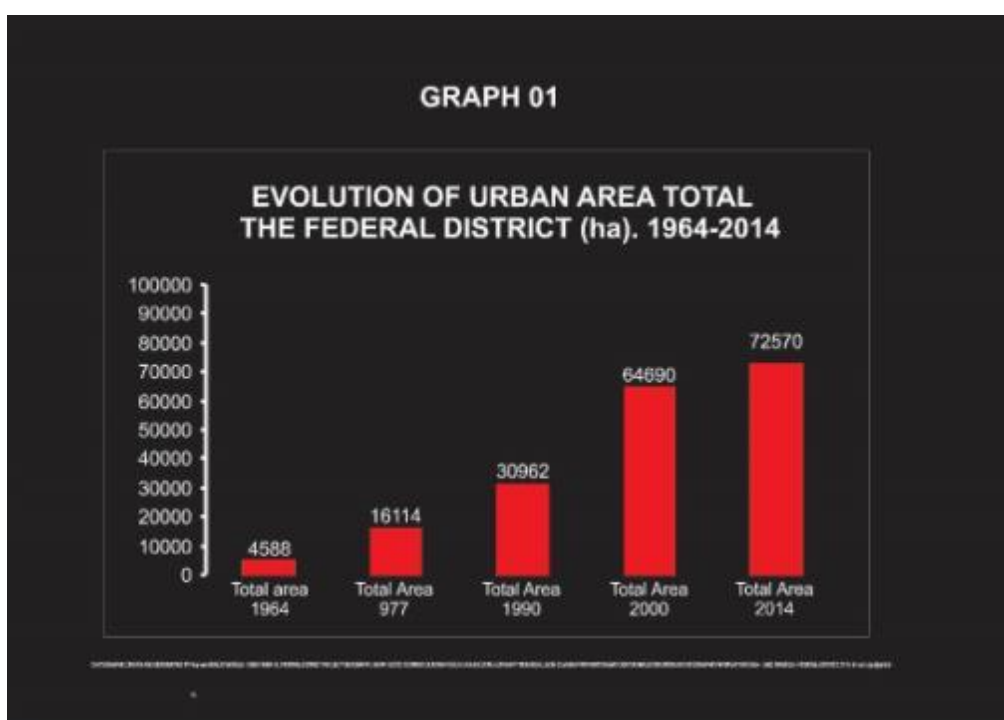


Fig. 2: Expansion Monitoring of urban space in DF – Brazil. 2000 – 2014.

2014 - Contemporary phase of the metropolitan urban area with traces of a territorial change rate still intense, where rural areas are still yielding to regular and irregular urban expansion (especially in its eastern part) by institutional, speculative or political pressure. The bubble of the formal housing system shows in various locations in the urban DF vertical growth projects waiting for buyers and investors.

Brasília truly presents itself as a summary of Brazil: the old and the new, projected and non-projected, richness and poverty, planned and unplanned, high density and low density, resulting in a territory filled with extremes and territorial contradictions. The rapid and uncontrolled growth process (see data in **Graph 1**) that took place brings attention not only to the increase of poverty and environmental degradation, but also in the downsizing of a historically fragmented urban cluster, which reinforces and still maintains a social-spatial segregation in the territory. This spatial monitoring represents the concrete expression of the urban dynamics in the geographic space, that is, the synthesis of historical processes acting upon the formation and consolidation of each moment. The clippings in time show specific situation in determined moments, constituting static views, but when observed as a group, a dynamic view is possible, in other words, capturing the movement of diverse rhythms and spatial history. With references that accuse the highest rate of urbanization in the country (over 90% of urban population) and of not being able to foreshadow the problematic situations that could possibly occur in the expansion process, DF has projected in its metropolitan and young landscape, especially in the outskirts, the spatial contradiction that can be observed in the Brazilian metropolis.



Graph 01 - Evolution of total urban area the Federal District (ha). 1964-2014.

The monitoring of confirmation of the tendencies of urban expansion of DF's territory are discussed in the following item.

3. DYNAMICS OF THE URBAN EXPANSION VECTORS OF DF.

Development of spatial monitoring allows us to relive the history of geographic facts, what happens presently and also capture dislocations of spatial flow. Through this, based on the force lines from the formation and growth processes of urban spots, verified in the spatial monitoring of DF, it has been possible to measure the movement of the expansion vectors developed throughout time and space.

The expansion vectors at the territory are most evidently conducted by the structural road system. The cartographic solution that was used to represent the spatial flow tendency of the urban parcels has for premise the representation of the vectors. The expansion vectors are characterized for being a segment with linear or zonal dimension that presents an oriented direction. The resulting maps present materialization of the dislocations through arrows, according to the pointed direction. Its variations in the presentation form occur according to length, size, grain and shape (ANJOS, 1992).

The main expansion vector is understood to be a territorial extension with well evidenced marks of the present and near future's urban growth, being its main conductor the road system and the conductor-stimulator factor of the spatial transformation process. The secondary expansion vectors are understood to be areas with a tendency of having space added to the urban space, nearly all are associated to a road axis and with agents operating for its expansion with greater or smaller evidence.

The movements expressed by the vectors shown in **Figures 3** and **4** represent the tendencies captured from specialized historic process. The most significant tendencies are the following:

1. *Sobradinho Planaltina Fercal Lago Oeste* Axis
2. *Taguatinga, Ceilândia* and *Brazlândia* Axis
3. *Taguatinga, Samambaia* and *Santo Antônio do Descoberto* Axis
4. *Gama South Outskirts Luziânia* Axis
5. *East Vale São Bartolomeu* Axis

The dynamics pointed by the growth movements shown in the thematic maps must be faced as another instrument to help comprehend territorial dynamics, as a background for a decision making sector and not as a consummated fact in space. Basic aspects of the constitution of the urban spot for the near future and environmental commitment are approached in the following part.

