

**Geo-environmental diagnoses of the São Francisco de Itabapoana city in the north of Rio de Janeiro state****Diagnose geoambiental do município de São Francisco de Itabapoana no norte do estado do Rio de Janeiro**

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**ABSTRACT**

The present work shows the Geo-Environmental Diagnosis of the municipality of São Francisco de Itabapoana, located in the northern region of the state of Rio de Janeiro. The main objective is characterized by the realization of the physical aspects of the place, emphasizing the geological, geomorphological elements, water resources and the sectors that allow the potentialization and development of tourist activities in the region. The study aims to enrich the data related to geology and geotourism in the region, since these are still scarce. It should be noted that the territory in question has a historically resilient socioeconomic framework and is home to a diverse mosaic of landscapes and environmental systems that enable the implementation of activities that encourage the circulation of currency and the creation of projects linked to effective sustainable development.

**Keywords:** Landscape, Geology, Tourism, Sustainability

**RESUMO**

O presente trabalho trata da Diagnose Geoambiental do município de São Francisco de Itabapoana, situado na região Norte do estado do Rio de Janeiro. O objetivo principal é caracterizado pela a realização dos aspectos físicos do local, enfatizando os elementos geológicos, geomorfológicos, hídricos e os setores que permitem a potencialização e desenvolvimento de atividades turísticas na região. O estudo visa enriquecer os dados relacionados à geologia e o geoturismo na região, visto que estes ainda são escassos. Registra-se que o território em questão apresenta um quadro socioeconômico historicamente resiliente e abriga um diversificado mosaico de paisagens e sistemas ambientais que possibilitam a implementação de atividades que fomentam a circulação da moeda e a criação de projetos vinculados a um desenvolvimento sustentável efetivo.

**Palavras-chave:** Paisagem, Geologia, Turismo, Sustentabilidade.

**1 INTRODUCTION**

Issues related to the environment are proving to be increasingly troubled and needing attention, mainly due to the impacts generated by the dizzying and disorganized urban spread. The current economic context has an extremely consumerist system and is unconcerned with the reflexes caused in the ecosystem, making it even more difficult to restore the exploited natural resources (Nascimento et al., 2008).

In Art. 1, CONAMA Resolution 01/1986 (Brazil 1986) establishes the concept of environmental impact as any modification of the physical, chemical or biological properties of the environment, motivated by any form of matter or energy that arise as a result of the actions human, which directly or indirectly influence the fields: health, safety and well-being of the population; social and economic activities; biota; aesthetic and sanitary conditions of the environment; quality of environmental resources.

The Fundação SOS Mata Atlântica / INPE (2017), presents data on the remains of the Atlantic Forest in the state of Rio de Janeiro, in a dynamic evaluated between the period 2016-2017, representing a total of 917,012 hectares of original vegetation corresponding to 20% primary coverage. These forest remnants show considerable communication among the fragments existing in the territory. Guimarães et al. 2010 states that one of the biggest problems involved is the lack of in-depth studies on biotic aspects, especially with regard to the association between the elements that form the landscape. Thus, an enormous need to invest in academic works with this theme is identified. Seeking to characterize and understand the interaction between biodiversity and the geodiversity of the place, to later propose the application of sustainable practices and preservation.

Nascimento et al. (2008) affirm that for the elaboration of a geoenvironmental diagnosis it is necessary to identify the physical and biotic dimensions of the place, investigating each element individually, to later analyze the behavior and the interdependence relationship between them and the environment as a whole. The integration of social, economic and environmental aspects acts as a fundamental tool for the effective use of sustainable development in a city. Therefore, conducting a survey of data on the geoenvironmental properties of the location portrayed in its valorization, bringing with it a series of positive points, such as the spatial reorganization of urban sectors.

