Periódico Eletrônico
Fórum Ambiental da Alta Paulista
ISSN 1980-0827 – Volume 19, número 1, 2023

Formation of a territory: the production process of the urban space of São Bernardo do Campo/SP

Jeane Aparecida Rombi de Godoy
Ph.D. Professor, UNIVAG, Brazil.
jeane.rosin@univag.edu.br

Periódico Eletrônico
Fórum Ambiental da Alta Paulista
ISSN 1980-0827 – Volume 19, número 1, 2023

SUMMARY
This article presents some aspects that guided the dynamics of the process of urban occupation of the protection spaces in the springs of the Billings Dam. In this region, the connection between the accelerated process of industrialization, disorderly urbanization, and the increase in population concentration over the years, devoid of adequate actions of planning and territorial ordering, contributed to the intensification of socio-spatial inequalities sustained by a pattern of exploitation and dilapidation of uses and degradation of ecosystems. From this framework, it analysed the occupation of the urban territory of São Bernardo do Campo, especially about the influence of industrialization, disorderly urbanization, and occupation of environmentally fragile areas, as well as sought to contextualize the need for new mechanisms of territorial planning and management to mitigate and reverse the high levels of biophysical vulnerability existing in the fragile spaces of protection of water sources. The approach adopted involved the analysis of data and information from various sources, such as previous studies, technical reports, municipal plans, and other relevant publications. It is hoped that the results found can subsidize the development of new studies, as well as contribute to the formulation of urban and environmental public policies.

KEYWORDS: spatial planning**;** urban occupation; urbanization; water source areas; public policies

1 INTRODUCTION

After the end of the Second World War, new possibilities for insertion in the international economic order were revealed, especially for developing countries such as Brazil. At the height of an economy oriented by the search for substitution of imported products, in view of the need to strengthen an expressive manufacturing industry and the facilities offered by the great capitalist powers in financing the initial process of industrialization under new economic and political conditions, through the strengthening of new bonds of dependence, it could not be otherwise but by the inflow of foreign capital (SOUZA, 2002).

In this context, for several nations that were beginning their industrialization process, the inflow of foreign capital produced contradictory effects by injecting considerable sums of investment into the economy, impacting not only the growth guidelines, but also sealing the bonds of dependence.

In Brazil, these reflexes were materialized in the first industrialized bases that emerged in the scenario of some states, in the specific case of the State of São Paulo, the emblematic example is the micro-region of the ABC region of São Paulo which, according to Souza (2002), "[...] serves to this day the nostalgic imaginary of supposedly better times in our economic history", this region, located in the southeast of the Metropolitan Region of São Paulo (MRSP), brought together municipalities that had the necessary requirements for the implementation of urban and industrial development projects engendered by the federal government[1] (SOUZA, 2002, p. 11). In later decades, based on a confluence of interests between internal and external circuits, present in the implementation of government development plans, in a short period of time the ABC region became a reference as an industrial hub for Latin America, with the circulation of considerable flows of capital and labour.

[1] The Juscelino Kubitscheck government's Plan of Goals, by adopting as its emblematic motto "to develop the country fifty years in just five years of government", established priority areas of investment for economic development, focused on the implementation of infrastructures (highways, hydroelectric plants, airports) and industrial zones. To this end, major automakers in the automotive industry (Ford, Volkswagen, Willys and GM – General Motors) arrived in the country, installing their plants in the southeast region of the country, specifically in the cities of São Paulo, Rio de Janeiro and ABC Paulista.

During this conjuncture, the municipality of São Bernardo do Campo emerges, which for a short time became a village linked to the municipality of Santo André. However, in less than ten years its territory was occupied by a heavy industrial base, markedly altering the indicators of the municipality, both in the socioeconomic, political, and environmental context.

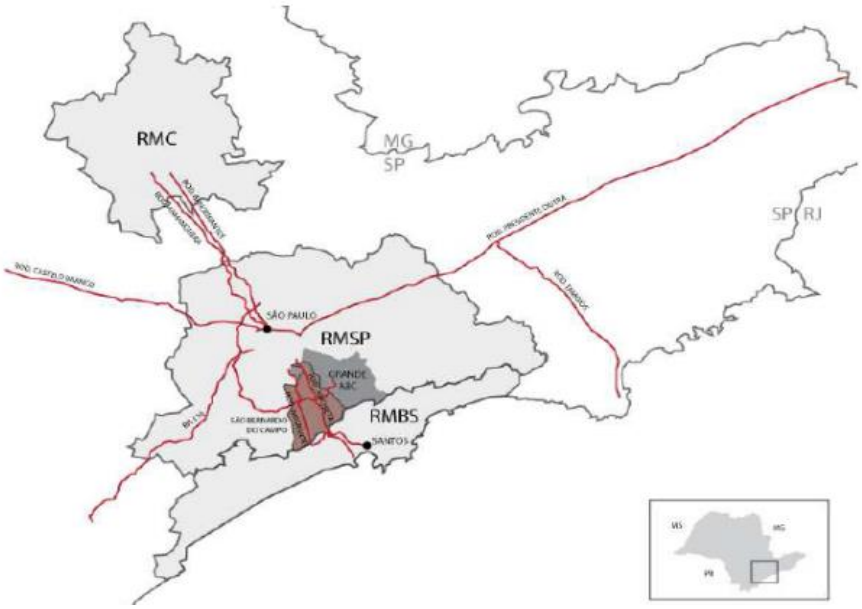
In the context of Brazilian cities, especially in the State of São Paulo, the city of São Bernardo do Campo gains visibility not only for its attributes of wealth, but notably for being one of the urban scenarios where externalities take on unusual dimensions, especially when it becomes an epicentre of contradictions.

The territorial conformation of the municipality of SBC is historically linked to the strategies determined by the actions, notably of the federal, state, and metropolitan governments in the implementation of the Anchieta and Imigrantes highways, and recently by the Rodoanel, which were decisive for its urbanization process, ensuring a notorious position in the metropolitan region of São Paulo (SÃO BERNARDO DO CAMPO, 2011).

Its strategic geographical position between the capital of the State of São Paulo and the Port of Santos guarantees it a privileged position in several sectors, since the connection between these two poles is made by the Anchieta and Imigrantes highways, which cross its territory in a north-south direction, constituting one of the main logistics for the flow of the most diverse products. in addition to the flow of people.

The expressive performance in several sectors is due to the historical concentration of local industrial activities – with a territorial extension of 408.0 km², it is also intersected by a logistics transport system that enables the connection with the main urban centres in the southeast of the country. This spatial configuration, articulated by these strategic highways, was decisive for its urbanization process, ensuring a notorious position in the metropolitan region of São Paulo (SÃO BERNARDO DO CAMPO, 2012).

Figure 1 - Road axes and location of the municipality of São Bernardo do Campo in relation to the Greater ABC, the MRSP, the RMBS and the State of São Paulo



Source: Geographic and Cartographic Institute (2002), road map of the State of São Paulo (DER, 2008).
Elaboration: FESPSP (2010 apud SÃO BERNARDO DO CAMPO, 2012), no scale.

All this scenario permeated by urban, economic, social and environmental transformations gave a new dynamic to the region, specifically in the period between 1947 and

1953, when there was the implementation of the Anchieta highway, and with it large industries, notably in the automobile and chemical sectors, were installed in its territory, registering in the municipality a high demographic growth, which occurred in the period between 1940 and 1950. when the number of inhabitants increased from 11.685 to 20.000 (LANGENBUCH, 1971).

A brief analysis of historical data indicated that the implementation of the urban infrastructure network, such as the highways that make up the road system[2] in the metropolitan region of São Paulo between 1940 and 1950, contributed to the intensification of urbanization in the State of São Paulo.

The new transport axes were a determining factor for the implementation of the industrial base, and in this period the industrial areas were constituted along the recently implemented Anchieta, Dutra and Anhanguera highways, which began to receive new industries, mainly multinationals, consolidating the ABC region as an important industrial centre of the MRSP.