From that monitoring regarding the historical process of territorial dynamics in the *Distrito Federal* was possible to verify changes in the types of use of the areas that make up this multi-polarized urban set. The boundaries between urban and rural intend to increasingly stronger demand

for predominantly horizontal expansion in expansion vectors already consolidated today. The resulting modeling of urban expansion is guided by road growth lines and peripheral lines to urban structural centers, which in the territory of the DF, are distributed as poles of development of each Administrative Region member of the *Distrito Federal*.

4. TYPOLOGY OF URBAN DENSITIES.

During the working process was possible to carry out a detailed mapping on a large scale, it was possible to identify the organization of the urban sprawl in 2014, within hierarchical categories of urban densities in a socio-spatial context. Urban density was categorized as provided below, from the cartographic representation of **Figure 5**.

- a) Very low density;
- b) Low density;
- c) Medium density;
- d) High density.

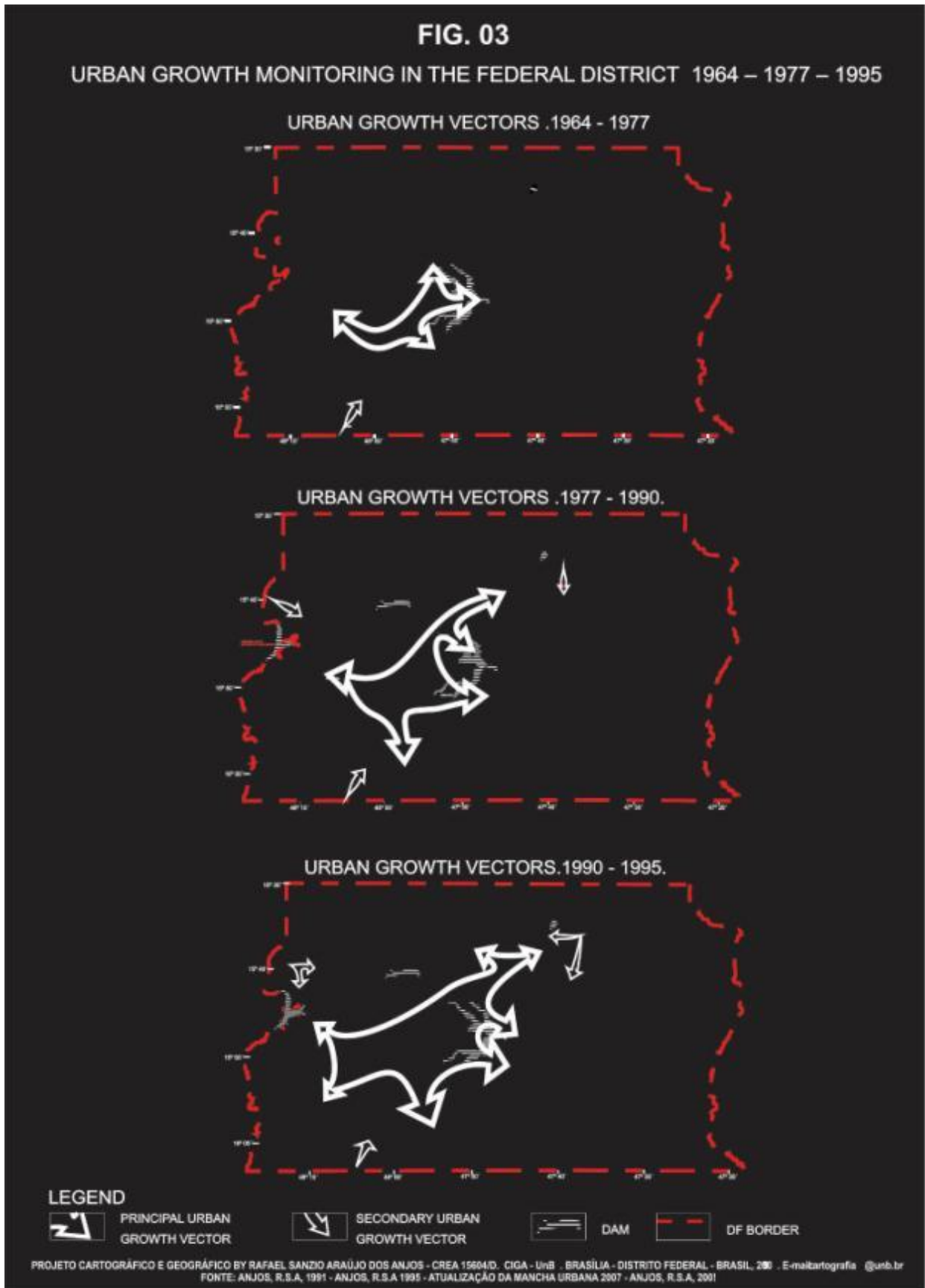


Fig. 3: Urban Growth monitoring in the DF – Brazil. 1964-1977-1995.

