



## **Human occupation and land use process in the Itaim basin, Taubaté, Brazil**

**doi: 10.4136/ambi-agua.2339**

**Received: 25 Nov. 2019; Accepted: 27 Dec. 2019**

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### **ABSTRACT**

Indiscriminate use of land leads to substantial changes in the routine of social groups. Caused predominantly by anthropic elements and historically observed by the behavior of the economic and social trajectories, this phenomenon causes changes in the landscape and territory. This investigation analyzed the historical and social incidents in the random occupation of a hydrographic basin, located in the city of Taubaté, State of São Paulo. It considers factors related to urban occupation and the characterization of the rural environment, based on the analysis of anthropic conditions related to gradual alteration of the landscape and the territorial environment, from a historical and environmental perspective. Based on topical incursions at particular points in the basin and analysis of components found in the water, a progressive and inevitable degradation of their natural characterization was found, as well as the urgent need of intervention by public entities, and the population that lives and works in the region is called for, in order to expand the preservation of what remains of history, environment and rural culture.

**Keywords:** environmental sciences, sustainability, territory, water management.

## **O processo de ocupação humana e uso do solo na bacia do Itaim, Taubaté, Brasil**

### **RESUMO**

O uso indiscriminado do solo provoca alterações substanciais na rotina dos grupos sociais. Causado predominantemente por elementos de ordem antrópica, observados historicamente por comportamento do arranjo econômico e social, o fenômeno acarreta modificações na paisagem e território. A pesquisa analisou as incidências históricas e sociais na ocupação aleatória de uma microbacia, localizada no município de Taubaté, Estado de São Paulo. Considera fatores relacionados à ocupação urbana e a descaracterização do ambiente rural, a partir da análise das condições antrópicas responsáveis pela alteração gradual do entorno paisagístico e territorial, desde uma perspectiva histórica e ambiental. A partir de incursões tópicas em determinados pontos da bacia em destaque e análise de componentes encontrados na água, constatou-se uma



progressiva e inevitável degradação de sua caracterização natural, motivo pelo qual reivindicasse uma urgente intervenção dos entes públicos e da população que habita e trabalha na região, no sentido de ampliar a preservação do que ainda resta de história, ambiente e cultura rural.

**Palavras-chaves:** ciências ambientais, sustentabilidade, território, uso.

## 1. INTRODUCTION

From a national and international perspective, anthropic interventions in nature have contributed to environmental degradation for decades. Studies with considerable scientific scope expose, through their means of dissemination, reflection protocols and political action on the decisive forms of destruction and / or conservation of the environment. Contemporary examples show devastating effects such as the burning of forests, rapidly degrading rivers, and the so-called concern for global warming.

Micro-studies have theoretical and methodological capacity to examine local phenomena and, thus, signal solutions that may help public policies. Research concerning relations between the local and the global aspects are mainly focused on the relations between mankind and nature, both urban and rural, encompassing the Natural and the Social History.

According to Held and Clawson (1965), soil and earth are not only affected by their geological history, but also reflect human history.

Land use change is, for example, a human action. In it lies the anthropogenic factors responsible for its conservation or destruction. Historical practice of survival and coexistence, occupying territorial spaces and exploring them, has become routine among human groups. The conquest of sociability as a way of living in the world required the intervention of mankind in its systematic discovery and occupation of territories and landscapes. As a driving force, the intervention left deep marks on the landscape, affecting the places of sociability. Nature and culture, in turn, explain the historicity of the built or destroyed environment.

The structuring and organic processes caused by human action in the environment are correlated with the dynamics of being-in-the-world. Discussion of a broader nature serves as an ingredient for the understanding of studies on anthropic movements that cause changes in landscape and territory. Short-range interventions that address further global repercussions later on.

The examination of a basin located in a region that has an exceptional heritage and environmental legacy, as in the case of Paraíba Valley in the state of São Paulo, requires attention to human interference processes, which cause changes in short, medium and long term, a task this study aims to achieve.

The municipality of Taubaté had a great influence on regional development, denoted by three moments of migration (Victal and Assumpção, 2015) which were provided by a network of roads and a network of cities from different periods of occupation by settlers in this area, and by the formation and growth of the first population centers between the 16th and 18th centuries described below.

The first moment of migration to the Paraíba Valley took place in the 16th century and was characterized by territorial expansion from the village of Piratininga (the actual São Paulo city), without major pretensions of the Portuguese Crown with territorial occupation or any economic return.

The second moment, already in the seventeenth century, was motivated by the discovery of the auriferous regions on the river banks, also known as alluvial gold in the Taubaté region. And the Portuguese Crown's attention to the protection and administration of this territory from the so-called Bandeirantes Path, which started from the east of São Paulo, with the use of rivers as vectors of territorial expansion, it went towards the Paraíba Valley.

The search for gold by the bandeirantes led to a new change in the axis of territorial occupation in the captaincy, shifting to the region of the village of Taubaté, which became the most important settlement nucleus in the Paraíba Valley in the 17th century, as it had a direct connection with the sea in two ways: one towards the port of Ubatuba and another to the port of Paraty, based on ancient indigenous trails.