In this sense, São Francisco de Itabapoana has characteristics to achieve proposals for sustainable and economic planning in the municipality. Since, it stands out in relevant activities that would allow the application of proposals, and improvements in investment, in view of the tourist potential of the region, such as the fishing character, the coastal geological structures (cliffs), quilombola communities and areas available for the creation of new Conservation Units and greater attention to the Guaxindiba State Ecological Station. Such a set can provide the site with the interaction between environmental, cultural and economic practices. In addition, the municipality portrays potential in other activities that integrate the production system at the national level, such as the planting of cassava, pineapple and cane, among other cultures on a smaller scale, such as guava, passion fruit, coconut and pepper. The present work has as general objective to characterize the physical environment of São Francisco de Itabapoana / RJ, emphasizing the geological, geomorphological and drainage aspects to the potentializing and developing aspects of tourist activity in the region.

During the elaboration of the work, the concepts related to tourism and the integration of the elements that constitute nature were approached. In addition, the importance of the most varied projects that residents of the municipality and tourists, who visit the city, was described, emphasizing the importance of preserving the environment. So that opportunities are given to the creation of proposals that can contribute to the improvement of the municipality linked to meeting the needs of residents and visitors of the region.

## **2 MATERIALS E METHODS**

The research had an exploratory content, developed from a qualitative perspective. Also classified as descriptive, since the facts were analyzed and observed without interference in them. To carry out the geoenvironmental diagnosis, it was necessary to make an analysis of

the natural and economic factors of the place. As a result, the literature review was based on the compilation of data found in books, scientific journals, cataloged articles, technical reports, maps, public documents, internet searches focused on the physical aspects of the city of São Francisco de Itabapoana / RJ. Local socioeconomic aspects were informed by the last Secretary of the Environment, Ilzomar Soares Filho, where he reported a brief overview of the strengths of the municipality's economy, mainly related to tourism and artisanal fishing.

Among the elements of the physical environment highlighted, Dantas et al. (2001) point out that, in recent years, the GATE Program (Information Program for Territorial Management) established the relevance of some authors by investigating the elements that form the landscape, in order to understand not only the geomorphological and geological aspects, but also the relationship with the biotic sphere. For the elaboration of a diagnosis of the physical environment, it is crucial to evaluate elements that constitute the natural scenario, interspersed with communication with fauna and flora, in an attempt to outline a mosaic of landscapes, enabling a deeper understanding of the theme (Dantas et al 2001). Finally, geological maps were made using QuantumGis 2.18.16 software, based on the Universal Transversal Projection of Mercator (UTM) - Datum SIRGAS 2000 - Zona 24K. The maps were separated into: Geomorphological, Drainage and Geological. Later, correlations were made between the maps produced and the compilation with the information obtained from the literature review.

### **3 RESULTS E DISCUSSIONS**

#### **3.1 SÃO FRANCISCO DO ITABAPOANA**

The municipality of São Francisco de Itabapoana has a total area of 1,122.4 square kilometers, with municipal limits: Campos dos Goytacazes, São João da Barrada, the state of Espírito Santo and the Atlantic Ocean. In 2010, the territory had 41,354 inhabitants (IBGE, 2010). According to data collected by the State Court of Auditors (TCE) of 2016, the socioeconomic status of the municipality reflected 25,371 households, of which 31% were in occasional use. During the summer and festive events, the last Secretary of Environment, stated that the population exceeds the mark of 100,000 inhabitants, conferring a strong tourist character in the place.

**3.1.1 Aspectos Socioeconômicos**

Since the colonization period, São Francisco de Itabapoana has been dominated by episodes that mark the exploratory feature of the municipality. In the environmental sphere, the territory reflects a peculiar signature in the physiographic sense, which provide particularities that design environments with fertile land, such as the cultivation of sugar cane, the first crop to be installed. The socioeconomic situation shows a resilient character, in the sense that, of all the municipalities that cover the Campos Basin, São Francisco de Itabapoana is the only one that has never received royalties from a producing well. While, according to data released by Info Royalties of the Candido Mendes University (2014), based on information from the ANP (National Petroleum Agency), São João da Barra, in 2014, received 32.2 million, while São Francisco de Itabapoana 2,2 million.

