



# Urban Regeneration and Green Spaces System: São Paulo Metropolitan Area

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## Abstract

This paper aims to reflect about urban green spaces role as an important regeneration element to restore urban landscapes in a decline process. The urban landscape is understood here as an interactive system between natural processes and human impacts. The study object is an area located in Guarulhos city, belonging to São Paulo metropolitan area and surrounded by important infrastructures, as Guarulhos international airport and Dutra regional highway. The area also contains established precarious settlements on protected floodplains; unqualified green spaces and riverbanks in process of illegal settlements; and a lack of basic sanitation services and silted streams that contribute to the floods occurrence in a local and metropolitan dimension. The study attempts to mitigate the conflict between infrastructure, environment and social dimension, which are so precariously articulated in this urban landscape, through a system of strategically planned green spaces, in order to achieve urban and metropolitan sustainability goals. Based on theoretical support, cartography and

empirical observations, it aims to understand the logic of this territorial occupation and also recognize, recover and integrate urban green areas in order to set an urban plan proposal. Finally, the paper tries to achieve population better quality of life, reduction a local and regional environmental impacts and political awareness to set public policies able to regenerate this territory in a process of urban and environmental decline.

## Keywords

Urban and metropolitan regeneration • Landscape • Green spaces system

## 1.1 Introduction

In the twentieth century, the relation between man and nature resulted in socio-environmental impacts from the Industrial Revolution that encouraged technological advances and economic growth instead of sustainable development. This advanced process throughout the last century led us to a serious situation of urban and environmental decline, which requires new practices and approaches that allow urban regeneration of contemporary metropolis.

The issues discussed here, urban and metropolitan regeneration, green spaces, landscape degeneration, infrastructure and precarious

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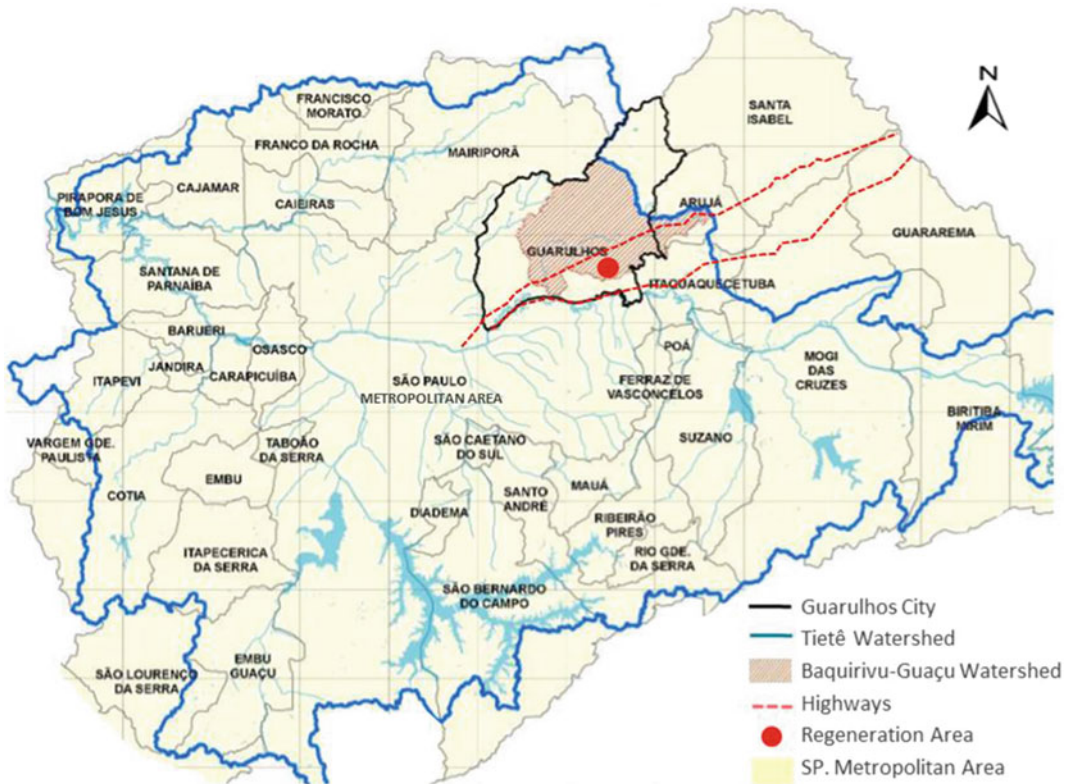
housing, emerged from the Industrial Revolution context and were discussed by many authors a century ago. Although in another context, these conflicts are still current and have been affected mainly developing countries as Brazil. As consequence of congested cities with precarious public health condition the green spaces initially used for beautifully and health started to be inserted to recovery the quality of life and for structure the cities (Benevolo 2019). While the new urbanism was concerned with the chaos of the tenement town of the nineteenth century, the city has sprawled and became less concentrated. From the nineteenth to twentieth century the new transport technologies allowed a huge process of suburbanization mainly in London and New York, where the production forces were more aggressive (Hall 2009). A new urban dimension with conflicts between nature, infrastructure and housing emerged from a result of capitalist production system. Production, exchange and consumption relations define capitalist space. Technological advancements and transport infrastructures are strategically planned to support and expand these capitalist relations and structure this space (Reis 2006). In addition to urban reconfiguration and expansion, infrastructure produces new locations, real estate appreciation and environmental impacts. This process also produces an unequal land use and unsuitable living conditions. According to Reis (2006), every time there is an intervention in an urban area, must be understood that it is structured by an economic development related to a specific infrastructure, and the area is changed, overlapped and, therefore, is in a constant process of transformation. It could be urban progress or urban decline. The study area is on this context of urban decline and needs to be regenerated. It means to establish integrated actions in order to improve its social, physical and environmental aspects to ensure its sustainable recovery. One of these actions could be to requalify urban green spaces through an urban plan and participatory urban projects. Urban green spaces refer to all urban land covered by vegetation of any kind, gardens, squares, parks, forests, farmland, tree-line streets, riverbanks and floodplains. It