There was an old road linking Paraty to Taubate, known as the “Cavarucanguera Road”. Whoever left Paraty passed through the region of Facão - as the region of the current city of Cunha was known - crosses the neighborhoods of Encruzilhada, Itacurussá, Encontro, Abóboras, Catioca, all - today - belonging to the municipality of Cunha. It then passed through the Faxinal, Cachoeira Grande and Barreiro regions - currently rural districts of the municipality of Lagoinha and entered the rural districts of Taubaté: Pedra Grande, Pouso Frio, Sete Voltas, until arriving at the Ipiranga district where they crossed the Una river, the Itaim stream and thus continued traveling until reaching the village of Taubaté, through the Cavarucanguera road, current Brigadeiro José Vicente Faria Lima Avenue, one of the main accesses to the Itaim basin.

The third moment is characterized by the coffee cycle, which put the urban nuclei of the Paraíba Valley in evidence from the economic point of view. It began in the states of Rio de Janeiro, São Paulo and Minas Gerais, more specifically in the Paraíba do Sul river valley and was the engine of Brazil's development from the early nineteenth century until 1920 when this region gained wealth and political power.

In most Brazilian municipalities, anthropic action on water and soil resources, as in all parts of the world, is closely correlated with urban, industrial and agricultural expansion. (Corrêa, 2001). Population growth, coupled with socioeconomic determinants, resulted, as we know, in urbanized areas with a high demographic density, leading to significant rates of depopulation of ruralized region, historical and sociological phenomenon, whose genesis in Brazil is located in the dynamic 1950s and 1960

The absence, in a municipality, of legal instruments such as Master Plan, Land Use and Occupation Law and Urban Land Installment Law, generated major social consequences such as: proliferation of lots or real estate exploitation; occupation of improper areas such as hillsides and floodplains; slum proliferation and damage such as floods, erosions and disasters arising from neglect. As stated by Fornasari (1992), urbanization brings profound changes in land use and generates large imbalances in natural physical processes.

Municipalities or cities, in general, are located in one or more river basins that in Brazil are recognized as the basic physical-territorial unit for planning and management of water resources through Law 9433/97, Brazil (1997).

Occupation of the river basin by the urban population raises major concerns, such as the impact of man on the basin and its action in the planning and development of space occupation, which increasingly requires a broad interpretation of the needs of different social and economic groups. available terrestrial resources, as well as in the rational action of matching absences and limited resources. (Tucci, 2000).

Corrêa (2001), studying anthropic factors, states that approximately 11% of the forest vegetation is found in the Itaim basin and serious erosion problems in near-springs, caused by cattle movement, inadequate vegetation cover, including in areas of tops of hills, use of fire, absence of conservation practices, poor roads and urban sprawl in the basin.

Studies on the state of water conservation in the Itaim basin (Lobato and Targa, 2004) indicated that 80% of properties are registered as rural and 48% have less than 10 ha; water uses by owners include human supplies (100%), animal supplies and hygiene (80%); The flow used by rural property is up to 500 L / day (72%); the main sources of water in the basin consist of springs (72%); sewage is disposed of directly in the watercourse (52%); the treatment of garbage on the property is burning (76%); the economic activity developed is beef cattle (64%) and milk (28%); land use and occupation is for pasture (80%).

The Itaim creek, of natural and historical connection with Una river, is located in Taubaté, SP. Its location can be considered critical, due to the thin geographical line that limits it between an area of urban expansion and another of environmental preservation. Its examination must, therefore, consider the long history of its occupation and its stages of degradation (erosion and sedimentation, for example), including the sociological, anthropological and economic relations of the region. An analytical indicator that expresses the complex and historical tensions between rural and urban.

Based on the compensatory afforestation methodology, Junior et al. (2007) estimated that it is necessary to plant approximately 434 ha of native vegetation in permanent preservation areas (PPAs) to compensate for runoff losses in the Itaim basin.

By studying unit hydrographs in the simulation of surface runoff in the Itaim creek basin in a sustainable urbanization scenario for the year 2020, the basin presented flood damping capacity by the vegetation cover of the basin in permanent preservation areas, added to the infiltration points, condominium water, considering only 50% waterproofed (Perim et al., 2015).

Another important aspect is that the Itaim stream was determined by the Ordinance 107/1998 of the Department of Water and Electric Energy of the State of São Paulo (DAEE) as a technical water supply reserve (SÃO PAULO, 1998), seeking to ensure the balance in the binomial, supply versus demand, in a future projection of increased water consumption in the municipality of Taubaté, observing the limits of its watershed, as well as the protection of its sources.

The objective of this research is to analyze historical aspects of human occupation and the associated land use process, relating them to scientific evidence derived from documentary analysis, hydrological studies of water quantity and quality of the Itaim stream previously performed and direct measurement of the parameters infiltration and sediment loading.