However, as the industrial base was structured in the sense of interconnecting the capital to the port of Santos along Via Anchieta, forming a centre of high polarity convergences, it began to attract a huge population contingent towards the municipalities of the ABC, especially to São Bernardo do Campo, where its spaces were largely occupied by farms. agricultural properties and large preserved areas, mainly around the Billings reservoir, forming a rarefied and sparse occupation, with low densities and large presence of vegetation mass.

In this context, the 1960s marked not only the consolidation of the centre of the city of São Paulo, but also the agglutination of the industrial sector, which began to exert a strong attraction for immigrants from different locations who arrived in search of new job opportunities and income, that is, in search of better living conditions.

Without the institutional structure and physical infrastructure necessary to respond to all the demands arising from the intensity of these events, the consequences became inevitable to the point that the high rates of population growth and disorderly territorial expansion, among other anomalies, gained visibility. This situation is even more critical, notably due to the installation of a heavy infrastructure necessary for the industrial development process, to which large government investments have been channelled.

However, it is important to emphasize that this entire process of economic development was not guided by a comprehensive and continuous planning process aimed at the transformation of the city, to guide the investments necessary for the implementation of an infrastructure network adequate to the dynamics intrinsic to the urbanization process.

Only around the 1960's did a period begin marked by large investments in public works, generating a new urban design for the city and, above all, causing its expansion towards the outskirts with the occupation of locations close to the Billings dam.

When observing the urban area in this period, although it presented characteristics of continuity and homogeneity, its pattern of centre-periphery urbanization does not fail to reveal the rationality marked by the interference of real estate speculation and socio-spatial segregation and, as neighbourhoods consolidated, other subdivisions were implanted or occupied increasingly distant areas.

[2] ALVIM (2003, p. 228), based on the studies of Wilheim (1965), shows that during the 1950s, a communications network consisting of important highways was implemented in the MRSP – the Anchieta Highway (1953), Presidente Dutra Highway (1951) and Anhanguera Highway (1953), which contributed to the expansion of the urban fabric and gave a metropolitan aspect to the spatial arrangement.

Guided by this logic, the city expands intensively, occupying areas that, from a geological and geotechnical point of view, were unsuitable for urban occupation, conforming to areas of risk (floodplains, soils of the crystalline complex – steep and susceptible to erosion and landslides) (MOROZ-CACCIA GOUVEIA, 2010, p. 245).

From the 1960's onwards, in the list of infrastructures necessary to guarantee and maintain the quality of urban space, the channelling of watercourses[3] was assimilated as a necessary condition for civility, in addition to providing real estate appreciation in its surroundings and guaranteeing a significant number of votes in electoral campaigns (MOROZ-CACCIA GOUVEIA, 2010, p. 247). In this context, Moroz-Caccia Gouveia (2010, p. 245), when dealing with anthropogenic changes, points out that the urban occupations in this period were the urban occupations towards the crystalline terrains existing on the edge of the sedimentary basin of São Paulo.

Such notes are presented by the author in her research on "The originality of the urban site of São Paulo", in which the various analyses carried out, especially through the maps referring to the urbanization and morphological changes of the period between 1952 and 1983, indicated an increase in occupation estimated at 237%, that is, for this period the author explains that "in 1952 the urban area occupied only about 20% of the total area of these areas. land (26 km²), in 1983, the occupation advanced over 87.7% km²", which corresponds to "68% of the total area of this geomorphological unit".

To better understand the value found, the author contextualizes Abreu's notes, in which the author clarifies that, by occupying beyond the limits of the sedimentary basin, the areas surrounding its Precambrian basement.

> [...] the urbanized territory has added to its economic and social problems also those originated by the dynamics of the relief, introduced by the action of the real estate speculator, in its various forms, and aggravated by the lack of sensitivity of government agencies, regarding environmental degradation. Thus, the metropolis began to face, along with the economic and social crisis, also a morphogenetic crisis with serious consequences (ABREU, 1992, p. 47).

Moroz-Caccia Gouveia (2010, p. 251-252) understands that the morphogenetic crisis, commented by Abreu (1992), is a set of responses of the physical environment due to the breakdown of the dynamic equilibrium, resulting from the anthropic actions that occurred in areas of Precambrian basement of the São Paulo Plateau.

In the context of this question, the author considers the specificities of the form of relief in this compartment, identified in the low and middle hills, with narrow and elongated interfluves, sloping slopes and medium to high drainage density, added to the lithological specificities and also of its surface materials, intensifying the degree of fragility of the relief, specifically when they modify the natural conditions due to the process of urban occupation.

> In view of the susceptibility of surface materials to weathering and remobilization processes by surface runoff, the landforms were originally in equilibrium, due to the presence of a vegetation cover whose root system, associated with the supply of organic matter to the material – "which functions as a true protective layer in relation

[3] The channeling of watercourses. "The predominant logic for the residents was (and continues to be) that of distancing, since the depletion of waste is done directly on them. There is no interest, as a rule, in knowing the final destination of the waste and, therefore, sewage collection and treatment services are not essential. It is enough to channel the stream, hide the 'filth', eliminate the odors and keep away rats and mosquitoes" (MOROZ-CACCIA GOUVEIA, 2010, p. 247).

> to the materials of the rock basement altered in situ" (ABREU, 1992, p. 49), guaranteed them stability. However, from the moment the vegetation cover is removed, and the surface materials undergo remobilization through the execution of cuts and embankments, the balance is broken, and the erosive processes begin to install themselves aggressively, culminating in the appearance of ravines. In addition, the changes imprinted on the geometry of the slopes, also resulting from cuts and embankments, by modifying the hydrodynamic behaviour, end up triggering landslide processes. The morphodynamical characteristics of the areas of the crystalline basement are unfavourable and present risks to urban occupation, regardless of the purchasing power of those who occupy them. (MOROZ-CACCIA GOUVEIA, 2010, p. 251).

By describing the occupation process verified in areas of the crystalline basement, where the natural environment, when altered with the removal of the vegetation cover to adapt the relief, ends up disrupting the entire balance of the dynamics of the natural environment, and starts to potentiate the occurrence of risks due to the specific environmental characteristics of this occupation process, Among which the author highlights:

> - The lack of technical criteria in the opening of streets;
> - The reduced sizes of the lots, which require the execution of successive cuts and embankments in order to create levels that can be occupied;
> - The permanent exposure of the alteration material, after removal of the organic layer of soil;
> - The absence of rainwater flow discipline devices, accelerating surface runoff;
> - The absence of sewage collection systems, which implies the discharge of wastewater on the surface and the installation of cesspools, allowing the continuous infiltration of water into the soil; and,
> - Absence of garbage collection, implying the dumping and concentration of garbage and debris on the slopes, creating very unstable deposits; among others. (MOROZ-CACCIA GOUVEIA, 2010, p. 252).

Although the consequences related to the removal of vegetation cover are explicit in processes of precarious occupation, especially in the implementation of irregular allotments because they cause, among the various impacts, the silting of water bodies, inadequate appropriation of floodplain areas – of fluvial environments, accentuating the occurrence of flooding, which are not recent facts. To exemplify this context, Alvim et al. (2006, p. 8) comment that in 1940 "the dredging service was already removing 120,000 m³ of earth per year from the Tietê River, in 1963, this volume rises to 1,500,000 m³.

In these locations, the impacts generated by this process were already perceived at that time, especially by the accumulation of debris in water bodies, mainly by the release of effluents from different origins into streams and rivers.

However, without disregarding the importance of its development not only for the formation of a metropolitan region, but also for the formation of an economic pole in the country, when looking at the issue from a systemic view, it is important to recognize its negative aspects, especially those that contributed to the expulsion of the lower income social strata towards the peripheral areas, especially for the Guarapiranga and Billings springs in the southeast.

Faced with this scenario, it can be seen that the State has remained absent for a long time, especially in the face of its numerous responsibilities, including not acting in the provision of housing for the most impoverished classes, not supervising and guiding the non-occupation of environmentally fragile spaces, and in a very controversial situation – it was and still remains as the promoter of many inadequate occupations of these spaces, whether through the

implementation of housing complexes, plugging and rectification of watercourses for the implementation of roads or adaptation of the road system.