Currently, the disproportionate apportionment of royalties associated with the favorable characteristics of the local soil, and the need to develop economically, São Francisco de Itabapoana stood out in agribusiness, fishing / gathering and in agricultural products at the regional and national level. The region is also known as Costa Doce, for having a vast summer vacation potential, enchanting tourists not only from the state of Rio de Janeiro, but also from the two states bordering it, Espírito Santo and Minas Gerais. Offering not only natural beauty, but also cultural and historical resources of colonial farms from the sugar cane rise period (19<sup>th</sup> century).

The territorial position of São Francisco in the Campos Basin includes an auspicious strategic location for serving tourist and business activities, both in the national and international spheres, mainly linked to oil exploration (TEC / RJ, 2016).

**3.2 ENVIRONMENTAL ASPECTS****3.2.1 climate**

The northern region of the state of Rio de Janeiro is represented by the humid tropical climate, dominated by summers with high rainfall and dry winters, with an average of four to five months predominantly dry during the year. The climatic aspects are directly related to the local drainage network, clearly differentiating the seasonal situation and its influence (Ramalho, 2005). The climate of São Francisco de Itabapoana is classified as Aw, according to Köppen and Geiger, with an average

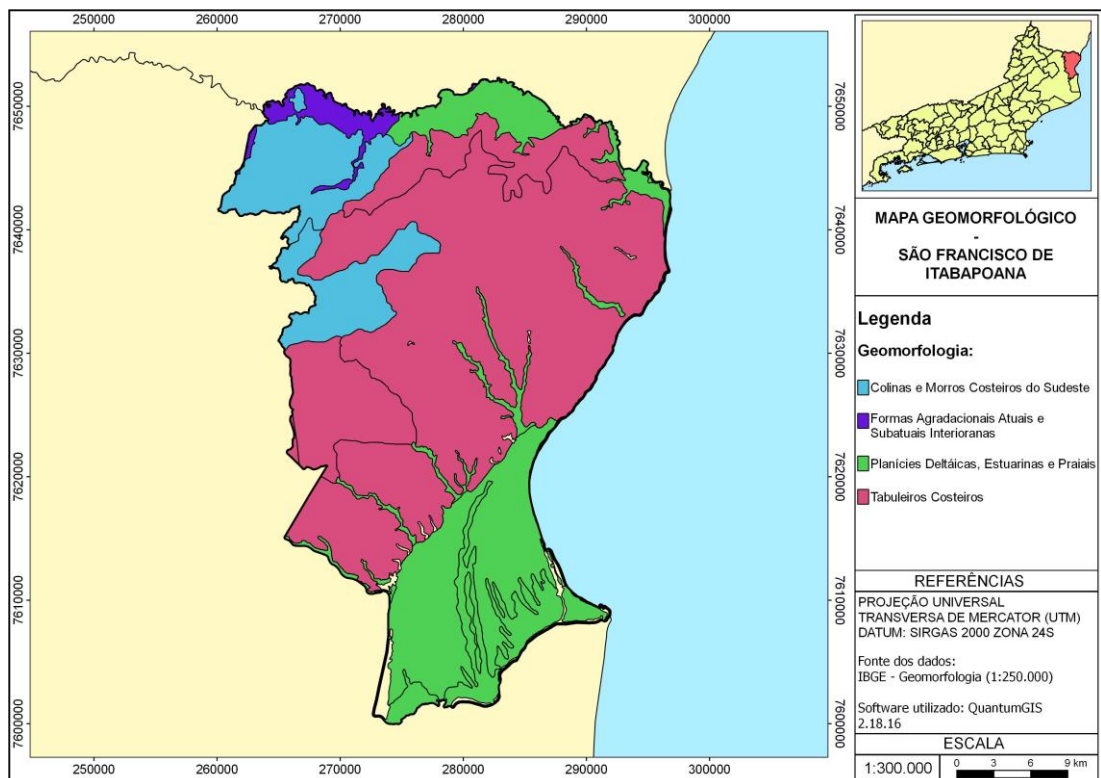
annual temperature of 23.1 ° C and annual rainfall around 1003 mm. February is considered the warmest month, expressing an average of 25.7 ° C, and July, the coldest, 20.4

°. During the year, the variation in temperature averages gives a value of 5.3 ° C (Clima Data, 2018).