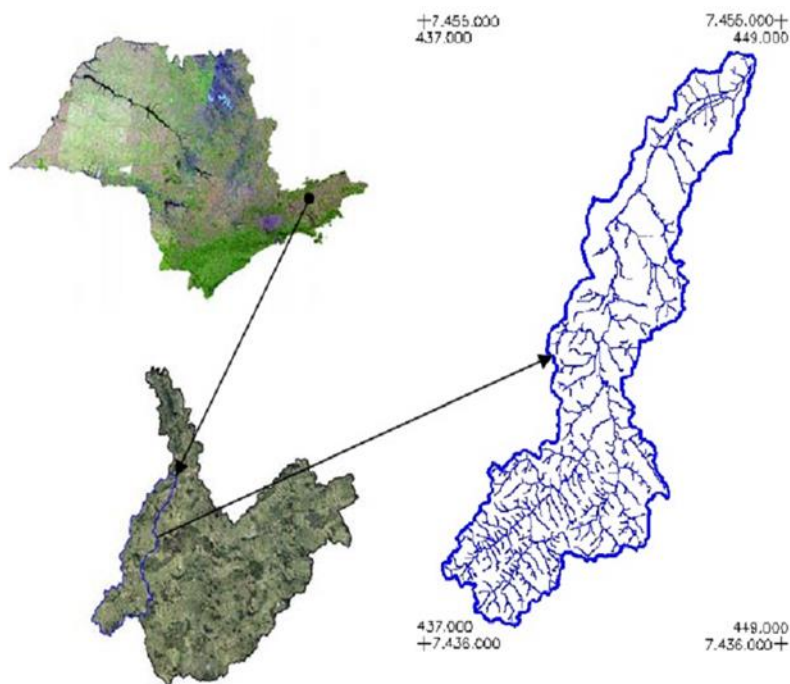
## 2. MATERIAL AND METHODS

The study area comprised a region of approximately 58.9 km<sup>2</sup>, (Batista et al. 2005) known as the Itaim basin (Figure 1), one of the tributaries of the Una river, a historic warehouse dating back to the gold exploration flag. The empirical work was carried out through interventions of recognition and consultation to the geographic charts of the Brazilian Institute of Geography and Statistics (IBGE), scale: 1: 50.000, of the municipalities of Taubaté, 1973, SF-23-Y-D-II-2; Tremembé, 1974, SF-23-Y-B-V-4; Pindamonhangaba, 1974, SF-23-Y-B-VI-3 and São Luiz do Paraitinga, 1974, SF-23-Y-D-III-1.

In this study we used the land use and occupation map (PMT, 2017), provided for in the Taubaté Municipal Master Plan (Law 412/2017), with the projection in the boundaries of the Itaim basin, identifying the areas of urban sprawl, conservation and special urban zones, in addition to the economic development zone and rural macro zone shown (Figure 2) of the Itaim basin presented by Rodrigues et al. (2019).

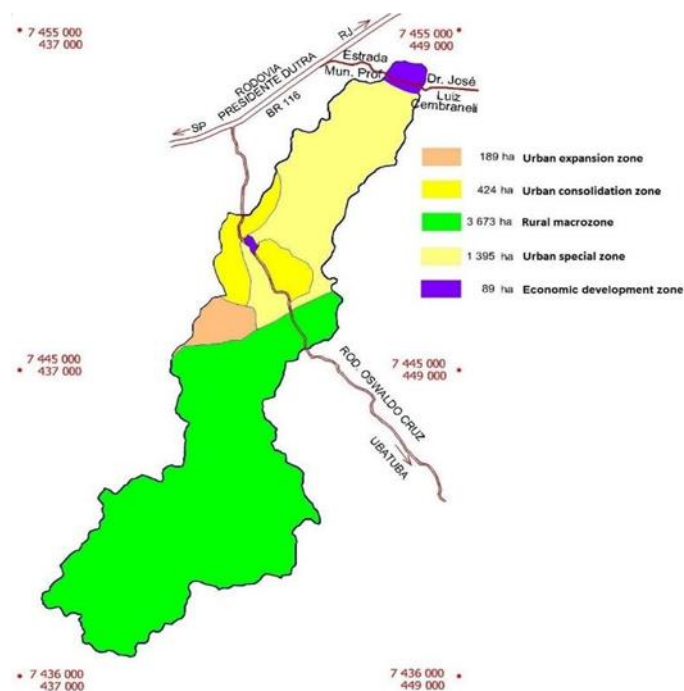
The Itaim basin was recognized with georeferenced photographic recording using GPS navigation and IBGE topographic charts in the scale: 1: 50,000. These visits sought to identify elements inherent to the landscape such as topography and anthropic environment, the state of conservation of rural roads, private properties, erosive processes within the area of influence and the Itaim bed.

Water infiltration tests in the soil were made by the Concentric Rings method and followed the methodology described in Aguiar et al. (2007).



**Figure 1.** Location of the Itaim River Basin.

**Source:** Batista and Targa, 2005.



**Figure 2.** Projection of the Taubaté Municipal Master Plan over the Itaim Basin.

**Source:** Rodrigues et al., 2019.

Morphometric characterization of the Itaim basin was performed following the procedures described in Santos et al. (2016), as well as the profile of the Itaim stream, which was elaborated, using geoprocessing techniques.