contains a variety of benefits including physical health benefits, psychological health benefits, socioeconomic benefits and environmental benefits.

The study area is located in Pimentas district, Guarulhos city, São Paulo metropolitan area, between Presidente Dutra and Ayrton Senna highways, adjacent to Guarulhos International Airport. It is also inserted in the Baquirivú-Guaçu watershed, an area of great urban precariousness, vulnerability and importance for Master Plan of Macro Drainage of Upper Tietê (PDMAT), which covers the entire metropolitan area of São Paulo. Guarulhos city has 1.4 million inhabitants and it is considered the most populous municipality in São Paulo metropolitan area, which has approximately 22 million inhabitants. São Paulo capital has 12.3 million inhabitants (Ibge 2022).

Although Guarulhos is characterized by a strong economy with an expressive industrial production, with the second largest GDP of the state (second only to the capital), it displays low social development standards. A large part of Guarulhos population lives in informal settlements whose presence is directly associated as unequal process of occupation. The implementation of transport infrastructures allowed new connections and a rapid suburbanization process in fragile and low-cost lands. The study area has approximately five million square meters and consists of many precarious settlements with high density and located in insecure tenure without a proper sanitation services and with higher risk of flood events. In the face of these urban landscape conflicts and considering the existence of natural and tropical green areas with potential to be qualify and integrate, this paper presents a green spaces plan, in order to try to mitigate these conflicts and regenerate this area. The urban regeneration idea here is to recovery urban landscape in a process of decline.

Through theoretical support, cartography and empirical observations, the paper is structured in introduction plus five issues. The first one describes some authors, ideas and projects that influenced the thinking about urban green areas, in Brazil and in the world. The second focus on