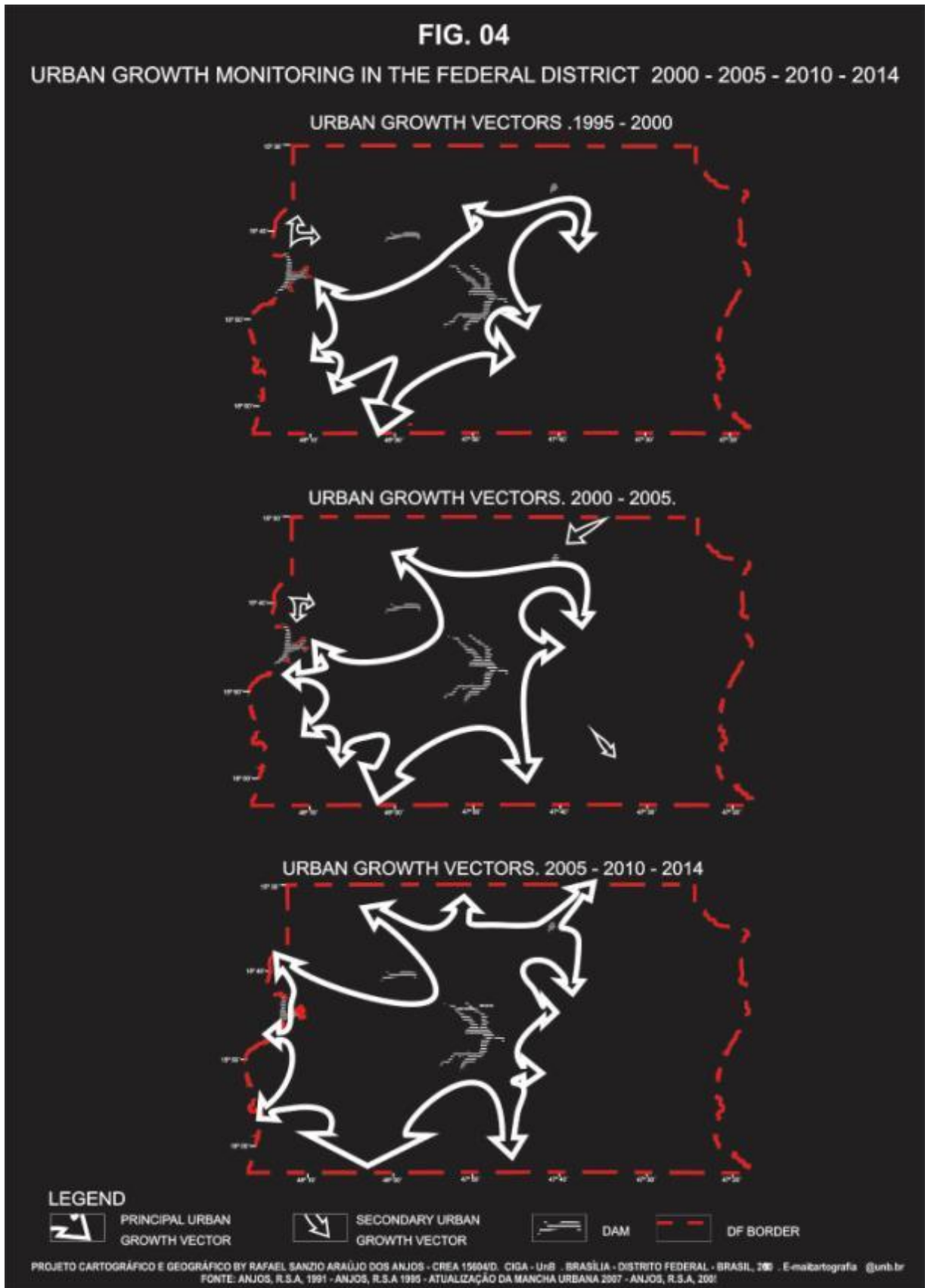


Fig. 4: Urban Growth monitoring in the DF – Brazil. 2000-2005-2010-2014.