The water samples collected in the Itaim stream were submitted to the determination of solids (total) present in the water at the Soil Laboratory of the Department of Agrarian Sciences of the University of Taubaté, using the methodology described in the American Public Health Association (1992).

For a better understanding concerning evolution of the landscape alteration processes in the basin, we have used images (Google Earth) from 1984 and 2019, which mapped points representing the predominant land use types in each mapped portion. For this purpose, the points were inserted in the georeferenced images, using the geoprocessing functionalities of the QGIS software in which the corresponding land use classes were created and the points spatialized in order to visually demonstrate and compare the advancement of these uses in the two resulting photocards.

### 3. RESULTS AND DISCUSSION

In terms of geometric characterization (Table 1), the Itaim basin has an area of 58.90 km<sup>2</sup>, a perimeter of 48 km and a length of the basin axis of 6.3 km. These measurements made it possible to calculate the compactness coefficient ( $Kc = 1.7$ ), form factor, ( $F = 0.13$ ) and circularity index ( $CI = 0.32$ ) indicating that the basin has a longer shape. Therefore, according to Villela and Mattos (1975), it has a lower concentration of defluvium and low incidence of flooding. The average hydrographic density was determined at 4.21 channels / km<sup>2</sup> (Lollo, 1995), which indicates average capacity to generate new channels (Lana, 2001).

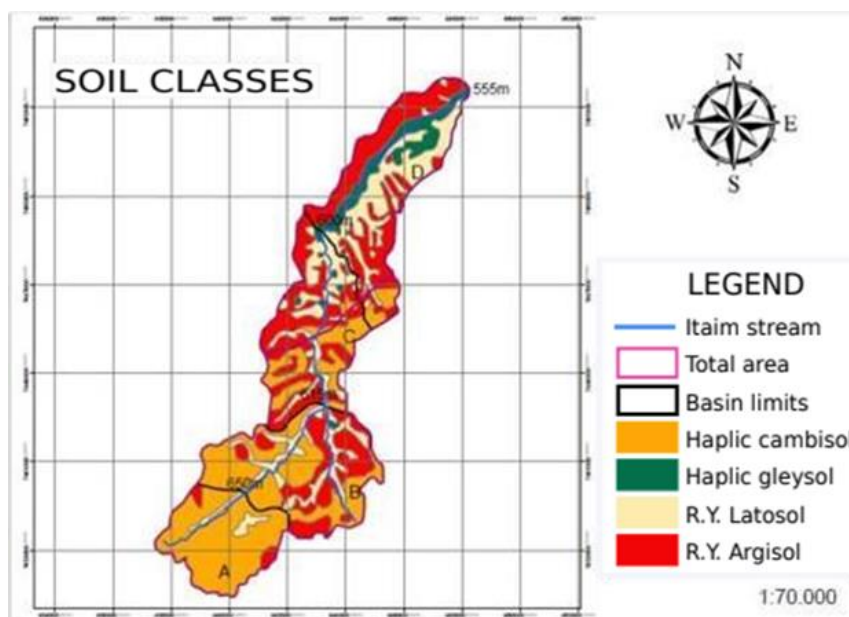
**Tabela 1.** Morphometric characteristics of the Itaim basin, Taubaté, SP.

Morphometric Characterization	Morphometric indexes	Acronyms	Units	Values
Geometric Characteristics	Area	A	km <sup>2</sup>	58.9
	Perimeter	P	km	48
	Number of 1st Order Channels	N	-	248
	Basin shaft length	L	km	6.3
	Compactness coefficient	Kc	-	1.7
	Form factor	F	-	0.13
	Circularity Index	IC	-	0.32
	Hydrographic density	Dh	channels.km <sup>-2</sup>	4.21
Relief Features	High altitude	Hmax	m	1060
	Average altitude	Hmed	m	680
	Minimum altitude	Hmin	m	577
	Altitude Amplitude	Hm	m	483
	Sinuosity Index	Is	m. m <sup>-1</sup>	3.0
	Channel Gradient	Gc	m. km <sup>-1</sup>	50.48
	Relief Ratio	Rr	m. km <sup>-1</sup>	23
Drainage Characteristics	Length of main channel	L	km	21
	Total length of channels	Lt	km	96
	Vector length of main channel	Lv	km	7.0
	Drainage Density	Dd	km.km <sup>2</sup>	1.63
	Maintenance coefficient	Cm	m <sup>2</sup> .m <sup>-1</sup>	0.613
	Basin Order		-	4

The channel sinuosity index ( $Is = 3.0 \text{ km. km}^{-1}$ ) indicates that the drainage channels of this basin are considered to be winding, being a fourth order basin. Drainage density represents the degree of topographic dissection and expresses the amount of available runoff channels (Christofoletti, 1981). For the Itaim basin, the drainage density ( $Dd = 1.63 \text{ km. km}^{-2}$ ) is considered median, according to Beltrame's classification (1994), which suggests, necessarily, that there is a median runoff according to the coefficient. ( $Cm = 0.613$ ), 0.613 m<sup>2</sup> of stable ground area to maintain each m<sup>2</sup> of perennial channel.