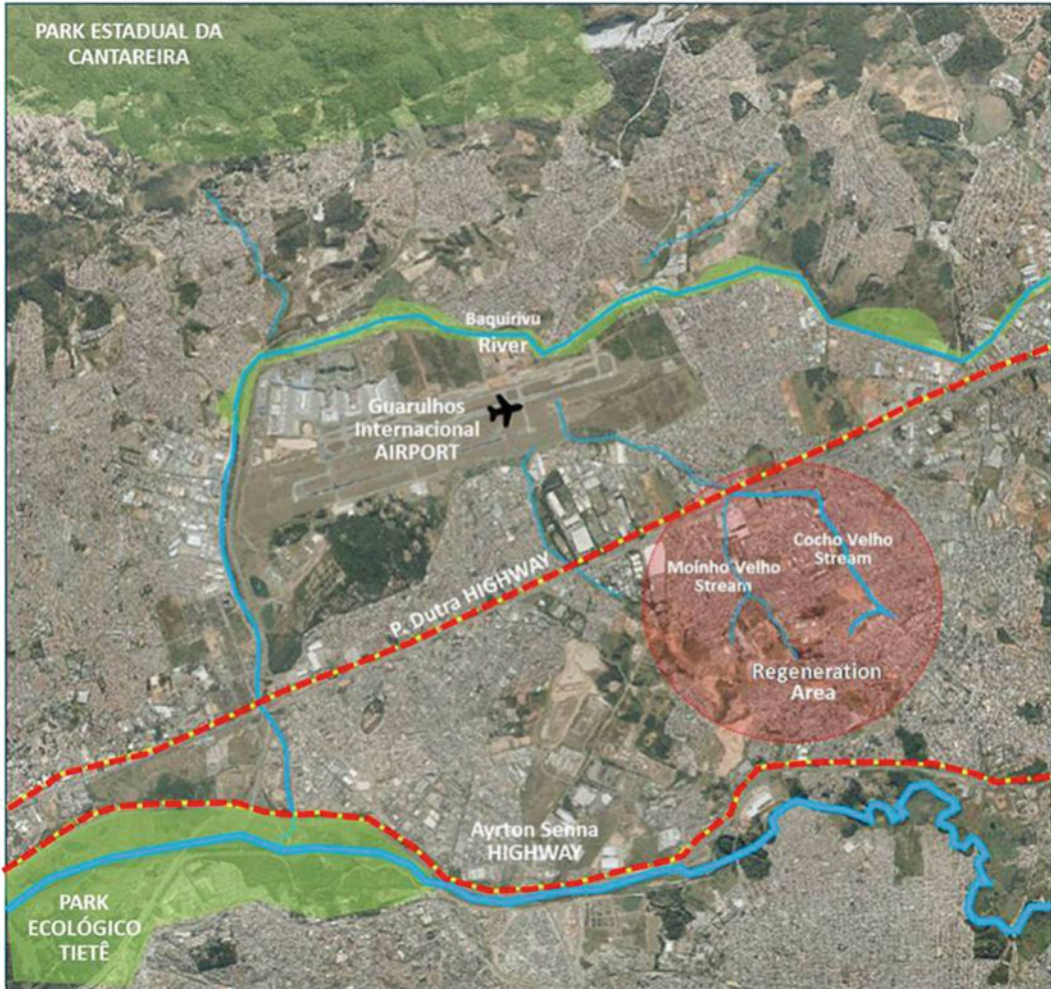
**Fig. 1.1** Study area in metropolitan dimension. *Source* Modified from Emplasageo site accessed in oct. 2022 ([www.emplasageo.com.br](http://www.emplasageo.com.br))

the Guarulhos city growth always related to the SP metropolitan area and their infrastructures. The third and fourth items focus on the Guarulhos environmental and housing problems. And the last one proposes a green space system plan based on empirical surveys and theoretical support (Figs. 1.1 and 1.2).

## 1.2 Green Spaces System

The function and arrangement of green areas are transformed according to the political and economic context of each time. In the industrial and liberal city green spaces were isolated islands in a compact urban fabric, while in the modern city they shaped a unique space, where all other elements are freely distributed: the city becomes a park where the various functions of urban life are established. This process shows the transition

from the private appropriation of the territory, to the recuperation of public control over the city space (Benevolo 2019). The chaos arising from the industrial revolution and the increase population in cities with precarious conditions, mainly for the working classes, led to social and environmental impacts and the reduction of green spaces in large industrialized cities (Benevolo 2019). In this context the green areas, initially conceived with an esthetic function, begin to have a sanitary function in order to reduce the health problems of the industrial city and guarantee a better quality of life for the population (Hall 2009). In the mid-nineteenth century, romantic and naturalist ideals, disseminated from Europe, led North Americans to the development of the Park Movement. This important landscape movement was against the low quality of life in American cities. However, this Movement, which intended to think about the city plan from



**Fig. 1.2** Study area in urban dimension. *Source* Made from Emplasageo site accessed in oct. 2022 ([www.emplasageo.com.br](http://www.emplasageo.com.br))

a system of open spaces, did not manage to control the city as an urban and architectural complex (Schenk 2008). From this movement, at the turn of the nineteenth to the twentieth century the landscape architect Frederick law Olmstead (1822–1905) was a pioneer in considering the relation between landscape and territorial planning for a balanced urban development. He established the basis of Landscape Architecture, and his ideas have influenced many urban planners and trends. Green spaces started to have a function of structuring the urban growth, linking technical advances to esthetic values, and in this way creating spaces of sociability (Schenk 2008).