2 OBJECTIVES

The objectives of this research aim to understand and highlight the impacts of the disorderly occupation of the urban territory of São Bernardo do Campo, as well as to point out ways to overcome the structural problems identified.

1. To analyse the occupation of the urban territory of São Bernardo do Campo, especially regarding the influence of industrialization, disorderly urbanization, and occupation of environmentally fragile areas.
2. Identify the consequences of disorderly occupation, such as the degradation of ecosystems, the extinction of species in the Atlantic Forest biome and the intensification of socio-spatial inequalities.
3. Contextualize the lack of comprehensive and continuous planning aimed at the transformation of the city, highlighting the absence of investments necessary for the implementation of an infrastructure network adequate to the dynamics intrinsic to the urbanization process.
4. Contextualize the need for new territorial planning and management mechanisms to mitigate and reverse the high levels of biophysical vulnerability that exists in the fragile spaces for the protection of water sources.

3 ANALYSIS METHOD

The approach adopted involved the analysis of data and information from various sources, such as previous studies, technical reports, municipal plans, and other relevant publications. It was built from a careful bibliographic review specific to the theme under study, which was subsidized by consultations in theses, dissertations, books, and articles in periodicals, related to the process of formation of the ABC region of São Paulo, particularly to the process of production of the urban space of São Bernardo do Campo/SP. The collection of data and maps was carried out in several consultations with public agencies - SEHAB/São Paulo and SEHAB/São Bernardo do Campo and data made available by the IBGE censuses - which made it possible to carry out a systematized analysis, seeking to understand the process of occupation and use of urban land and its socio-environmental specificities. Thus, based on the information and data collected, we sought to understand the initial process of formation of this territory and its relationship with the socio-spatial and environmental aspects in the context of the metropolitan region of São Paulo.

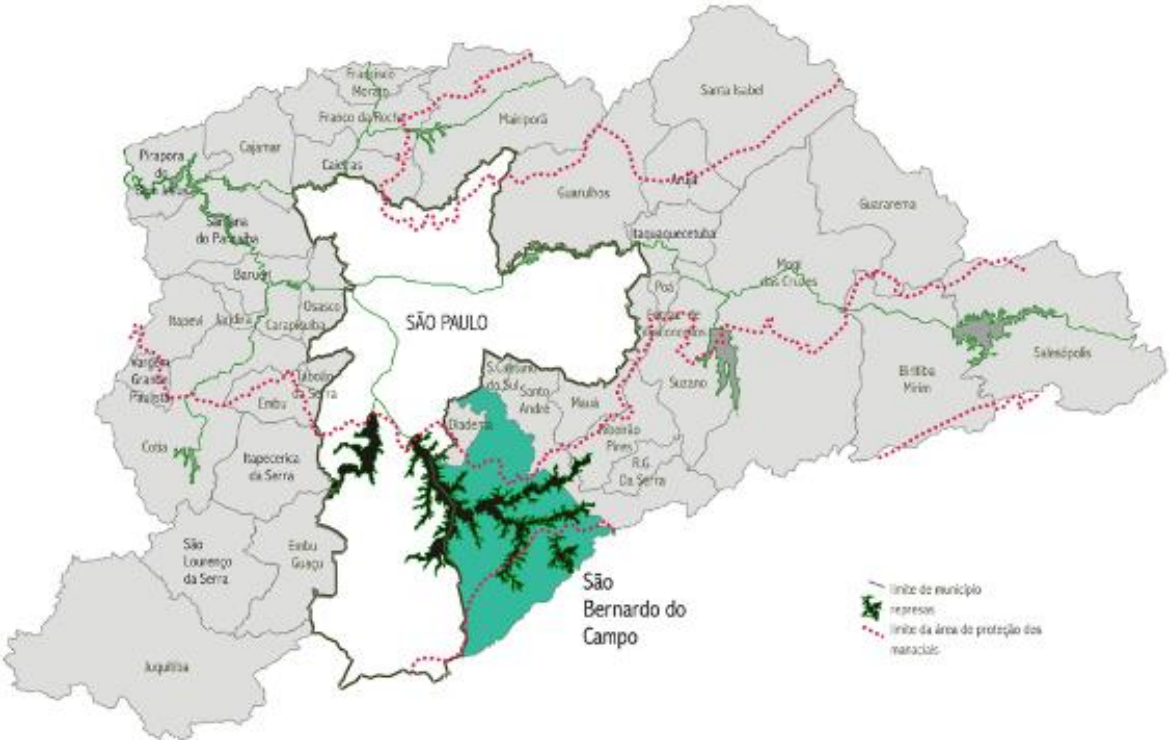
4 RESULTS

4.1 São Bernardo do Campo: the loss of vegetation cover due to territorial occupation.

São Bernardo do Campo is part of the geographical portion of the southeastern sub-region of the MRSP, also identified as the greater ABC region, a territory initially constituted by the municipalities of Santo André, São Bernardo do Campo and São Caetano do Sul, in a later

phase the municipalities of Mauá, Diadema, Ribeirão Pires and Rio Grande da Serra were incorporated.

Figure 2 - Location of the Municipality of São Bernardo do Campo



Source: São Bernardo do Campo; Prosanear (2005).

Regarding environmental aspects, it is also verified in its territory the presence of primary forest remnants of the Atlantic Forest integrating the arboreal composition of the Serra do Mar Park, as well as 70.8% of the surface of the municipality is recorded as a protection area for the springs of the Billings Dam, which are part of the green belt of the biosphere reserve determined by UNESCO, to preserve one of the biomes with the greatest biodiversity on the planet. All this geographical context, where there is a predominance of natural attributes that can be protected, allows São Bernardo do Campo to occupy a relevant position in the face of the environmental potential within the scope of the MRSP.

The territorial dimension of the municipality of São Bernardo do Campo covers 407.10 km², of which 268.83 km² are written as environmental protection areas, 212.94 km² are included in areas of protection of water sources and the Billings Dam occupies an area of 75.82 km² (Table 1).

Table 1 - Territorial Dimensions – São Bernardo do Campo

Área	km²	%
Urban area	118,74	29,2
Rural area	212,54	52,2
Billings Dam	75,82	18,6
Total of the municipality	**407,10**	**100,0**
Protection of water sources	212,94	52,3
Environmental protection	268,83	66,0

Source: Research and Database Section – São Bernardo do Campo; Prosanear (2005).

The last census conducted by the IBGE (2010) indicated that the municipality has a population of 765,203 inhabitants, of which 752,417 live in the urban area and 12,786 are residents of the rural area. For a better understanding of the process of demographic evolution that occurred in the municipality, data provided by the IBGE censuses (1940, 1960, 1970, 1980, 1991, 2000 and 2010), organized by Silva (2013, p. 237), were inserted, which pointed out that São Bernardo do Campo followed the trend of the MRSP and presented a significant increase in its population between the years 1970 and 1980. The increase in population, as a social phenomenon, can be associated with the economic context of Brazil, which, in the case of São Bernardo do Campo, was reflected in the strengthening of the local economy and the creation of new jobs, resulting from the expansion of its industrial park.

Table 2 - Population Evolution from 1950 to 2010

Scope	1950	1960	1970	1980	1991	2000	2010
Bernardo do Campo	26.272	82.411	201.662	425.602	566.893	703.177	765.463
RMSP	2.699.449	4.608.380	8.139.730	12.588.725	15.444.941	17.878.703	19.677.844

Source: Silva (2013, p. 237), adapted by the author.

The combination of these aspects contributed to the densification of the municipality, particularly from the 1960s onwards, progressively increasing until the decade of the year 2000, when growth rates slowed down. Its effects were decisive for the consolidation of the urban fabric (Table 3), mainly due to the speed at which it occurred over the years, demanding a wide network of urban infrastructure, equipment, and services in addition to housing units, considering that in the 1960's the[4] housing deficit and irregular occupations in areas of water sources were already identified.