Regarding the occurrence of soils in the basin (Maria Filho, et al 2016), as shown in Figure 3, the haplic Gleysol (Gx) occurs in the floodplain areas. The Red Yellow Latosol (LVA)

follows the river channels of the Itaim creek and tributaries, laterally to the floodplain areas. In the high parts and intermediate slopes of the basin the red yellow Ultisol (PVA) is found and, closer to the springs, the Haplic Cambisol in the upper course of the basin.



**Figure 3.** Itaim basin soils, Taubaté, SP.

**Source:** Maria Filho et al. (2016).

It is observed by the hydrological classification of soils in Brazil from Sartori, et. al (2005), that there is a predominance, in the Itaim basin, of hydrological type C and B soils that have, respectively, low and moderate infiltration capacity when completely wet.

Otherwise, infiltration tests conducted in the basin indicated that different land uses and coverings interfere with the infiltration capacity, since the observed Basic Infiltration Speeds (VIB) were: forest ( $417 \text{ mm.h}^{-1}$ ), eucalyptus ( $52 \text{ mm.h}^{-1}$ ), pasture ( $19 \text{ mm.h}^{-1}$ ), areas under maize, rye, sorghum, wheat, etc. ( $7.2 \text{ mm.h}^{-1}$ ) and coffee cultivation ( $1.5 \text{ mm.h}^{-1}$ ).

These infiltration results indicate that permeability is rapid in the forest, moderate in eucalyptus, slow in pasture and agriculture, and still very slow in coffee growing areas, according to the Soil Survey Staff (1993). In a way, these infiltration velocities interfere in the runoff and erosive processes, due to the different uses, and reflect the current sedimentation situation of the Itaim stream, since historically the basin has gone through the migration cycles in the region since the days of colonial Brazil according to Victal and Assumpção (2015).

According to Devide (2013) the hydrological dynamics impacted by coffee became even more altered with the replacement of coffee plantations by pastures that do not intercept the water in the canopy. Moreover the litter layer is lower to regularize the gradual recharge as it occurs in the soils. Forest, which allows the infiltration of water of 51% of the precipitation at depths greater than 120 cm, as shown by Targa et al. (2019). Another aspect is that the basin has approximately 44% of its area covered by pastures and only 13% of tropical forest. Thus even the area defined in the Municipal Master Plan as Rural Macrozone (Figure 2), which includes preservation area, the occurrence of forest is deficient.

The impact caused by heavy rainfall is the consequent disintegration of the Itaim basin soil, since given the infiltration capacity in pasture-covered areas, agriculture is considered low and, therefore, runoff tends to be high, allowing sediment flow that drag on with rainfall storms. After two years of monitoring the flow and suspended sediment concentration in the water, a solid flow equation was developed for the Itaim stream that indicated a load of  $6848 \text{ kg.day}^{-1}$  suspended sediment in the water (Moreira, Targa and Batista, 2006).

Dias (2007) found for the dry and wet periods in the Itaim basin, respectively, an amount of total solids of  $250 \text{ mg L}^{-1}$  and  $400 \text{ mg L}^{-1}$ , and emphasized that this is due to the low amount of area with native forest vegetation, high activity. agriculture and greater degradation in this basin, probably influenced by urban activities.

In Figure 4, after the Itaim stream de-clearance procedure in 2017, it was possible to verify the volume of sediment that was removed from the stream and deposited in its margin. Although this procedure is usual in the region, this is a controversial and inconsistent issue, as the São Paulo State Department of the Environment allows for deconstruction after licensing, but not its removal or use, so that sediment removed from the bed must be deposited on the bank, which ends up contributing to its return to the creek bed with the next rains.



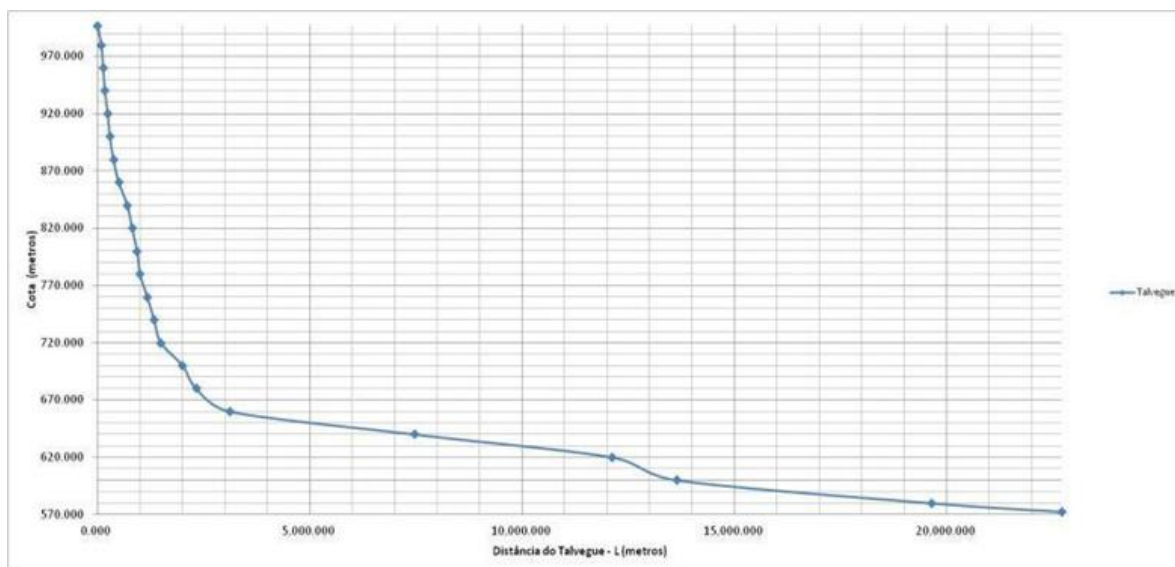
**Figure 4.** Sediments removed from the Itaim creek in 2017 in Taubaté, SP.