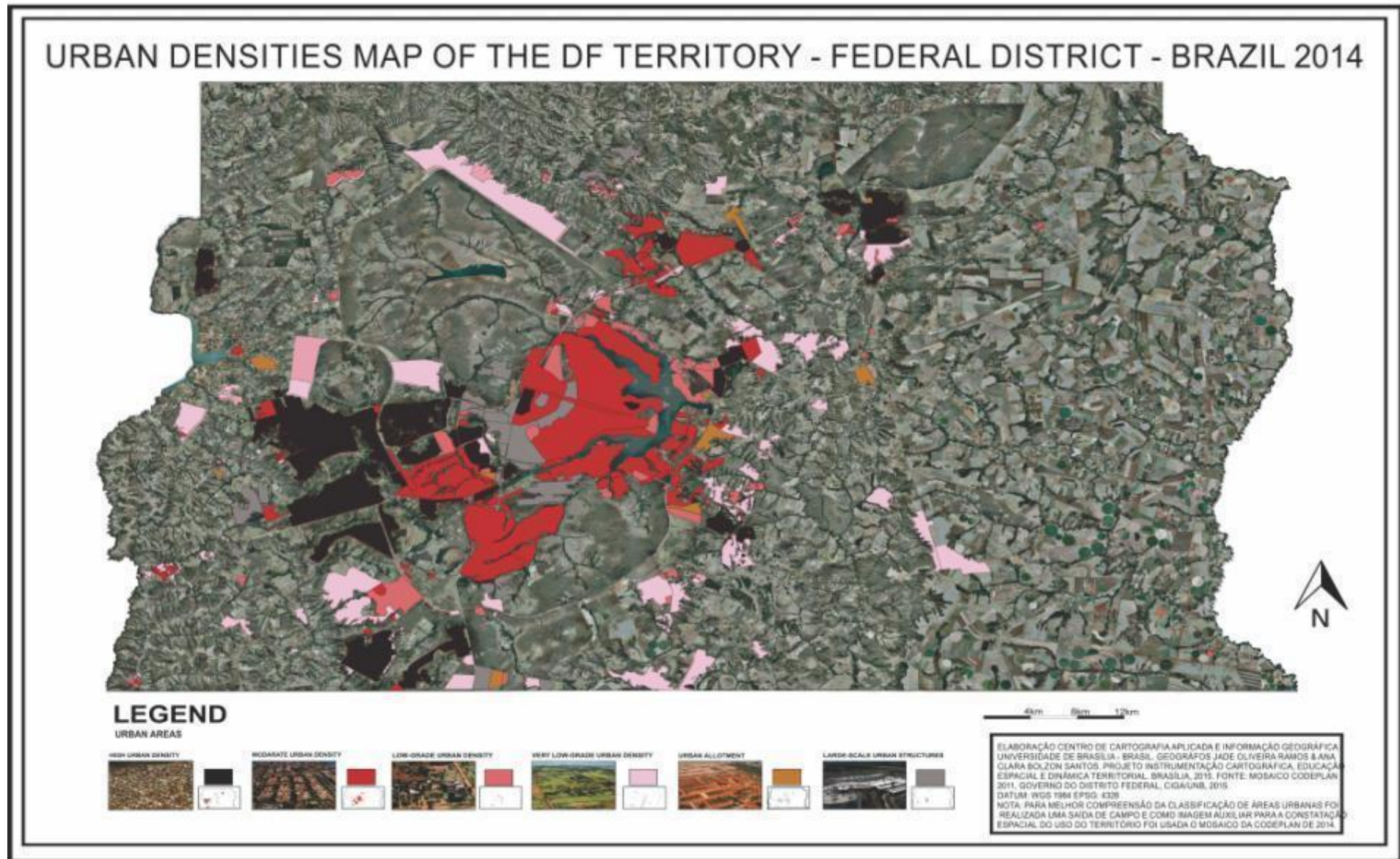


Fig. 5: Urban densities map of the territory - DF – 2014.

5. DYNAMICS OF THE URBAN SPACE IN A NEAR FUTURE AND PHYSICAL-ENVIRONMENTAL RESTRICTIONS OF DF.

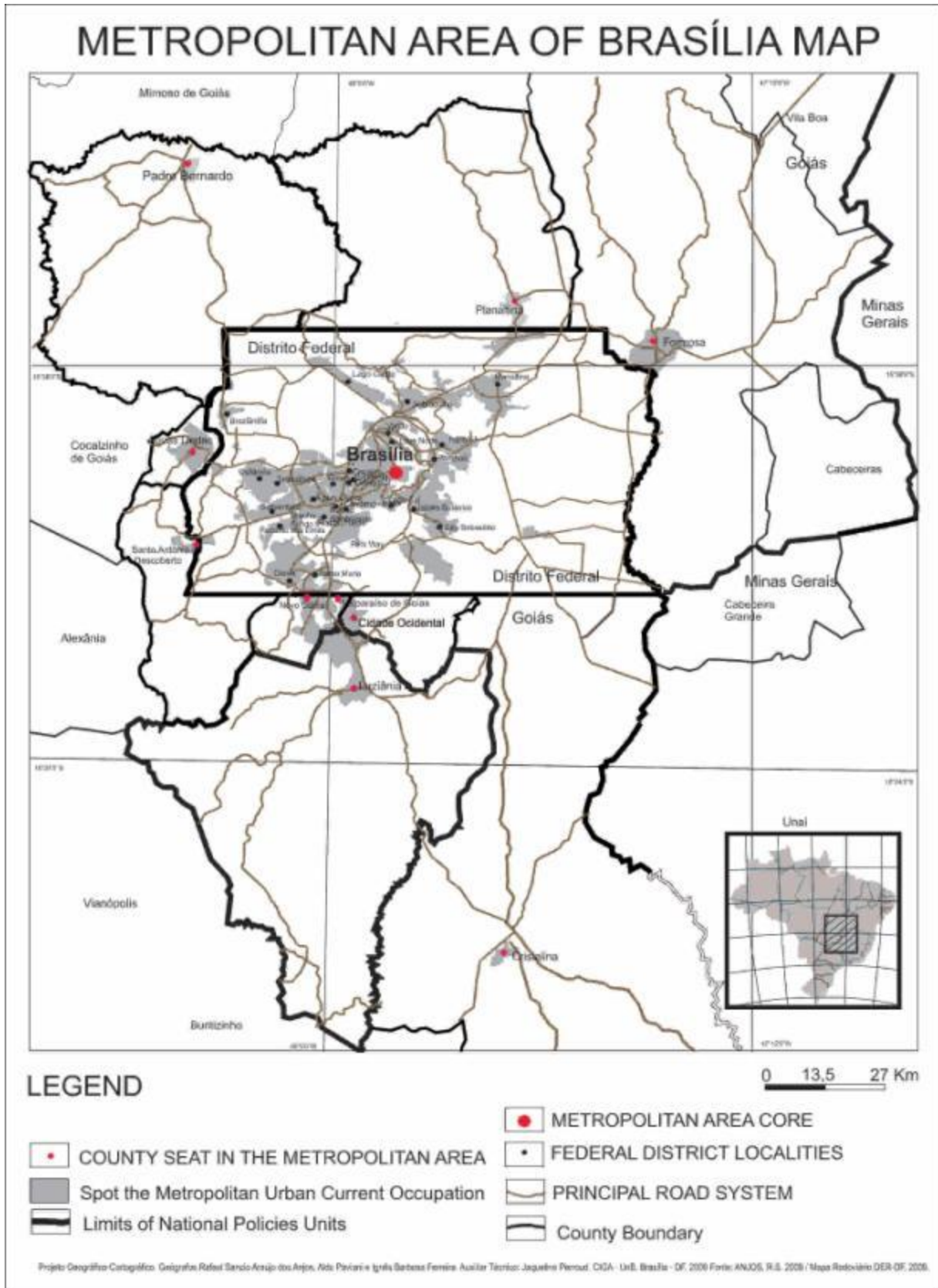


Fig.6: Metropolitan area of Brasilia map.

The identification and recognition process of the present urban spot and its growth vectors constitutes as a reference for configuring future tendencies. The spatial ascertainments, like different levels of consolidation of urban parceling, systematically pulverized in DF's territory are indicators that show the irreversibility of this spatial process, as well as thickening of the urban structure (ANJOS, 2008). There is a possibility that not all of the spots will be consolidated, due to interference of State actions or by a real stabilizing of the habitation deficit. However, the projected area of 91.334 ha presented in the extremities of practically all urban growth axis (2010), must be understood as yet another instrument to aid in the comprehension of a developing spatial process, as a reference for government decisions and actions, overall.