In 1857, Olmsted became Superintendent of the Central Park in New York. Between 1865 and 1874 he produced his most important projects as Prospect Park in Brooklyn; the Boston Park System (Emerald Necklace); and Riverside in Chicago. Observing the tenements towns at the time, he argued that parks were necessary to civilize urban life and that they would only make sense if they became public, open to the entire population, with pedagogical functions and strategies to guarantee quality use of spaces. His goal was to educate through the place. Frederick Law Olmsted saw the landscape from the sensations it provided. For him the relationship

between man and nature would be vital for human health (Schenk 2008). In 1870, Olmsted wrote “Public Parks and the Enlargement of Towns”. He presents the idea of the plan articulating free spaces, large and small parks and the streets and avenues system (parkways). The quality design of these elements would promote a pleasant displacement shaded and could form part of a system of parks. He defended the parks importance as a symbol of a new community life and the landscape to improve the fast pace of urban life (Schenk 2008). Emerald Necklace in Boston was an implementation of a connected system of green areas for Boston city in USA. Designed between 1878 and 1895, Olmsted did not make large concrete reservoirs, but an underground system of intercommunicating lakes that directed waste water to the sea, connected parks instead of large reservoirs. This space was forested, transforming people’s lives. This historical and lasting plan of integrating open areas has become a reference when we discuss landscape design (Schenk 2008). This intervention plan was a precursor to contemporary practices such as the connection of parks and green areas, the requalification of waterways, the creation of green corridors within the urban areas, recreation, environmental conservation and especially sanitation service and flood control solutions through urban infrastructures that were designed as landscapes. In other words, the integration of landscape with hydraulic and sanitary engineering through the installation of vegetated strips along streams; the connection of the city center to the countryside through parkways; the creation of green belts around the city; the water regime as a basis for the design of lakes and waterways; and finally the restoration of mangroves and river courses are old and valid practices that should be further explored nowadays. This is a project that displays the advantage that large infrastructure obtains when its esthetic dimension is not overlooked and when regional urban planning and landscape designs are integrated.

In London of 1880 e 1890 the urban planner Ebenezer Howard (1850–1928), influenced by the landscaper Frederick Law Olmsted, wanted to link the benefits of the countryside with the

city benefits through a garden cities proposal and an urban planning on a regional dimension (Hall 2009). Howard conceives his garden city ideals, linking the economic and social opportunities of the city with the pleasures and environmental quality of the countryside, but not only. Actually, he aimed rebuild capitalist society progressively within an infinity of cooperative communities (Hall 2009). Howard was more concerned to social processes than to the physical form of cities. His goal was to ensure the better quality of life of the workers and that they became owners of their lands. Although his thinking has been considered utopic, he broke with the current city model and influenced on later urban movements (Hall 2009). Almost a century later, McHarg (1920–2001) also defended the importance of human development in harmony with nature, indicating that urban planning should pay attention to landscape natural processes (McHarg 2000). He reinforced the relevance of human development in harmony with nature and the need for urban planning to consider the natural processes of the landscape, in particular the relationship between man and open spaces not built and with natural spaces.

The fields of Architecture and Urbanism, Landscaping and Ecology, through their respective approaches, define and analyze the physical structure and the socio-cultural relations established between the territory and the people who live there. In this way, urbanization must observe the place function, aiming to protect natural processes and the population urban life (McHarg 2000). These ideas have still influenced the current works.

In Brazil, landscape integrated into urban planning occurred from an esthetic point of view, then technical considerations and, finally, under an environmental-ecological orientation. Through the twentieth century, São Paulo city began to disregard their rivers and floodplains. São Paulo watercourses have always played an important role in the development of the city, providing food, circulation and recreation. Also they had the function of taking away garbage and sewage, which became a problem with the city growth. With the floods increase, the floodplains areas

admired for their nature and landscape become focus of diseases. The riverbanks have lost their charm, and the rivers have become urban barriers. From this moment, the main rivers that structure the city begin to have their course aligned in order to allow drained water as quickly as possible (Golveia 2016). The solution for the problems related to water epidemics, floods and pollution would be solved by engineering works that consisted of draining wetlands, channeling and plugging rivers, building galleries and pools for rainwater. However, these interventions caused changes in the natural landscape. The idea of gray engineering, pipes, galleries and plugs has remained for a long time and has been the basis of technical urban drainage projects in most Brazilian cities.