In the profile relative to Ribeirão Itaim (Figure 5) there is a steep slope ( $103 \text{ m km}^{-1}$ ) with a fall of 330 m in the first 3200 m and then a slightly softer slope ( $4.6 \text{ m km}^{-1}$ ) with a drop of approximately 90 m on a 19500 m channel to its Una River outlet. Although Itaim is considered to be winding, this steep fall in the first 3200 meters causes high water inflow in the basin under heavy rainfall conditions and increases the possibility of sediment carrying in high volumes, as Moreira et al. (2006) and Dias (2007).

The dynamics of migration in the colonial period in the 17th to 18th centuries with the policies of gold, coffee and, more recently, the process of industrialization in the 19th and 20th centuries, make up the historical framework of the municipality of Taubaté, a phenomenon that greatly impacted the daily life of the city and its sociological profile. In the twentieth century, for example, the rural exodus was one of the decisive elements of this change that can be identified and related to the economic stagnation of neighboring municipalities and the



consequent population displacement, causing objective needs of urban planning due to demographic growth. In this context, the opportunity is open for real estate speculation to act and disrupt the territory and the landscape, inciting the public authorities to isolated and corrective intervention.



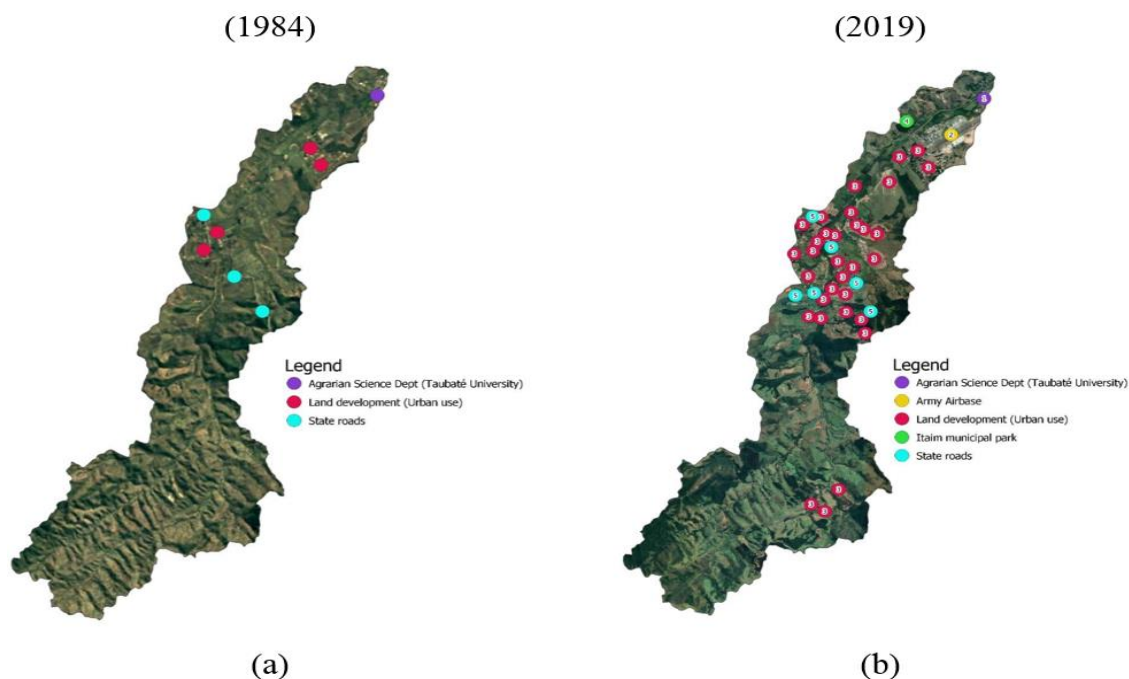
**Figure 5.** Profile of the Itaim creek bed in Taubaté, São Paulo.

Currently, the availability of free space to satisfy the need for urban expansion of the municipality is worrying, because as the positioning of the urban network, the occupation of the Itaim basin will intensify even more, as well as the rest of the Una river basin, which has 84 % of its area in the municipality of Taubaté.

The municipality of Taubaté has several developing fronts that, even supported by the Spatial Ordering Code and its Zoning Charter, are vulnerable to irregular occupations, especially in Itaim, a technical reserve for urban supply.