This graphic representation of the formation of urban spots is not only a spatial indicator to aid in the comprehension of a developing urban process, as well as scenery for real and possible bases of the territory's urbanization. Some ascertainments of the transformation process in the usage of territory are relevant:

1. It was verified that the present and near future's urban spot continue to and possibly will continue to occupy areas previously covered by herbaceous vegetation. This fact was established in the implementation of locations such as Samambaia, Ceilândia, Gama, Santa Maria, and recently, in urban occupations such as Estrutural and Itapoã. The main issue is that during the speculative process of territory usage, involving natural and urban spaces, the latter assumes a more valued position;

2. The productive agricultural spaces are also significant examples of transformation in urban spaces. The Agricultural Colony Vicente Pires (Colônia Agrícola Vicente Pires), in the proximities of Taguatinga, is the most emblematic example of this type of transformation, followed by a more recent process in the area of Ponte Alta, in the whereabouts of Gama. Some areas of the preservation planted forest of pines and eucalyptus constitute, in spite of the environmental restrictions, vulnerability spaces for urban occupation. In the proximities of Paranoá, a significant area has been deforested for a non-authorized urban expansion. Due to the importance of these areas as recharge spaces for aquifers, and also, of limiting the urban growth process, the matter of permanent territorial monitoring becomes a fundamental component to diminish the spatial incongruence in transformations of territorial use (ANJOS, 2005).

The distribution of the presented spots must be faced as an auxiliary instrument to comprehension of a process that unwinds, as a background screen for decision making and not as the whole of it. It is understood that it is only possible to have a consistent posture in measures to be taken presently when the perspectives of what the future will be like are visible, feeding, therefore on expectations and especially on speculations of what could happen. The future of the city is not treated as a

certainty, but as a tendency. Our focus is to work with spatial tendencies and ascertainties, real and acting.

It is relevant to notice that the monitoring of urban expansion dynamics constitutes only one record of time-space, but reflects public, population, economic and cultural dynamics. The data reveals a continuous growth of the urban spot and its population and points to the management of the problem of space for habitation. The population increase takes place basically in outskirt areas, creating dysfunctions in Brasília's urban structure. A severe effect of this accelerated population growth is the disjunction with the economic growth and urban infra-structure, generating unemployment and traffic jams on the structural roads, especially in the outskirts. This spatial situation, with movements of the urban space, still reveals an urban cluster that maintains itself without being able to preview and solve problems that affect it, especially related to the growth process. Even more, investigation of the evolution of the urban spot allows the supposition of a tendency of stabilization of the urbanization phenomenon, mainly due to concrete existent limitations in the usage pattern of DF's territory. Some references of urban expansion vectors and contexts of restrictive spaces for urbanization, as well as the main conclusions and recommendations of the study are treated in the following section.

6. SOIL SEALING, URBAN VERTICAL GROWTH AND ITS CONSEQUENCES IN THE URBAN ENVIRONMENT.

Soil sealing is directly related to the population density and the growth of urban area. As reported above, Brasilia, over its little more than fifty years, has undergone a major urban expansion, this increase generates enormous pressure on basic infrastructure, which often do not support the demand generated by the city's growth. Thus, we present two basic analyses to expose the situation of soil sealing in Brasilia. First, we will make the intersection of the sealed area with the river basins and sub-basins of the Distrito Federal, as we can see in the map of **Figure 7**, and then the same sealed area and the terrain slope in the Distrito Federal .

The definition of variables sealing, basin and slope was due to the direct relationship between them, since the impact of soil isolation by urban area directly affects water recharge of basins and the ground hypsometry (**Photos 1, 2, 3, 4, 5, and 6**). Observing the first map it is possible to identify the river basins and sub basins most affected by the sealing process, which are the same where the process of urban density has the highest rates, as noted on a map of DF densities. The Hydrographic Basins of Lake Paranoá and Descoberto hold most of the urbanized area of Brasilia, as well as large areas of urban and population density, except (ANJOS et.al., 2015).

The Hydrographic Basins of Lake Paranoá and Descoberto hold most of the urbanized area of Brasilia, as well as large areas of urban and population density, except for the central area of

Brasília, declared a Historical and Artistic Heritage of Humanity by UNESCO, bounded in map center. It is noteworthy that the presence of historical heritage paralyzes the process of urban growth in the central area of the city. It is in this territory that there was the development of the Pilot Plan and the regulation and control of the occupation are more present. Therefore, as has been seen, the central area of Brasília has a lower density than its surroundings. This brings an important peculiarity to Brasília; it is one of the few large cities in Latin America, where the center is less dense than the periphery.

This peculiarity has led the agents of the real estate capital to act in areas where control was less strict, precisely in areas which today have a higher occupancy rate. Moreover, as also highlighted in cartographic products, is going a vertical growth process in strategic areas of the city, mainly in the Administrative Regions of Taguatinga, in the past, and currently in Águas Claras, Gama, Guará, Samambaia and Ceilândia. The highlighted areas on the map, for the most part are within the Paranoá and Descoberto Basins, specifically in Sub-basins of Melchior and Riacho Fundo (numbers 19 and 20 respectively).

The highlight for these Basins and Sub Basin is important to present where the sealing process and population density are developing with greater force and, consequently, greater impact. It is worth mentioning other Basins, such as Corumbá and its Sub-basins of Alagado and Ponte Alta and Santa Maria (numbers 27 and 28), in the southern part of the DF, where also has a high density and development of vertical growth processes.