In 1930, the architect and mayor Prestes Maia (1896–1965) proposed his main project to São Paulo city. The Avenue Plan was based on the opening of fast avenues in order to develop and structure the city. However, to channeling and plugging rivers of valley bottom to open big avenues in their banks increased the problems of flooding and have reduced the chances of São Paulo becoming a green and fluvial metropolis. At the same time the sanitary engineer Saturnino Brito (1864–1929) carried out many studies of sanitation and urbanism in the country. He was against the occupation and defended the preservation of Tietê river floodplain that crosses São Paulo capital. He designed the rectification of the river and his plan included a park that would be the largest river park in the world and would avoid floods during the great rains. It was not implemented, and today there are more than six fast lanes in each side of the river, even more if we consider the local lanes. This practice was encouraged by politic interests in the real estate and in the automobile industry (Golveia 2016).

From the 1970s, better and more sustainable urban drainage practices focused on river renaturalization and on restoring the natural hydrological cycle became trends in the world (McHarg 2000). Currently new approaches were introduced in public policies debate to deal with the relationship between rivers, floodplains and urban areas in São Paulo city. The results have

changed the way of understanding the urbanization and the water system from the municipal and state levels. However, the interventions are not integrated yet, resulting in actions that are often incomplete and not responding the needs. Finally, the first great Brazilian character in the history of the landscape in a different way was Roberto Burle Marx (1909–1994). By the hands of Burle Marx nature never was designed only as scenery, and it was completely integrated in Brazilian modern architecture. However, his scientific and technical knowledge came from a botanical and not from the urban field, and his greatest contribution refers to esthetic and environmental issues, what makes him different from Olmsted. His Landscape was not a structuring element of urban interventions. Quantitative, practical and functional urbanism stands out in American territory. The Landscape idea based on issues of humanistic and natural orders revealed fragile in face of modern development (Schenk 2008).

The authors above show how it is important to reinforce the importance of Landscape Planning or Landscape Architecture. To look not only at the urban but at the territory and landscape, considering planning and designing of open spaces such as streets, sidewalks, avenues, squares and parks. Several studies, such as those by Schenk (2008), conclude that green areas and open spaces can produce positive effects on urban quality and on population living conditions. They are important elements of climate adaptation in cities. Urban open spaces make up a complex system connected to other systems. Among their multiple functions are leisure, circulation, flood mitigation, environmental conservation and social interaction. Among its numerous benefits, the following stand out: the reduction of rainwater runoff; temperature reduction; improved air quality; greater diversity of flora and fauna, increased biodiversity corridors; improved landscape; provision of recreational spaces; encouragement of educational activities; increased social interaction; improved psychological health of the population; and appreciation of the cultural heritage. Some strategic actions are: Trying to keep the soil

permeable, green areas free, keeping small farms producing food, not interrupting the water cycle, not occupying floodplains (especially in tropical countries whose rivers produce many floods), mitigating the negative impacts that infrastructure causes when they change nature cycles. For these spaces to be set as a system, they must be qualified, integrated and connected, even if they were not planned or implemented as such. Through the requalification and integration of the green areas perhaps we can mitigate the conflict between infrastructure, social dimension and environment impacts.

Recovering authors and their ideals could help to educate, raise awareness and strengthen a culture that gives importance to green public spaces and finally, to reinforce the cities potential when they are planned based on green systems.

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### 1.3 Urban Evolution and Infrastructures

Different economic cycles are supported by the strategic and technical progress of transport infrastructures which allow enlarge social relations and a continuous advancement in the urbanization process (Reis 2006). According to Hall (2009) the city of 1900 de-concentrated due to new transport technologies, the electric tram, the electric train, the subway, the bus, allowed new connections and a process of suburbanization to take place, new homes and factories were built on its periphery.