Table 3 - Evolution of consolidated urban land from 1989 to 2010 (km²)

Scope	1989	1999	2010	1989 a 1999	1999 a 2010	1989 a 2010
Bernardo do Campo	63,26	70,40	75,57	7,14	5,17	12,31
RMSP	1388,33	1546,74	1662,85	158,41	116,11	274,52

Source: Silva (2013, p. 240), adapted by the author.

From this perspective, when observing the data from INPE (1989, 1999 and 2010), organized by Silva (2013, p. 144, the process of territorial occupation of the municipality was not restricted to consolidated urban settlements advancing over rural areas and protection of the springs of the Billings Dam, characterizing a sparse and rarefied occupation. As can be seen in Table 4, this phenomenon was more pronounced when compared to the MRSP.

[4] Between 1960 and 1970, the municipality of São Bernardo do Campo presented the highest geometric annual growth rate in relation to the Greater ABC, the MRSP and the State of São Paulo itself. The significant difference between the TGCA of the population of São Bernardo do Campo and the TGCA of the Greater ABC (2.65%), MRSP (4.08%) and the State of São Paulo (6.19%) is due to the installation of the Brazilian automobile park, in full expansion, in the municipality, in the 1950's and 1960's, after the construction of the Anchieta Highway (AGUILAR, 2010, p. 151).

Periódico Eletrônico
Fórum Ambiental da Alta Paulista
ISSN 1980-0827 – Volume 19, número 1, 2023

Table 4 - Evolution of sparse occupation in the municipalities of the MRSP from 1989 to 2010 (km²)

Scope	1989	1999	2010	1989 a 1999	1999 a 2010	1989 a 2010
Bernardo do Campo	3,11	3,56	5,93	0,45	2,38	2,83
RMSP	158,26	206,78	262,37	48,52	55,59	104,11

Source: Silva (2013, p. 244), adapted by the author.

As a result of the process of occupation, consolidated or sparse,[5] it is possible to assess that there has been a loss of native vegetation in its territory, especially due to the high demand for urbanized land for the implementation of new urban settlements and expansion of existing ones. The advance on the territory, in the specific case of São Bernardo do Campo, caused several negative impacts on the natural environment.

From this point of view, regarding vegetated forested areas due to the diversity of their functions, they present use values related to the services they perform, especially those of water resource conservation. However, its natural renewal is restricted to the carrying capacity of the natural environment, technologies, and the intensity of uses. Specifically, water, its [6]renewal process results from the predisposition of biogeochemical processes to regenerate its natural properties, where the presence of the plant component assumes an essential role, given their interdependencies. Thus, when it comes to the need for recovery and protection of the areas of water sources, the vegetation cover in their surroundings, as well as in the springs and along the watercourses that feed their reservoir in the territorial context of their basin, are components of vital importance.

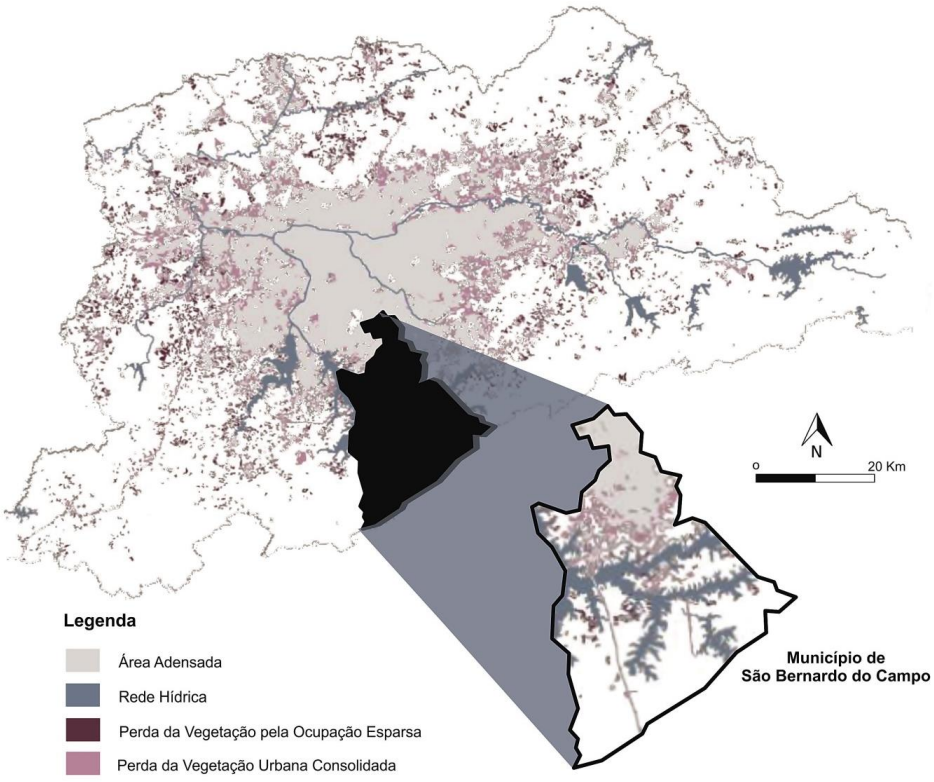
Therefore, the study of such aspects in the municipality of São Bernardo do Campo for the focus of this investigation is essential. From this perspective, through its study, it was found that, in addition to the removal of the cover formed by native vegetation, or the state of its regeneration, the occupation of the territory directly influenced the dynamics of several ecosystems, resulted in the extinction of some species of the Atlantic Forest biome, as can be seen in Figure 3.

[5] "*Sparse occupation*: includes occupied areas of smaller dimensions, of lower building densities and physically disaggregated from the main urban complex, whether these areas are urban or rural. They comprise sparsely occupied subdivisions and residential condominiums, with a low concentration of buildings, as well as residential and leisure farms and sites located far from the main urban area, usually along highways or local access roads" (SILVA, 2013, p. 116).

[6] Renewal of the water resource – "[...] Water is one of the most important natural resources in the territory, representing, along with solar energy, one of the essential requirements for life on Earth. 'Theoretically', the hydrological cycle determines that water can be considered a renewable resource, that is, a resource that has permanent and continuous characteristics of formation and circulation. However, in recent decades, the debate on its scarcity has been widening and, although the total volume of water in the world has remained constant, its capacity for regeneration has been impaired by the way and pace at which it has been appropriated and used by society" (ALVIM; KATO; BRUNA, 2008).

Periódico Eletrônico
Fórum Ambiental da Alta Paulista
ISSN 1980-0827 – Volume 19, número 1, 2023

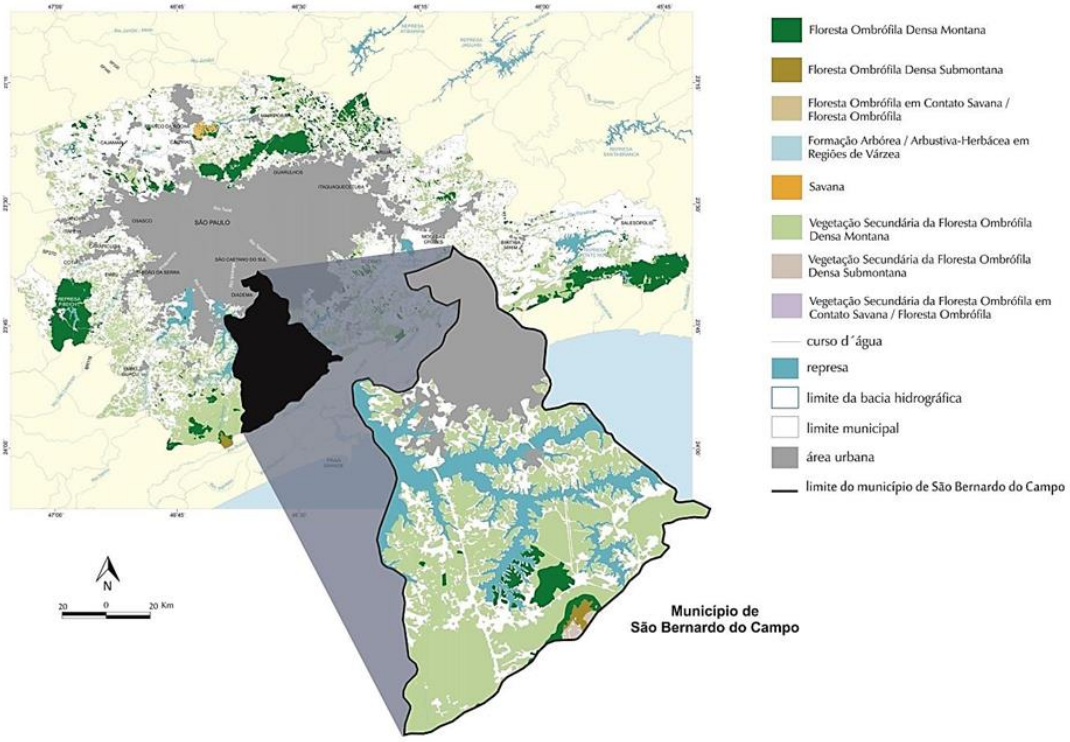
Figure 3 - Vegetation loss due to consolidated and sparse occupation