The second map below shows the relationship between soil sealing and the terrain slope, we can see by examining the two cartographic products in areas of greatest slope, where we find the great divisors of river basins the occupation is intense and consolidated. This finding leads to an important question of the urban environment of the capital of Brazil, the areas where there are important aquifer recharge have the urban area functioning as an insulating of the process of infiltration of rainwater and surface water. The density of urbanization is a determining factor for the increased water runoff, especially the rain origin, which leads to increased potential for flooding in urban areas of the city, a reality that is already manifest in various parts of the capital.

Photo 1: Border between DF and Goiás State. Urban cornubation process.



Photo 2: Soil sealing process and vertical growth area. Vicente Pires and Águas Claras regions.



Photo 3: Flooding in central area of Brasília.

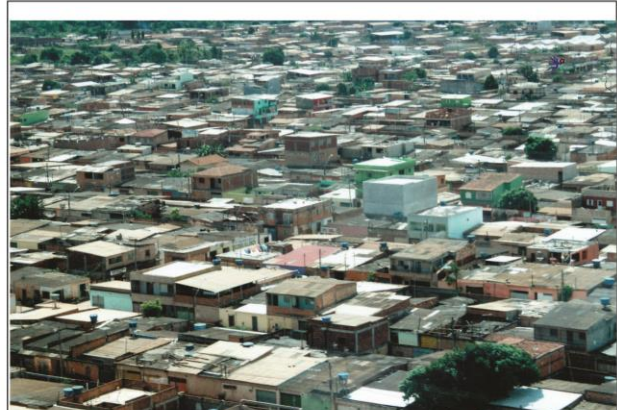


Photo 5: Paranoá neighborhood. A pattern of popular occupation sealing the soil.

Photo 5: Urban area in watershed divisor.

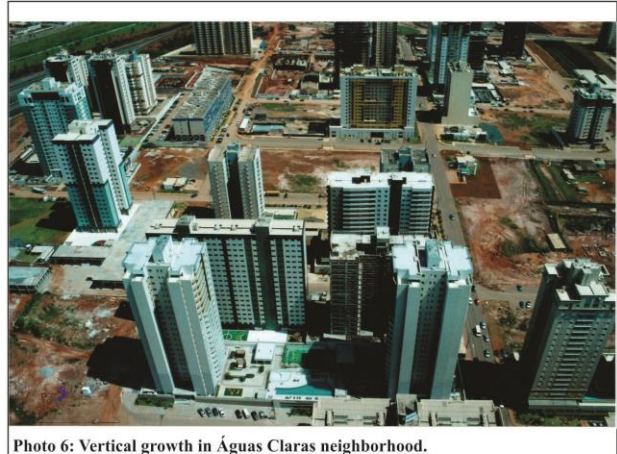


Photo 6: Vertical growth in Águas Claras neighborhood.

Photos 1, 2, 4, 5, and 6 by CIGA/UnB Crew. Photo 4 by Claudio Reis/Framephoto/Estado Newspaper.