Inaugurated in 1950 Dutra Highway notably boosted the industrial and suburban development in Guarulhos territory. New development opportunities in Guarulhos city due to a better connection enabled its integration into the metropolitan area of São Paulo, modifying his urban landscape. During the 1950s and 1970s Guarulhos had an industrial economic growth that exceeded the capital and the industrial suburbs of the capital. The industries began to dominate not only the highway axis, but also to attract sprawl settlements away from the highway axis (Langenbuch 1971). Because of its proximity to the capital, it became a commuter town

for industrial workers, with implemented settlements without urban and environmental quality. The city had a fast urban, industrial and population growth. The construction of Dutra highway, later extended, was justified by the need of developing the country's industrialization and to promote more efficient road connection between the two largest Brazilian cities—São Paulo and Rio de Janeiro. The highway construction, the city industrialization and the role that Guarulhos played in the metropolitan area of São Paulo were decisive to a population explosion in the following three decades. Between the 1980s and 1990s, other major projects have affected the arrangement of Guarulhos urban territory, the construction of Guarulhos/São Paulo International Airport and the Ayrton Senna Highway. The airport construction was implemented in order to expand the country's economic development because Congonhas Airport in São Paulo has already exceeded its operational capacity to transport passengers and goods. Inaugurated in 1985, Guarulhos airport has intensified the process of urban settlement in its surroundings areas due to the greater offer of jobs and income opportunities, such as Pimentas neighborhood, the study area location. The Baquirivu river floodplains, on which the airport was built, were environmentally fragile with precarious sanitary service and with low land value. Furthermore, the lack of control of urban legislation attracted the low-income population to this area. In the same period besides the international airport and to complement Dutra highway was inaugurated Ayrton Senna Highway to improve the access to the international airport and the traffic on Dutra Highway. These infrastructures result from investments to increase better connections and to insert Guarulhos in an important strategic area, unfortunately without worrying about the urban and environmental impacts of it.

From 1990, with the productive restructuring and the highways modernization, have begun an attraction process of large supply centers and logistic condominiums along Dutra Highway. According to Eigenheer (2018), the intensification of the urban sprawl dynamics in the

twenty-first century, now related to the tertiary sector, has caused the merging of sprawl urban areas, and it has established a new and complex metropolitan dimension that demands attention. As pointed out Guarulhos territory is crossed by important connecting roads and has an international airport in the center of its territory—infrastructures of regional and national importance, which fragment this territory and also allows regional dynamics, as Dutra Highway used as a daily connection between Guarulhos city and its surroundings. These transport infrastructures were not implemented by the Guarulhos municipality. The decisions, investments and construction came from the state and federal government. Some of these infrastructures in addition of a great impact in the territory have no relation with the city's urban dynamics, as Guarulhos Airport. Besides reconfiguring and urban sprawl, these infrastructures change the natural cycles of nature and cause strong environmental effects. In addition, they have a strong esthetic influence on the landscape, so their projects could be part of a process that integrates regional urban planning and landscape.

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## 1.4 Environmental Fragility

Patrick Geddes (1854–1932) points out the complex issue of the urban planning limits and defends the planning of the region that surrounds the city, covering a natural region, a watershed or a geographic unit with the same regional culture (Hall 2009).

Baquirivu-Guaçu basin is located northeast of Upper Tietê Basin (BAT), a large part of which is inserted in Guarulhos city. The study area includes two tributaries of Baquirivu river: Cocho Velho stream and Moinho Velho stream. Large industries, different configurations of housing developments, educational institutions, services and illegal settlements are occupying the floodplains of these streams silted up with waste.

According to Campos and Oliveira (2014), in Cocho Velho stream floods occur every two years and sometimes reach and block Dutra highway. In 1999, floods blocked the airport

because the waters of the Cocho Velho stream, which also cross the airport site, reached the runways.

During the urbanization process of this area, its rivers and streams received informal settlements in their floodplain areas, which even today contribute to the process of degradation of water bodies and of flood occurrence. Until today, the municipality of Guarulhos has a precarious sanitation service. The main function of the streams in the study area is to receive waste disposal and illegal constructions or avenues to solve connection problems. Unfortunately, there seems to be no interest in their landscape treatment or their incorporation to the city through implementation of parks and urban furniture. According to Campos and Oliveira (2014), the construction of airport in the 1980s on the left bank of Baquirivu river, led to a more recent urbanization process in its floodplain, changing the fluvial geomorphology and the flood regime; however, the existence of natural vegetation and floodplains suggests strategies to protect these residual areas in order to control flood occurrence. Considered as one of the most vulnerable areas of the metropolitan area, Baquirivu river basin is importance for Macrodrainage Master Plan of the Upper Tietê Basin (PDMAT). Storm water contention should be carried out in the territory of all basins and not only in floodable areas to ensure the maximum flow capacity of the main rivers.

