Journal of Civil Engineering and Architecture 20 (2026) 292-296
doi: 10.17265/1934-7359/2026.07.004

Use and Occupation of the Floodplain of the Macacos of the River (Rio de Janeiro, Brazil)

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Abstract: In order to better understand the transformation dynamics of landscapes, it is fundamental to evaluate geographic, political, social, economic, cultural and historical interactions. The main objective of this work is to delimit and classify the land use of the floodplain of the river basin. Rio das Macacos, drains part of the South Zone, Rio de Janeiro, the Horto Community and the Botanical Garden, flowing into the Rodrigo de Freitas Lagoon. Analyzing the land use of the floodplain of the Macacos River, it was observed that a large part of its area has undergone extensive process of occupation, captained by private real estate capital.

Key words: Land use, geographic area.

1. Introduction

The degradation of water resources is an increasingly popular theme in several types of diagnostics and environmental impact studies. Par Barbosa [1], in the Metropolitan Region of Rio de Janeiro, the hydrographic basins have been suffering since the mid-20th century with the intense and disorderly urbanization process. The population has grown on a large scale and has been appropriating the resources that the geographical space offers them, without due respect for environmental laws, facilitated by the inefficiency of State control (for various reasons), generating, as a consequence, the formation of irregular constructions (in river borders or slopes), thus disrespecting the Forest Code and the specific legislations that regulate the Marginal Ranges of rivers.

In the flood plains, the process of accelerated urbanization has caused numerous environmental problems for the population, especially those associated with disordered occupation. For Vanzela, Hernandez, and Franco [2], the use and occupation of the soils exert a marked influence on the surface runoff and sediment supply in the bed of the springs, which can alter the water quality and availability.

The areas corresponding to the floodplain are constantly and intensively occupied without adequate planning, placing the safety of the population inhabiting them in different degrees of risk. In this way it is important that there is awareness of the population and a plan by the State to plan and manage areas of risk, aiming to raise the level of development of that region and population.

The main objective of this work is to delimit and classify the land use of the floodplain of the Macacos river basin, which drains part of the South Zone, Rio de Janeiro, the Horto Community and the Botanical Garden, draining in the Rodrigo de Freitas Lagoon.

2. Method and Materials

For the analysis of the hydrographic basin of the Macacos river, the work was developed in different stages. The first one consisted of a bibliographical/ cartographic survey, and authors such as Christofoletti [3] and Silva [4] were analyzed.

The second step was the acquisition of the 1:10.000

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land registry plans produced by the City of Rio de Janeiro in 2010. The land use data were obtained through satellite images of the Pereira Passos Institute, in detail scale, of the year of 2010.

The delimitation of the basin and the digitization of the basin were performed using the ArcGIS 10.1 geoprocessing software. For the delimitation of the floodplain, the altimetric gap was found between 0 and 40 meters, through the interpretation of Silva's [4] writings.

The last stage was the field visits to know the spatial dynamics of the river basin in question and the real situation of the floodplain in October 2015.

3. Results and Discussions

According to Barbosa [1], the hydrographic basin has been recognized as a physical geography space unit since the middle of the 20th century. At present, other sciences, called environmental sciences, have incorporated, in their studies, the analysis of this special unit, in the sense of developing environmental protection programs. Teodoro *et al*. [5] define a river basin as a set of lands drained by a river and its tributaries, formed in the highest relief areas by water dividers. Having its delimitation based on geomorphological criteria, drainage basins have advantages over planning units defined by other attributes, whose boundary tracings can be quite imprecise, such as, for example, units defined by climatic attributes, or even based on the types of vegetation, which may not cover the landscape continuously.

The watershed of Rio dos Macacos is located in the South Zone of Rio de Janeiro and has an area of 4.8 km2, has a WE direction extension and its source is embedded in the crystalline rocks of the Tijuca Massif, where Biotite gneiss, quartz, plagioclase and pomegranate. This geological substrate supports a fairly steep relief that becomes flat abruptly, near the Horto community, at 75 m altitude, when the river begins to cut extensive sub-horizontalized stretches covered with recent sediments (alluvium) (Fig. 1).