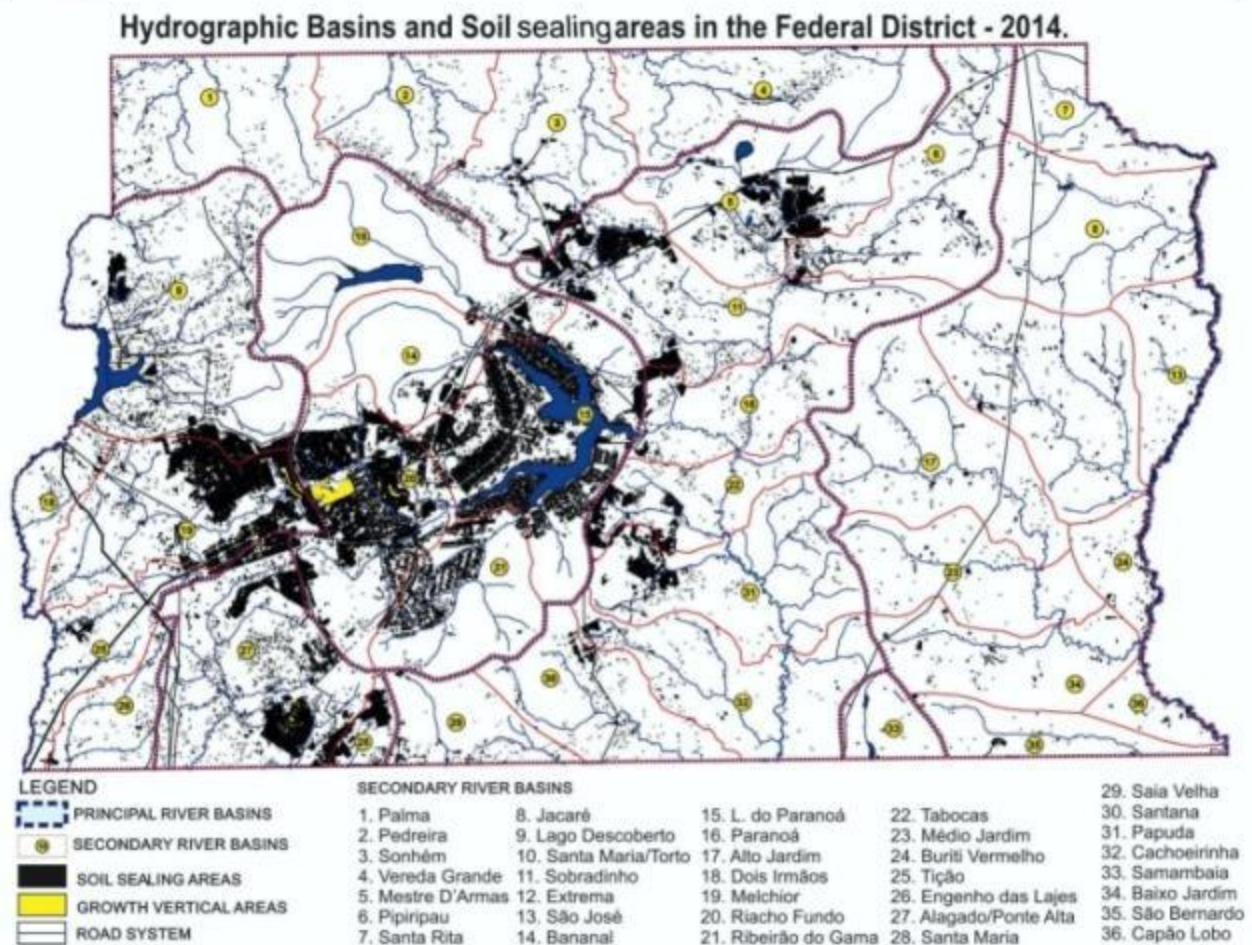
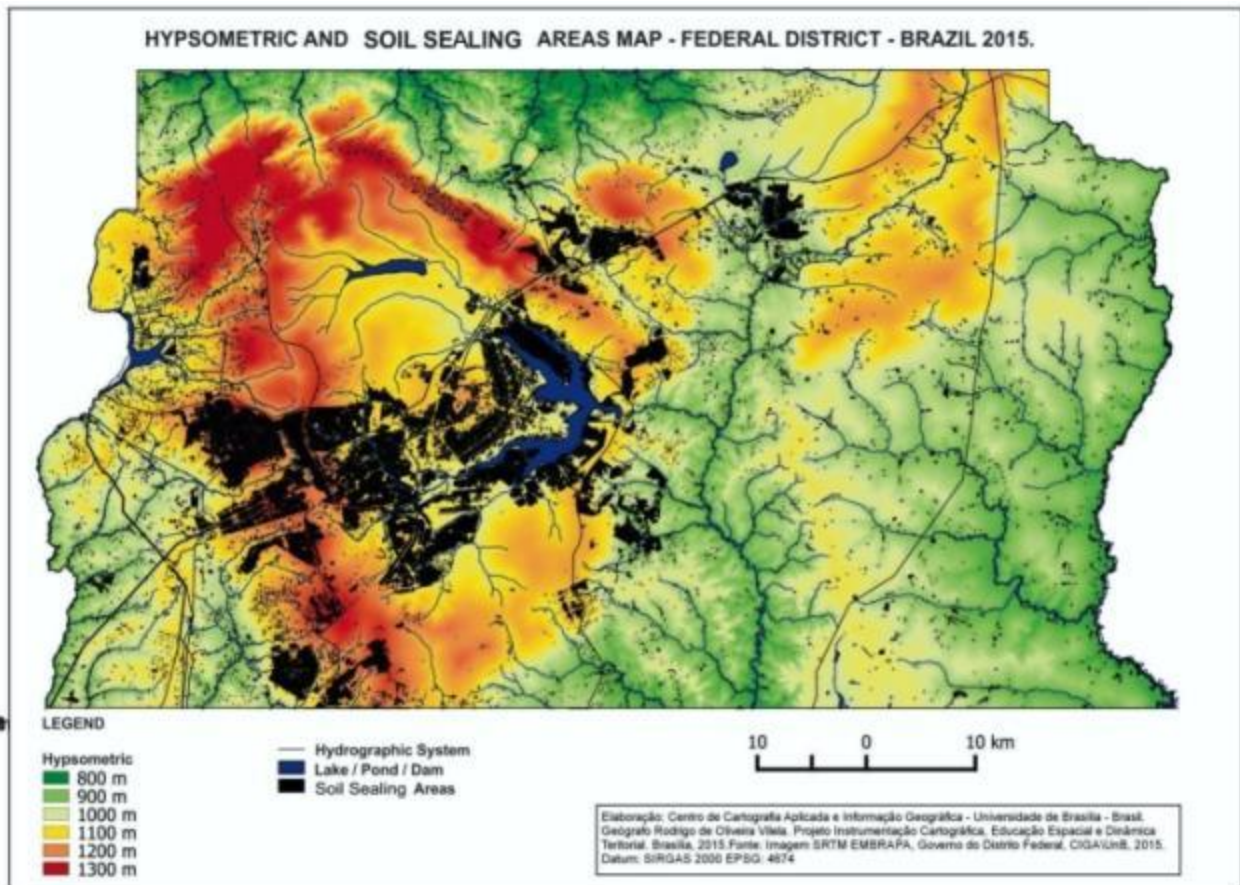


Fig.7: Hypsometric and soil sealing and hydrographic basins and soil sealing areas in the Federal District, Brazil.