According to Calzetta et al. (2003), the lower region of the Itaim basin already had a greater anthropic impact due to the presence of a road network and being located near the limit of the urban area of Taubaté and consequent implementation of human occupation infrastructures such as the Department of UNITAU Agricultural Sciences, the Brazilian Army Aviation Command (COMAVEX), the Paraíba Valley Middle Dairy Cooperative (COMEVAP), the Hotel Fazenda Mazzaropi, the Association of Parents and Friends of the Exceptional (APAE), the landfill, the neighborhoods Marlene Miranda, Baraceia, in addition to Dr. Jose Luiz Cembranelli municipal roads, Remedies and Itapecirica, and the Oswaldo Cruz state highway (SP-125).

Considering the use and occupation of the Itaim basin of 1984 (Figure 6 a) and 2019 (Figure 6 b), it is observed that the anthropic action increased in 2019, mainly in the middle and lower third of the basin, represented by the large expansion of areas with urban infrastructure and, consequently, road network. It is also observed that urbanization has already advanced (Figure 6b) over the area defined as rural macrozone (PDMT), which has environmental conservation characteristics in the middle third, but also in high areas, which may compromise water infiltration into the soil and further increase the runoff in the basin as well as erosive processes and sedimentation of Itaim. The municipality's permission for these urban sprawl areas (either officially or for lack of enforcement) should be prohibited. The inspection needs to act in order to curb this type of occupation of the Itaim basin, because this area is a technical reserve of water for human supply, as established by the State of São Paulo (1998) through Ordinance 107/1998.



**Figure 6.** Land use and occupation in the Itaim basin in Taubaté, SP in 1984 (a) and 2019 (b).

Figure 7 (a, b, c, d) shows the area of the Pilot Farm of the University of Taubaté in the Itaim Outreach region in 2004, 2010, 2016 and 2019 after the Itaim marginal floodplain area was systematized in 2004 (Figure 7 a) allowing cultivation and agricultural production. As siltation increased in the proportion  $6800 \text{ kg}\cdot\text{day}^{-1}$  defined by Moreira et al. (2006), the floodplains were being flooded (Figure 7b) longer each year. In the meantime, the municipal government was authorized to promote the deforestation of the Itaim bed, which was carried out in 2017 (Figure 7 c).

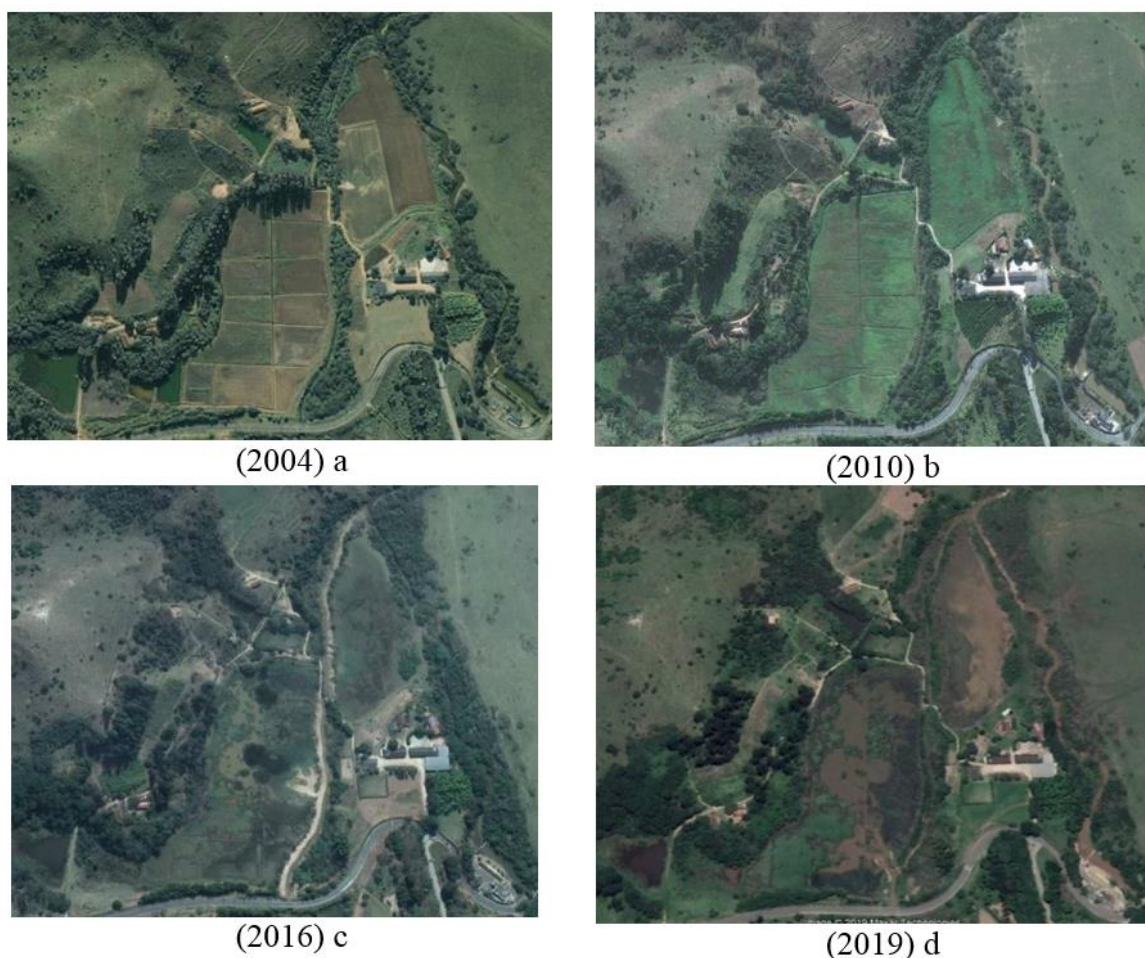
On the other hand, the expansion of urbanization and the road network, registered in 2019 (Figure 6b), caused a significant increase in sedimentation, so that the outflow of water from Itaim to the Una river was blocked by sediment, which caused the maintenance of marginal areas of flooded floodplains for at least two years (Figure 7 d). Evidently, in this scenario, occurrence of higher rainfall may damage the already installed infrastructures, such as the Dr. José Luiz Cembranelli road; the hangars, buildings and runway of the Brazilian Army Aviation Command (COMAVEX); and the train (Maria Fumaça) from Itaim Municipal Park.