Within the river basin, the floodplain is also known as floodplains, which are the most common form of river sedimentation. According to Christofoletti [3], the floodplain can be defined and delimited by different criteria, according to the perspective and the objectives of the researchers. A floodplain develops on a channel of a valley that is filled with alluvial lands and that presents meanders due to the low slope of the course of the river that, in times of floods overflows the channel and floods the region.

The flood area of the Macacos river has 1.1 km^2, incorporating a large sub-horizontalized area, which presents different uses and occupation, shown Fig. 2.

The intensity of use and occupation of a river basin is strongly associated with the level of waterproofing of the soil of that same region and therefore these aspects must be worked together. The mapping of information is a widely used feature to make the patterns of use and occupation of spaces more evident. Visualizing facts in space improves understanding of existing interactions.

In the floodplain of the Macacos River, the forested area (remnants of Mata Atlântica) accounts for almost 20% of the total area of the floodplain and is mainly located near the foothills of the steep slopes of the Tijuca Massif.

The hydrographic basin has important forested areas associated with the Tijuca National Park Conservation Unit managed by the ICMBio (Chico Mendes Institute for Biodiversity Conservation), but the occupation fronts have risen towards the slopes, promoting deforestation and destruction. The increasing advance of occupation over protected areas and floodplains, without planning, regardless of its use, may represent an area of risk for the population, since it is in the river basin that the processes that start over of the basin are reflected, such as periodic flooding, due to the increase in river flow in the amount, sediment deposition, often arising from erosion processes and even water damming, due to the accumulation of sediment or even litter along the tributaries.

In the floodplain, Secondary Vegetation occupies 24% of its area and is observed mainly in the low course of the river, and it is represented architectonic