Source: Silva (2013, p. 166), adapted by the author.

According to data from the Forestry Institute (2005), the municipality of São Bernardo do Campo has an area of 1,522.52 ha of dense montane ombrophiles forest in a protection area for the Billings springs (Figure 4).

Figure 4 - Native cover of the Upper Tietê watershed in 2001



Source: São Paulo (SMA, IF, 2005), adapted by the author.

The research found that, despite the remote sensing and geoprocessing resources that are available to monitor the vegetation cover of the territory of the State of São Paulo, the Forestry Institute (an agency linked to the Secretariat of the Environment since 1986) has not made available data on the historical series of the process of deforestation and occupation of the State of São Paulo since 2005. This fact could compromise the analysis of the case study.

Thus, in view of the lack of information and considering the objectives proposed within the scope of this thesis, it was considered that the studies carried out by Silva (2013) developed from satellite images of the Landsat series (available free of charge on the websites of INPE) and the *University of Maryland Institute for Advanced Computer Studies*[7], are the most pertinent to complement the identification of the percentage of vegetation cover (tree and creeping) in the MRSP, as well as in São Bernardo do Campo (Tables 5 to 7).

Table 5 - Percentage of tree vegetation area from 1989 to 2010 (%)

Scope	1989	1999	2010	1989 a 1999	1999 a 2010	1989 a 2010
Bernardo do Campo	54,81	54,02	53,17	-0,79	-0,85	-1,64
RMSP	49,53	46,16	44,72	-3,37	-1,44	-4,81

Source: Silva (2013, p. 254), adapted by the author.

Table 6 - Percentage of undergrowth area from 1989 to 2010 (%)

Scope	1989	1999	2010	1989 a 1999	1999 a 2010	1989 a 2010
Bernardo do Campo	11,51	10,05	9,73	-1,47	-0,32	-1,79
RMSP	27,43	28,05	27,01	0,62	-1,04	-0,42

Source: Silva (2013, p. 258), adapted by the author.

Table 7 - Percentage of vegetation cover area from 1989 to 2010 (%)

Scope	1989	1999	2010	1989 a 1999	1999 a 2010	1989 a 2010
Bernardo do Campo	66,33	64,07	62,90	-2,26	-1,17	-3,43
RMSP	76,96	74,21	71,73	-2,75	-2,48	-5,23

Source: Silva (2013, p. 262), adapted by the author.

When comparing the data measured by Silva (2013) for the period between 1989 and 2010, it was possible to verify that the municipality of São Bernardo do Campo lost 3.43% of vegetation cover in relation to its territory.

In a first analysis, although this percentage does not seem so expressive, when we take

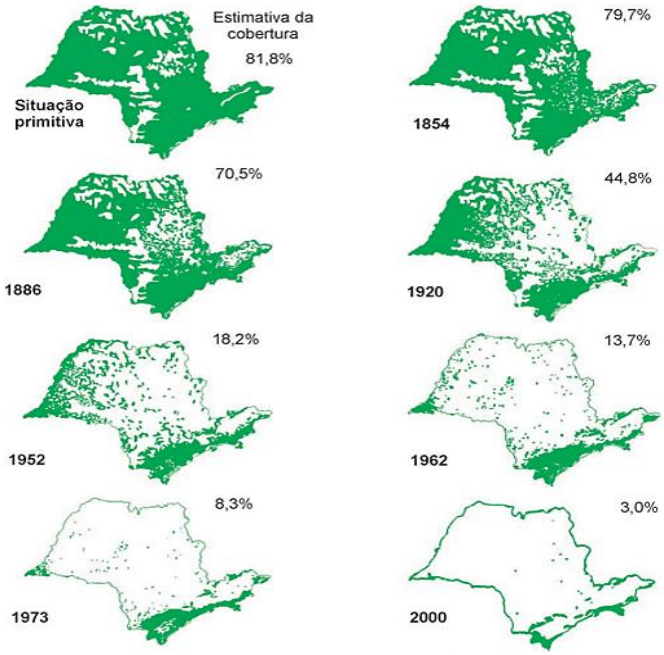
[7] "The images obtained by the *Thematic Mapper* (TM) sensor are composed of seven multispectral bands with spatial resolution of 30 by 30 meters (bands 1, 2, 3, 4, 5 and 7) and 120 by 120 meters (band 6). The image obtained by the *Enhanced Thematic Mapper Plus* (ETM+) sensor is composed of eight multispectral bands with a spatial resolution of 30 by 30 meters (bands 1, 2, 3, 4, 5 and 7), 60 by 60 meters (band 6) and 15 by 15 meters (band 8 – Panchromatic)" (SILVA, 2013, p. 224).

Periódico Eletrônico
Fórum Ambiental da Alta Paulista
ISSN 1980-0827 – Volume 19, número 1, 2023

as a reference the interval between the year 1854 and 2000, a period in which the State of São Paulo lost 76.7% of its vegetation cover as a result of a predatory appropriation of this natural resource, the values that measure the loss of vegetation cover in the municipality of São Bernardo do Campo, begin to arouse serious concerns, especially when considering their importance for the preservation and maintenance of the Billings water source ecosystem.

To better understand this context, the following maps were inserted, which illustrate the process of evolution of vegetation cover loss (Figure 5). Through careful observation, it is possible to verify the proportion of damage over each period, reaching the conclusion that only 3% of the native vegetation cover remained in the entire State of São Paulo. In the case of the process verified in the municipality of São Bernardo, considering that in just 21 years there was an estimated loss of 3.43% of its native vegetation cover, it is still relevant information as it makes it possible to measure the proportion of environmental damage that has been occurring in the ecosystems of the areas of protection of the springs of the Billings dam.

Figure 5 - Reconstitution of forest cover in the State of São Paulo



Fonte: Cavalli et al. (2005 apud SÃO PAULO, 2005, p. 11)[8].