In the 1970s, drainage and sanitation service systems were planned from the regional scale by São Paulo Metropolitan Planning Company (Emplasa), with environmental conservation strategies and considering the watershed as the planning unit. For politics decision, Emplasa company does not exist anymore, and the current urban plans hardly consider watersheds as structuring elements for territorial urban planning. Floods are one of the main natural disasters that impact cities. These phenomena often occur because of rapid and heavy rains, intensified by soil sealing, straightening of watercourses and reduction of runoff from channels due to silting. Because of their urban complexity, metropolitan areas are more impacted by floods and require greater attention to mitigating risks due to



climate change. Therefore, public policies of intervention in valley bottoms, such as the creation of open areas, linear green parks, and sanitation service and drainage systems integrated into the landscape, are strategies to retain and control water, to prevent flooding, to address unequal land use and, finally, to strengthen the production of healthy environments.

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## 1.5 Housing Precariousness

From the nineteenth to twentieth century English urban planners already defended the importance of avoiding the total separation of different social classes in city and land planning, as well as the guarantee of land ownership to citizens (Hall 2009). Brazil has an extensive legislation favorable to the provision of social housing and the land tenure regularization and however still lacks political efforts and interest. Due to the large housing deficit and many informal settlements in the country, the most recent legislation has become more flexible in order to provide the incorporation of these settlements into the urban territory and the titling of their occupants. Currently, the city is allowed to promote land tenure regularization in preservation areas (APPs), as long as there are no settlements in the risk areas and there are improvements of urban environmental sustainability conditions in relation to the previous situation.

In Brazil there is a critical situation of Environmental and Social Fragility. The country has the largest social and territorial inequality, which means deficit and precarious housing, at the same time, an exclusive territory, where the opportunities are unequal and the social classes occupy segregated spaces. This situation makes environmental disasters frequent, because many low-income population lives in the risk areas due to the lack of public housing policies. Besides, the climate change will occur with increasing frequency and periodicity, as well as the temperature increase and the intense rainfall.

Regarding the Housing Deficit, Guarulhos had in 2000 a deficit amounting to 6.8% of the

total of São Paulo metropolitan area. The city has many families in precarious situation, amounting to 16.54% of the total number of families in the city. The housing demand in the city is directly related to precarious land occupation (PMG 2011). In the metropolitan context, Guarulhos has a proportionally higher percentage than São Paulo metropolitan area (13.42%) and São Paulo city capital (12.55%). According to PMG (2011), Quantitative Housing Deficit in Guarulhos is 48.043 new homes. The precarious settlements or Qualitative Housing Deficit is 48.464 units that need legal regularization; 9433 units that need simple urbanization; 32,953 units that need complex urbanization; and 24,804 units to be removed for being in risk areas or preservation areas. "Simple urbanization" is understood as those in which one of the infrastructure items is missing and where 5–10% of removal is possible with small contention works and "complex urbanization" as those with a high rate of removal due to risk and with a lack of infrastructure, more than one item.

According to municipal information, the first reference to precarious settlements in the municipality of Guarulhos dates back to 1970. From that time on, the illegal settlements have become an option for low-income families. Most of these settlements are in floodable areas, in areas of high slopes or in public areas. In the 1980s, the popular movement for housing started in Guarulhos as a way to pressure the communities to take part in the governmental decisions in the housing sector; however, unfortunately the public housing policies are still unable to face the precarious urban situation in Guarulhos. In 2015, the United Member States defined seventeen Sustainable Development Goals (SDGs) in order to end extreme poverty, reduce inequality and protect the planet by 2030. The eleventh goal focuses in make cities and human settlements inclusive, safe, resilient and sustainable. In addition to the objectives defined here, this paper aims to contribute and to be aligned with the world's sustainable development agenda (Fig. 1.3).



**Fig. 1.3** Settlements at Cocho Velho stream. *Source* Made from Google maps view

## 1.6 Methods

According Geddes, the planning should begin with the survey of the resources of a natural region. The data collection precedes the plan (Hall 2009). Three important actions were established to propose a system of green spaces in Guarulhos city, as well as, to foresee its future development and monitoring: Recognition, Requalification and Integration.

The first action was to recognize an urban landscape with socio-environmental conflict with urban and metropolitan impact. Next step was identified in the landscape, strategic green spaces with the potential to recover it, as gardens, squares, parks, floodplain areas, riverbanks, tree-lined avenues, urban voids, public spaces and void private space subject to expropriation or exchange to other locations. The second action proposes the requalification of the identified green spaces through participatory urban projects

that identify the urban and environmental potential of each green space. It is necessary to be clear about the demand of users and the role that each space will play. Each green space must be analyzed in order to propose a consistent function with its physical and environmental structure. The third action proposes to consider the integration of the green spaces recovered in the urban project. To consider the existing territorial occupation is important to avoid expropriations. Bike lane, pedestrian path, linear parks, tree-line streets, sidewalks and public transports may be strategically connected to establish green corridors.