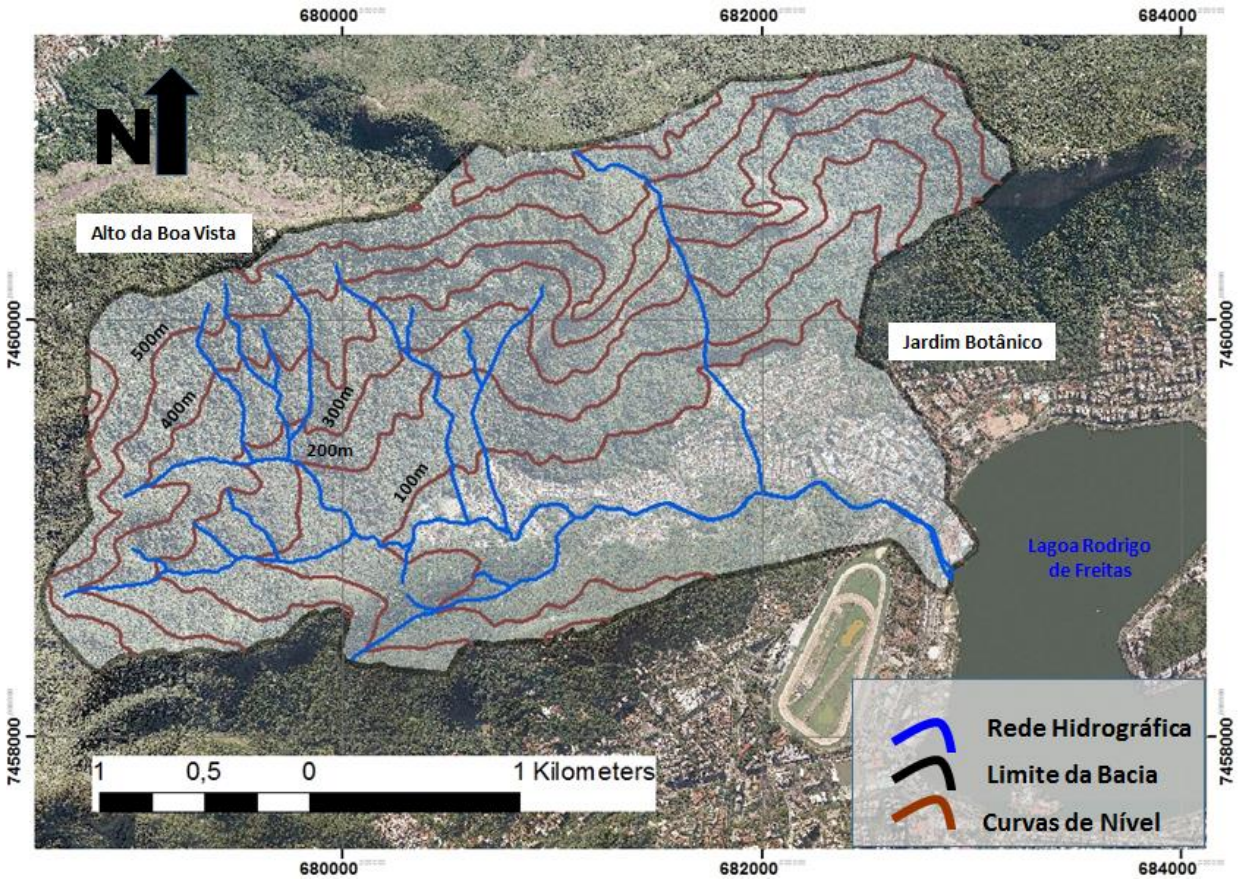

Fig. 1 Location of the hydrographic basin of the Macacos river.

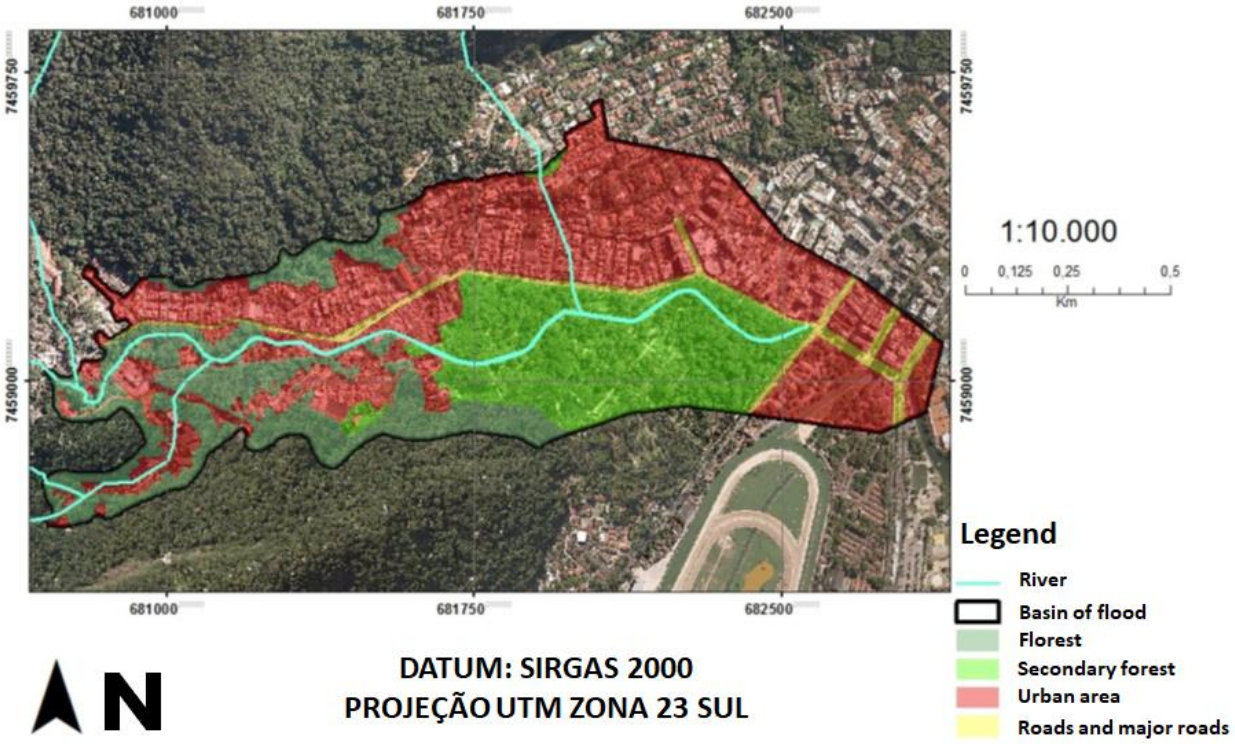

Fig. 2 Flood plain soil use map.