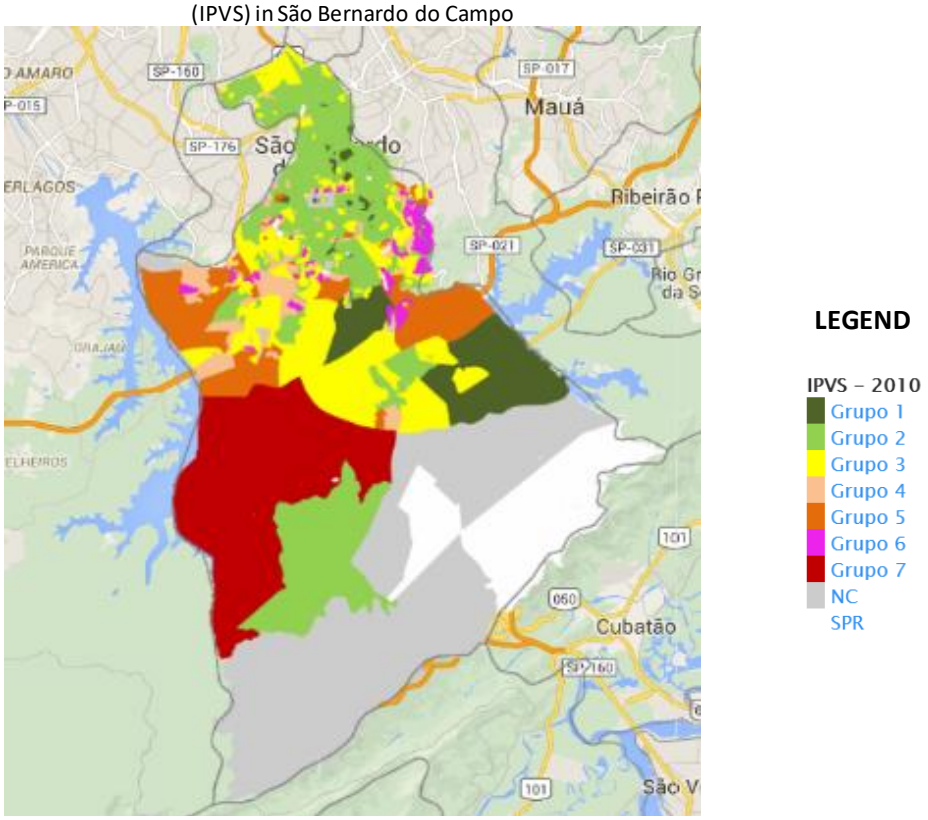
In view of the current context in which precarious housing occupations are inserted, especially those that occupy the APPs, when addressing the issue of the degradation of the natural ecosystem of the springs of São Bernardo do Campo, it is necessary to broaden the focus of its reading, associating this critical situation with the degree of social vulnerability in which a large part of the resident population is inserted (Figure 5). From this perspective, the asymmetries are explicit, in which situations of risk and vulnerability indicate the environments of precarious settlements in environmentally fragile areas, specifically when they occupy protected spaces, inserted in the water sources of public supply. In the case of the municipality of São Bernardo do Campo, the issue assumes intensely critical proportions, in view of the data presented by the Municipal Risk Reduction Plan (PMRR) (SÃO BERNARDO DO CAMPO, 2010b;

[8] Available at: <http://www.iflorestal.sp.gov.br/sifesp/publicacoes.html> Accessed on: 22 jul. 2011.

NOGUEIRA et al., 2011), in the study carried out and reviewed at the end of 2013, where risk situations were identified in 53 **settlements, with 152 risk sectors**, of which **859 houses were characterized as high risk and 1,146 houses at medium risk of landslides, undermining of stream banks, flooding and flooding** (emphasis added).

By associating this context of territorial occupation with the data from the research carried out by Seade (2010), a more detailed picture of the issue is obtained as it describes the predominant characteristics of its social fabric, as shown in Figure 6.

Figure 6 - Spatialization of the São Paulo Social Vulnerability Index (IPVS) in São Bernardo do Campo



Source: Seade (2010), maps without scale.

In 2010, the survey carried out by Seade released data related to the indicators that make up the São Paulo Social Vulnerability Index (IPVS), [9]in which the municipality of São Bernardo do Campo presented the following panorama (Table 8 and Figure 7):

Table 8 - São Paulo Social Vulnerability Index (IPVS)

CLASSIFICATION	POPULATION	SITUATION
Group 1 (no vulnerability)	37,862 persons (5.0% of the total)	In the space occupied by these census sectors, the average nominal income of households was R$7.738 and in 1.2% of them the income did not exceed half the minimum per capita income. Regarding demographic indicators, the average age of those responsible for households was 46 years old and those under 30 years old represented 11.2%. Among female heads of households, 13.3% were up to 30 years old, and the proportion of children under 6 years old was equivalent to 7.7% of the total population of this group.

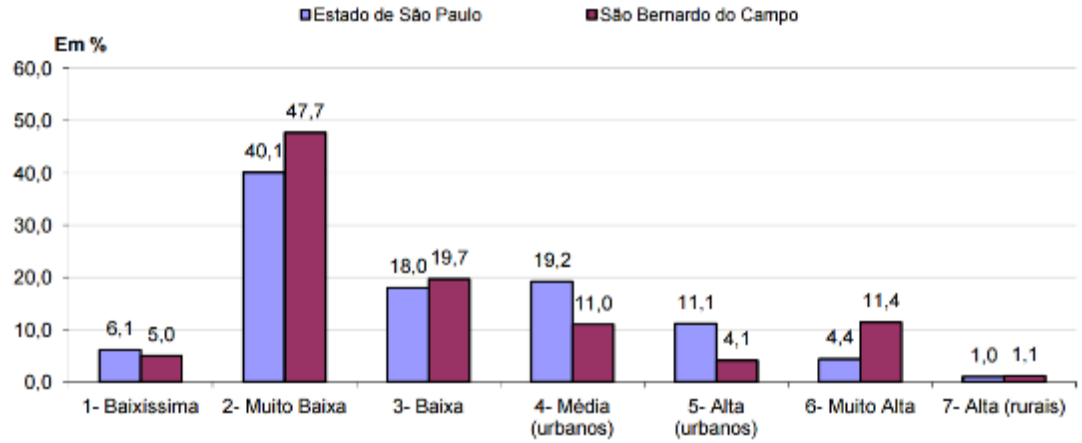
[9] SEADE. 2010. Available at: <http://www.seade.gov.br/produtos/ipvs/> Accessed on: 4 jul. 2016.

Group 2 (very low vulnerability)	362,845 persons (47.7% of the total)	In the space occupied by these census tracts, the average nominal income of the households was R$ 3.507 and in 5.9% of them the income did not exceed half a minimum per capita income. Regarding demographic indicators, the average age of heads of households was 50 years old and those under 30 years old represented 8.9%. Among the female heads of household, 8.7% were up to 30 years of age, and the share of children under 6 years of age was equivalent to 6.1% of the total population of this group.
Group 3 (low vulnerability)	149,630 persons (19.7% of the total)	In the space occupied by these census tracts, the average nominal income of the households was R$ 2.478 and in 12.1% of them the income did not exceed half a minimum *per capita income*. Regarding demographic indicators, the average age of heads of households was 42 years and those under 30 years of age represented 18.9%. Among the female heads of household, 20.5% were up to 30 years of age, and the share of children under 6 years of age was equivalent to 9.0% of the total population of this group.
Group 4 (medium vulnerability)	83,819 persons (11.0% of the total)	In the space occupied by these census tracts, the average nominal income of the households was R$ 1.636 and in 22.7% of them the income did not exceed half a minimum *per capita income*. Regarding demographic indicators, the average age of heads of households was 45 years and those under 30 years of age represented 11.9%. Among the female heads of households, 9.7% were up to 30 years of age, and the share of children under 6 years of age was equivalent to 8.7% of the total population of this group.
Group 5 (high vulnerability)	31,451 persons (4.1% of the total)	In the space occupied by these census tracts, the average nominal income of the households was R$ 1.417 and in 28.6% of them the income did not exceed half a minimum *per capita income*. Regarding demographic indicators, the average age of heads of households was 42 years and those under 30 years of age represented 19.4%. Among the female heads of household, 20.3% were up to 30 years of age, and the share of children under 6 years of age was equivalent to 10.3% of the total population of this group.
Group 6 (very high vulnerability)	86,399 persons (11.4% of the total)	86,399 persons (11.4% of the total). In the space occupied by these census tracts, the average nominal income of the households was R$ 1.288 and in 30.9% of them the income did not exceed half a minimum *per capita income*. Regarding demographic indicators, the mean age of heads of households was 41 years and those under 30 years of age represented 21.0%. Among the female heads of household, 21.4% were up to 30 years of age, and the share of children under 6 years of age was equivalent to 10.5% of the total population of this group.
Group 7 (high vulnerability – rural sectors)	8,537 people (1.1% of the total)	In the space occupied by these census tracts, the average nominal income of the households was R$ 1.048 and in 39.5% of them the income did not exceed half a minimum *per capita income*. Regarding demographic indicators, the mean age of heads of households was 45 years and those under 30 years of age represented 17.7%. Among the female heads of household, 19.4% were up to 30 years of age, and the share of children under 6 years of age was equivalent to 10.1% of the total population in this group.