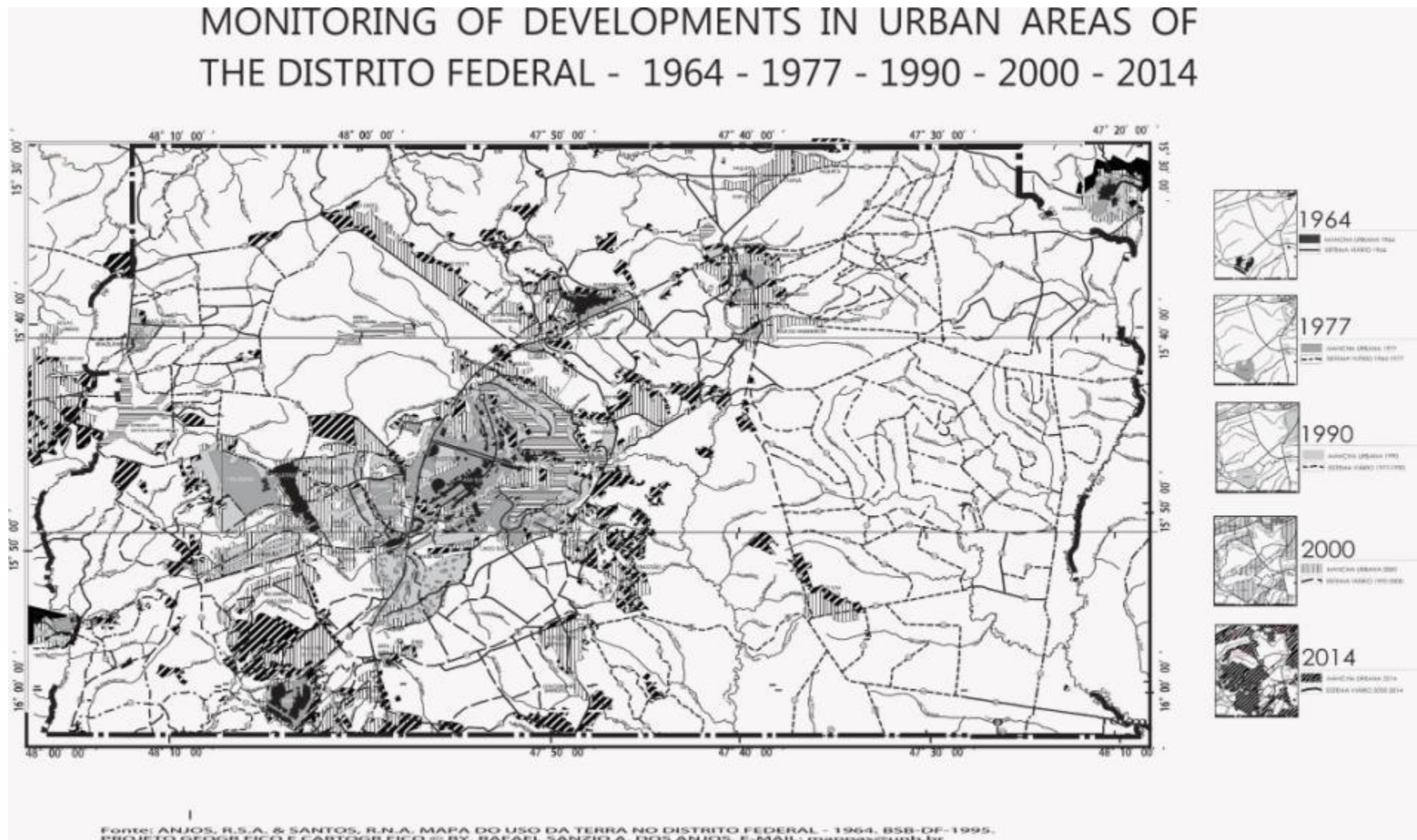


Fig. 8: Monitoring of developments in urban areas of the DF – 1964 - 2014.

7. CONCLUSIONS AND RECOMMENDATIONS

In the process of giving closure to the study, it was found to be relevant to highlight some basic territorial facts confirmed in the spatial structural ascertainments of the cartographic documentation developed, particularly in crossing the present expansion vectors, the urban spot for the near future, the hydrographic basins and the physical-environmental restrictions of *Distrito Federal*. The spatial integrations reveal conflicting territories and that configure a series of incongruences in occupation patterns and their tendencies, facts that express a series of incompatibilities and contexts in the forms of taking over this space.

Seeking systematization of the group of observations, we have grouped four basic orientations according to the tendencies configured in the present urban expansion vectors. They are the following:

The Urban Dynamics Core (C)

In the *Paranoá* Basin is located the core of territorial dynamics of DF and the most environmentally compromised spaces. Pressure and invasion of spaces of environmental preservation reveal the importance of creating real devices to decentralize activities in this important territorial unit. The many occurrences of consolidated urban spaces in areas of environmentally physical restrictions point to the need of more detailed investigation of the damage level and existent solutions in these sites. In this sense, the implementation of a priority spatial monitoring to control the process and aid in solving the problems is a structural path do diminishing and stabilizing these records.

North Vectors (N)

The space of the *Maranhão* Basin, due to its environmental sensibility, revealed by the concentration of water springs, the irregular landscape, and the extensions of gallery forests and *cerradão*, shows a need for priority of compatible uses with the particular characteristics of this territorial unit. Physiographic restrictions of the *Maranhão* River basin's region reaffirm the previous observation that concerns the stimulated occupation pattern(s) in this geographic unit will constitute the survival reference of the preserved springs, of the exuberant vegetation and stable irregular topography.

South Vector (S)

The springs of *Corumbá* River basin, with significant occupation and consolidated locations such as *Gama* and a series of spaces in usage transformation process (agricultural to urban) such as the *Ponte Alta* area, point to the necessity of a more efficient territorial management.

East Vector (L)

In the *São Bartolomeu* basin, where we find great extensions of *Cerrado* with different alteration levels, is the most vulnerable space for use transformation, especially urban and agricultural. The

São Bartolomeu River valley, with its strategic placement between vast extensions of great cultures and the urbanization core, proves to be a prioritized vulnerable area to additional environmental problems, mainly due to the group of urban growth vectors already in development and the consolidation of this territorial unit.

West Vector (O)

The presence of the *Taguatinga-Ceilândia-Samambaia* urban group at the *Descoberto* River basin indicates demographic concentration in a dynamic space still surrounded by agricultural spaces. **Figure 9** shows a group of expansion vectors

A tendency for stabilization of horizontal urban expansion of DF is established, be it in spatial records or in quantitative data. In other words, the velocity of the expansion of the urban cluster of Brasília must continue in a slower rate than the ones verified earlier. With this perspective, a new territoriality for urban *Distrito Federal* is configured, where the creation of an ample planning and management structure will be necessary, one that does not implicate of weakening of the decision making sector but attributes different features to it with less centralized, more representative and more direct actions.



Fig. 9: Secondary vectors dynamics in the urban areas of Federal District.

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