Fig. 3 Aerial view of the occupation verticalization in the flood plain of the Macacos river [6].

and floristic project of the Botanical Garden Institute of Rio de Janeiro, where it is possible to identify innumerable national vegetal species and foreign.

The Urbanized Areas represent 53% of the surveyed area and are mainly constituted by the buildings in the western and northern stretches of the plain. In the vicinity of the Horto Community, there is strong human pressure and the secondary vegetation is intermixed with the urban fabric. The growth of the middle-class Botanic Garden Botanico neighborhood from the second half of the last century offered a strong construction in the northern part of the floodplain (Fig. 3).

The anthropic action on the surface a watershed causes transformations in the hydrological system. The introduction of impermeable surfaces reduces infiltration and reduces the retention surface, so there is a decrease in water supply, which can lead to water drainage. The same waterproofing causes an increase in the surface runoff combined with the increase in the speed produced by the artificial drainage, resulting in higher peak flows with a faster occurrence time, causing flooding in urban areas [7].

6. Conclusions

The hydrographic basins present in the urban environment constitute a spatial cut of fundamental importance for the urban planning and almost always, its process of use and occupation of the soil, is developed in a spontaneous way, rarely based on the environmental questions.

The occupation of the earth from the different human needs makes more and more the study of the environment become the subject of scientific research, since the spatial information, mainly on the use and coverage of the land, is established as an essential condition for the understanding of how man appropriates space.

Analyzing the land use of the floodplain of the Macacos River, it was observed that much of its area has been undergoing a large occupation process, captained by the private real estate capital.

The monitoring of these changes will benefit the entire population, since it will function as an instrument for rational planning of occupation and land use, implying, therefore, a significant improvement in the quality of life. Within this context, Rio de Janeiro City Hall will have an important environmental control instrument that, if effectively applied along with existing legislation, will greatly reduce the negative effects, such as floods in urban areas along the Rio de Janeiro. Monkeys.

References

[1] Barbosa, D. R. 2013. “Land Use and Occupation in the Marangá River Floodplain (RJ).” In *Brazilian Symposium on Applied Physical Geography*. XV, 2013, Vitória, ES, Brazil. Annals. Federal University of Espírito Santo. Articles. CD-ROM.

[2] Vanzela, L. S., Hernandez, F. B. T., and Franco, R. A. M. 2010. “Influence of Land Use and Occupation on the Water Resources of Córrego Três Barras, Marinópolis.” *Agriambi Magazine* 14 (1): 55-64.

[3] Christofoletti, A. 1980. *Geomorphology*. São Paulo: Edgard Blücher, 2nd ed., 188p.

[4] Silva, T. M. 2003. “The Geomorphological Structuring of the Atlantic Plateau in the State of Rio de Janeiro.” In *Brazilian Symposium on Applied Physical Geography (SBGFA)*. X, 2003, Rio de Janeiro, RJ, Brazil. Annals. Rio de Janeiro: University of the State of Rio de Janeiro. Articles, pp. 1536-40. CD-RO.

[5] Teodoro, V. L. I., Teixeira, D., Costa, D. J. L., and Fuller, B. B. 2007. “The Concept of Hydrographic Basin and the

Importance of the Morphometric Characterization to the Understanding of Local Environmental Dynamics." *Revista UNIARA* 20: 137-56.

[6] Vieira, C. 2017. "One of the Most Beautiful Cities in the World … No Doubt!" Accessed 12 Nov. 2017. http://www.panoramio.com/photo/71133087.

[7] Tucci, C. E. M. 2003. "Floods and Urban Drainage." In *Urban Floods in South America*, orgs. by Tucci, C. E. M., and Bertoni, J. C. Porto Alegre: Brazilian Association of Water Resources, p. 45.