Font: Seade (2010).

Periódico Eletrônico
Fórum Ambiental da Alta Paulista
ISSN 1980-0827 – Volume 19, número 1, 2023

Figure 7 - Distribution of the population, according to groups of the São Paulo Social Vulnerability Index (IPVS) of the State of São Paulo and the municipality of São Bernardo do Campo – 2010



Note: All census tracts in the city of São Paulo were considered urban.
Source: IBGE (2010); Demographic census; Seade Foundation (2010).

Figure 7 shows that the vulnerability identified in Group 6 – as very high – reaches 11.4%, i.e., 86,399 people living in vulnerable situations in the municipality of São Bernardo do Campo, a value significantly higher than the values found in the municipalities of the State of São Paulo, which had an index of 4.4%. When considering the environmental dimension, the whole conjuncture involved in the treatment given to protected areas, specifically the areas of water sources, evidences a critical context, arising from a series of aspects that permeate from irregular housing occupation, indiscriminate and predatory land subdivision in distant peripheries, where the lack of infrastructure and precariousness of public services of basic necessity have been for decades a reality experienced by thousands of people. people, either due to the ineffectiveness of plans and programs or due to the ineffectiveness of the management system. In general terms, all this context allowed São Bernardo to present a highly complex context by housing in its territory a framework composed of 155 favela nuclei (60%) with 55,012 housing units, in addition to presenting in its territory 106 irregular allotments with 31,808 units, adding up to a total of irregular settlements estimated at 261 nuclei with 86,820 units (PLHIS-PMSBC, 2012). However, it should be noted that, of this universe, there are 68 favela centres with 18,053 units and 83 irregular allotments with 26,850 units, which total an estimated value of 151 centres with 44,903 units.

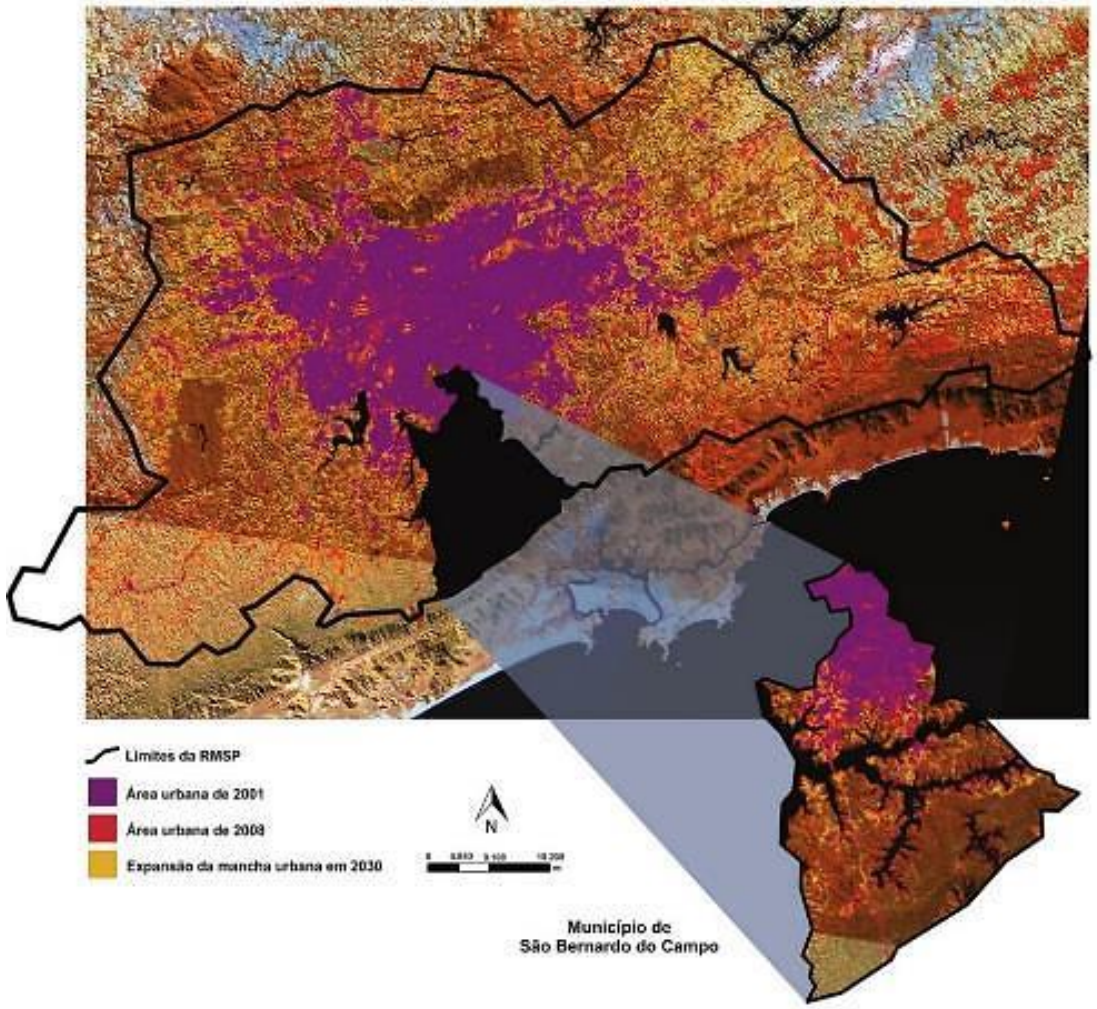
This situation highlights the urgent need for government actions, specifically the implementation of public policies aimed at improving the quality of life of social segments in situations of vulnerability.

In view of the complexity and scope of the issue, it is also important to consider the studies carried out by Nobre et al. (2010) on the vulnerability of the MRSP, where the authors discuss this problem on a broader temporal and spatial scale. From this perspective, the authors point to an increase in the projection of the urban area in the MRSP for the year 2030, which indicates that there may be a greater demand for land, exponentially increasing the demand for

Periódico Eletrônico
Fórum Ambiental da Alta Paulista
ISSN 1980-0827 – Volume 19, número 1, 2023

water, due to the vegetative increase of the population and migration and immigration processes, associated with social and economic factors (Figure 8).

Figure 8 - Projection of the expansion of the urban area of the MRSP in 2030



Source: Landsat 7 ETM+ satellite image (orbit 219-076, resolution 30x30m), NOBRE et al., 2010, p. 20 and 21 – Adapted by the author

The projection presented by Nobre et al. (2010) shows that the peripheral regions of the metropolitan region will suffer an occupation, but intensified following the current scenario, as well as those recorded in the historical series. In these places, there will be strong pressure on existing natural resources, increasing social and environmental vulnerability in the territory, such as the emergence of new risk areas subject to climatic events (floods and landslides), among other aspects.

> If the projected area for 2030 is roughly double the current area, the risks of flooding and flooding will increase proportionately. In this case, more than 20% of the total expansion area would be susceptible and could eventually be affected. In the same way but considering the steeper slope ranges (greater than 15º and 30º) obtained in the "Hand" model, the areas vulnerable to landslides in 2030 were identified. Approximately 11.17% of the expansion areas in 2030 may constitute new areas at risk of landslides (NOBRE et al., 2010, p. 24).

In addition to this worrisome scenario, municipalities such as São Bernardo do Campo must focus on efforts to contain the process of occupation of environmentally fragile areas and

try to minimize the pressure on the ecosystems of the protected areas of the Billings springs – territories where the most intense situations of vulnerability are found.