These connections aim to establish a well-articulated system capable of providing mobility, social interaction and a strong identification of the landscape, preventing its disqualifications and future deterioration. Green spaces do not assume value and little qualify the territory when isolated, but when they are somehow integrated with other free spaces, they assume an important

environmental function and could regenerate the territory. Regarding the first action, green spaces were revealed through the empirical and cartographic analysis of the area then a system of green spaces was established from the empirical and morphological analysis of Guarulhos territory. In a second step, the goal will be connect the green spaces system to other large green areas that structure the city area, as Baquirivu River Linear Park, Cantareira Mountains and Tietê Ecological Park (see Fig. 1.2). Maps of environmental vulnerabilities were analyzed to implement the Green Spaces System. An urban growth in areas with great socio-environmental complexity was observed. Sectors in where there are low-income urban settlements on fragile soils and floodplain areas, which require removal, as Jardim Ansalco case (Fig. 1.4). As pointed out above risk areas are along the banks of Baquirivu

river tributaries, mainly Cocho Velho stream that has a medium risk of flooding (Figs. 1.5 and 1.6).

The spatial analysis made possible to define the main conflicts, pointing out the critical landscapes and the places where it is important to concentrate efforts. Regarding flood areas, medium risk areas were pointed out. A few stretches of canalized and rectified streams were observed, all with open section. However, most stretches of streams that cross the study area are in natural state, with undermining and siltation, at the same time, they still present natural vegetation. The characteristics of Guarulhos urban drainage, the under-dimensioning and precariousness of the micro- and macrodrainage systems added to the silting up of the rivers, indicate fragility for floods events. This process is triggered by historically high-intensity rainfall. The morphological analysis of the area was carried



**Fig. 1.4** Risk area mapping. *Source* Made from CPRM Serviço Geológico do Brasil in 2014



**Fig. 1.5** Green spaces system implemented in the study area. *Source* Made from Google Earth base



**Fig. 1.6** Jardim Ansalca in a floodplain area. *Source* Made from Google Earth base

out based on the empirical and satellite observations. The physical elements pointed out were essential for approaching and complemented the landscape and the green spaces revealed. These elements were divided into two groups. The first one consists of transportation infrastructure, environment (urban parks, squares, floodplain areas, private land) and hydrography, here called continuous elements. The second group consists of urban settlements (housing, industry, productive facilities, commerce, urban and social equipment), which are distributed discontinuously throughout the territory, and are called discontinuous elements. These elements, environment, transportation, hydrography and urban settlements, together with the theoretical analysis, help to establish the challenges to be mitigated. A plan was proposed based on the mapping carried out.

According Viganò (2010), to set a territorial plan, at the same time, conceptual, where

proximity relations are set and conflicts are inserted contribute to structure strategies for a large scale of urban planning, capable of regenerating metropolitan territories, starting from the local scale but also affecting regional scale. The urban plan proposes a natural and qualitative evolution of this area based on the challenges found. Next step now is to move from plan scale to a participatory urban project scale. Just an integrated plan of green spaces is not capable of solving the complex urban problems of housing, poverty and environmental degradation. Complementary actions, political and economic, are essentials. The real state sector should be connected with these conflicts and should be more controlled by urban legislation. However, through a plan could be possible to identify, mitigate and avoid the proliferation of new conflicts, especially when it has an urban landscape multi-scalar vision that goes from the plan to the project scale (Fig. 1.7).



Fig. 1.7 Urban plan proposal. Source Made by the author

## 1.7 Final Comments

Currently, in addition to the esthetic, sanitary, integrative and structuring function, green spaces may assume an important function as regenerating element of the urban landscape, with the ability to mitigate socio-environmental conflicts when they are well qualified. Besides a green space system another actions would be essentials to regenerate this area: to link infrastructure with the landscape natural process, to plan in a local and metropolitan dimension and finally to set housing and land tenure public policies to achieve the great demand of the low-income population. In this way it would be avoided that green spaces without proper use in countries with a large housing deficit, such as Brazil, become attraction elements for informal and precarious settlements instead of elements of urban and metropolitan regeneration.

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