The results presented for the Itaim basin have shown urban and rural sprawl areas, as described and defined in the 1991 Taubaté Municipal Zoning Charter (PMT, 1991). It was evident from the on-site observations that the limits by zoning have already been overcome, but there is still doubt about the clearest definition that determines the most appropriate boundary between the geographical line that should separate the urban from the rural and the natural boundary imposed by the natural characteristics of the landscape.

The borderline aspect parallel to the landscape generates paradox, since instruments such as plantations, modest houses, livestock, unpaved roads, are not devices to define what can be a rural and urban area, as noted by Blay (1971), these instruments or landmarks are flawed and can generate misconceptions about the concept of rural.

The concept of rural space varies according to the conception or point of view, but in general it associates rural with the agricultural conception (Jung, 1972), generating a division of opinions and opening space for dilemmas. Among these dilemmas, the expansion of a city

or urbanized area in general carried out with sacrifice and absorption of the rural landscape, incorporating it.



**Figure 7.** Lowland areas on the Taubaté University Pilot Farm at the meeting of the Itaim creek (left) with Una river (right) at different periods.

The proposal for a rational organization of space does not depend on whether the area is rural or not, as mentioned by Bruna (1983), but rather on planning supported by agricultural zoning. It is a fact that the urban area stands out more than the rural area and that promising proposals are largely aimed at improving cities, but the lack of legislative clarity at the federal, state and municipal levels as to the real boundaries between urban and rural areas, hinders and compromises possible projects in the rural area, as well as the implementation of agricultural zoning in the Itaim basin.

In this analysis of the Itaim watershed, it was observed that with the strong demand for areas that provide rural leisure and tranquility of the countryside, as well as the city's infrastructure, the areas of the Itaim basin have been occupied not only by gated communities but, also by recreational farms, buffets, theme park and country clubs.

The degradation of the Itaim basin is a slow, longstanding process. Its uncritical occupation justifies the reasons that led the basin to the current state, because as mentioned by Held and Clawson (1965), human history largely affects the soil.

According to a historical survey, the degradation of the Itaim basin began in the past through the removal of native forest cover for activities such as coffee cultivation, the lack of sustainable planting techniques and the consequent depletion of fertile land, then gave way to livestock extensive pasture implantation, which mismanagement led to degraded pastures.

Erosions of various types, caused by successive human interventions, interfere with the quality and availability of water due to the dragging of soil particles and sedimentation of water sources, bringing serious consequences for the conservation of water quantity and quality (Lobato and Targa, 2004).

Pontifical studies referring to aesthetic studies demonstrated perspectives connected with respect to the characterization and compilation of the physical state caused by natural and anthropic interventions in the region. In all of them, it is possible to verify the centrality of the use of only one of the two tributaries of Una, especially Itaim, expressing a state of contemporary and significant art on the subject.

The presented results compose a relevant map on the state of conservation and degradation of the Itaim basin and bring to attention important imbalances in the disorderly occupation of the region that still requires more studies based on the Environmental History approach, for example.

#### 4. CONCLUSION

The geographical position presented by the urban area of Taubaté and the pace of human occupation currently achieved, indicate that the process of occupation of the Itaim basin tends to intensify in the coming years, proportionally increasing liabilities such as higher flow velocity, erosion intensity, volume of sedimentation and flood frequency. The degradation presented so far has spread throughout the region with little discernment and without proper supervision. The critical situation of the different areas of the basin is explained by the ongoing anthropogenic factors with serious risk of disappearance of rural Taubaté if specific legislation for its protection is not formalized and enforced. Initiatives related to the valorization of rural areas, such as rural and environmental tourism, as well as the payment for environmental services, could remedy the problematic, erosive and degrading situation of the region examined, among other actions related to the preservation of culture, history and rural economy.

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