From this brief contextualization, it can be inferred that this critical situation stems from a mistaken and incipient planning process that, among other aspects, allowed the intense informal occupation of its protection areas with the indiscriminate removal of vegetation cover that occurred over the years, causing an intense process of degradation of water bodies, in addition to intensifying the socio-environmental vulnerabilities.

In summary, in this region there is a notorious connection between the accelerated process of industrialization, disorderly urbanization and the increase in population concentration verified over the years, devoid of adequate actions of planning and territorial ordering, which have contributed to the intensification of the socio-spatial inequalities sustained by a pattern of exploitation and dilapidation of uses and degradation of ecosystems.

It is in the confrontation of such issues that a new institutional and political structure emerges in an attempt to overcome the structural problems, through – among others, new mechanisms of territorial planning and management, in order to mitigate and reverse the high levels of biophysical vulnerability existing in the fragile spaces of protection of water sources, which present, among other aspects, the compromise of environmental services essential for the balance of the urban ecosystem and regional.

5 CONCLUSION

In this region, the sequelae resulting from population growth, associated with the severe economic contingencies verified over the last decades, have markedly influenced the urbanization process with serious social and spatial consequences, which have been strongly materialized in the low quality of urban life. These form critical scenarios of various vulnerabilities, exacerbating the living conditions of those who occupy precarious settlements, where a large part of the resident population remains unaffected by the basic infrastructure network, in many situations having their conditions aggravated by being inserted in risk areas.

The way in which the urbanization process occurred in Brazil contributed to devaluing and/or not recognizing the importance of environmental assets, especially water bodies in urban areas, distorting their image by attributing negative aspects to them and denying their potential. environmental and urban planning.

The absence of adequate interpretations guided by a systemic view for the edition and applicability of protective norms, in particular, the understanding of the geophysical conditions concerning these spaces, restricted their legal destination to the use and occupation compatible with their geophysical constitution in the process of territorial planning.

In view of these aspects, the disorderly occupation of the urban territory of São Bernardo do Campo has resulted in numerous problems: worsening levels of water pollution, densification and increase of irregular and precarious occupations of environmentally fragile areas, increase in the socio-environmental vulnerability index, among other factors.

These consequences were caused by accelerated industrialization, disorderly urbanization, and increased population concentration, which contributed to the exploitation and dilapidation of ecosystems.

In addition, the research demonstrated the importance of new territorial planning and management mechanisms to mitigate and reverse the high levels of biophysical vulnerability

that exist in the fragile spaces of protection of water sources. These strategies should be aimed at promoting more sustainable and equitable development, which considers the protection of ecosystems and the reduction of socio-spatial inequalities.

In summary, the study points to the need for a more careful and planned approach to urban development, which considers socio-environmental impacts and promotes sustainability and equity.

6 REFERENCES

AB'SABER, A. N. O suporte geológico das florestas beiradeiras (ciliares). In: RODRIGUES, R. R.; LEITÃO FILHO, H. F. **Matas ciliares:** conservação e recuperação. São Paulo- SP. Editora da Universidade de São Paulo, 2000. 15-25p.

ACSELRAD, H. Sentidos da sustentabilidade urbana. In: ACSELRAD, H. (org.). **A duração das cidades: sustentabilidade** e risco nas políticas urbanas. Rio de Janeiro: DP&A, 2001. p. 27-55.

ALVIM, A. T. B. (2003). **A contribuição do CBH-AT à gestão da Bacia Metropolitana,** 1994-2001. Tese (Doutorado em Arquitetura e Urbanismo). Faculdade de Arquitetura e Urbanismo, Universidade de São Paulo. São Paulo, FAUUSP. 2003.

ALVIM, A. T. B. et al..Políticas públicas e planos de urbanismo na escala local intra-urbana: instrumentos e metodologias de avaliação e acompanhamento. Relatório final de pesquisa. Fundo Mackpesquisa (mimeo).2006.

ALVIM, A. T. Assentamentos irregulares e proteção ambiental: impasses e desafios da nova legislação estadual de proteção e recuperação dos mananciais na Região Metropolitana de São Paulo. In: BOGUS, L. M. M. et al. (orgs.). **Reconversão e reinserção urbana de loteamento de gênese ilegal:** análise comparativa Brasil-Portugal. São Paulo, Educ, 2010.

ALVIM, A. T. B.; VITALE, S. P. S. M. Direito à moradia sem risco: desafios das políticas e projetos urbanos em assentamentos precários em São Paulo. In: COUTINHO M. DA SILVA, R. (org.). **Desafios urbanos para a sustentabilidade ambiental nas cidades brasileiras. Rio** de Janeiro: PROURB/UFRJ, 2012. v. 1.

BRAGA, F.; TERRA, C. (org.). **Avesso da paisagem.** Ruptura, desordem e risco no ambiente urbano. Rio de Janeiro: Rio Books, 2012.

BRAGA, R. Planejamento urbano e recursos hídricos. In: BRAGA, R.; CARVALHO, P. F. C. (org.). **Recursos hídricos e planejamento urbano e regional.** Rio Claro: Laboratório de Planejamento Municipal – Deplan – UNESP – IGCE, 2003. p. 113–127.

BRASIL. **Decreto n. 23.793**, de 23 de janeiro de 1934.

BRASIL. **Lei n. 12.651,** de 25 de maio de 2012. Institui o novo Código Florestal. Dispõe sobre a proteção da vegetação nativa; altera as Leis nºs 6.938, de 31 de agosto de 1981, 9.393, de 19 de dezembro de 1996, e 11.428, de 22 de dezembro de 2006; revoga as Leis nºs 4.771, de 15 de setembro de 1965, e 7.754, de 14 de abril de 1989, e a Medida Provisória nº 2.166-67, de 24 de agosto de 2001; e dá outras providências. Brasília: DOU, 2012. Disponível em: <http://www.planalto.gov.br/ccivil_03/_ato2011-2014/2012/lei/l12651.htm>. Acesso em: 24 maio 2016.

BRASIL**. Lei n. 12.727,** de 17 de outubro de 2012. Altera a Lei nº 12.651, de 25 de maio de 2012, que dispõe sobre a proteção da vegetação nativa; altera as Leis nºs 6.938, de 31 de agosto de 1981, 9.393, de 19 de dezembro de 1996, e 11.428, de 22 de dezembro de 2006; e revoga as Leis nºs 4.771, de 15 de setembro de 1965, e 7.754, de 14 de abril de 1989, a Medida Provisória nº 2.166-67, de 24 de agosto de 2001, o item 22 do inciso II do art. 167 da Lei nº 6.015, de 31 de dezembro de 1973, e o § 2ºdo art. 4º da Lei nº 12.651, de 25 de maio de 2012. Brasília: DOU, 2012.

BRASIL. **Lei n. 4.771**, de 15 de setembro de 1965. Institui o novo Código Florestal. Brasília: DOU, 1965.

CBHAT – COMITÊ DE BACIA HIDROGRÁFICA DO ALTO DO TIETÊ. **Plano de Bacia Hidrográfica do Alto do Tiete.** São Paulo: FEHIDRO; FUSP, 2009.

ROESLER, M. R. V. B. **Gestão ambiental e sutentabilidade:** a dinâmica da hidrelétrica binacional de Itaipu nos municípios lindeiros. Cascavel: Edunioeste, 2007.

SÃO PAULO (ESTADO). **Lei Estadual de Proteção aos Mananciais nº 9.866/97**. Uma nova política de Mananciais: Diretrizes e Normas para a Proteção e Recuperação das Bacias Hidrográficas dos Mananciais de interesse Regional do Estado de São Paulo. São Paulo: DOE, 1997.

SÃO PAULO (ESTADO). **Lei Estadual nº 13.579**. Define a Área de Proteção e Recuperação dos Mananciais da Bacia Hidrográfica do Reservatório Billings – APRM-B, e dá outras providências correlatas. São Paulo: DOE, 2009.

SÃO PAULO (ESTADO). **Lei n° 12.233,** de 16/01/2006. Define a Área de Proteção e Recuperação dos Mananciais da Bacia Hidrográfica do Guarapiranga. São Paulo: DOE, 2006.