### 3.2.2 Geomorphology

The geomorphological context of São Francisco de Itabapoana is part of the Cenozoic Sedimentary Basin Morphostructural Unit, which is divided into three main Morpho-sculptural Units: the Sedimentary Basin Boards, the Fluvio-marine Plains and the Coastal Plains. On a more specific scale, the territory belongs to the Geomorphological Unit classified as Tablelands of São Francisco de Itabapoana (Dantas 2000). In this sense, the Tabomeiros de São Francisco de Itabapoana Geomorphological Unit is expressed by features with tabular shapes, originating from the tertiary sedimentary deposits, named as Grupo Barreiras, characterized by dissected reliefs, where the orientation of the river currents goes towards the sea (Dantas, 2000). For a better demonstration of the morphology of the local relief, the Geomorphological Map (Fig. 1) was made, with the respective geomorphological Units.

Figure 1. Geomorphological Map with the respective Geomorphological Units of the municipality of São Francisco de Itabapoana. Source: IBGE – Geomorfologia (1:250.000) – Software QuantumGis 2.18.16; (Reis et al., 2019).



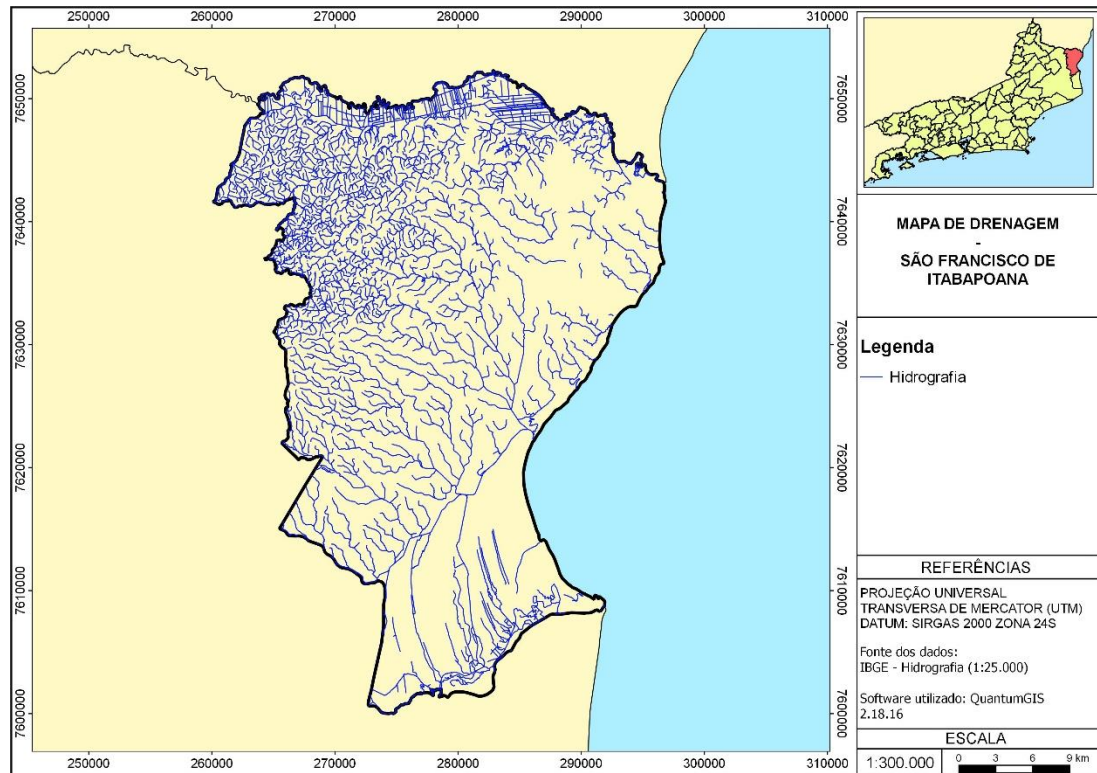
On the map it is possible to see that the region is mostly dominated by Tertiary Tabuleiros and that only to the northwest of the municipality the relief shows higher altitudes, and as a consequence, it is more rugged. The action of exogenous agents promotes a very active dynamic to the place, caused not only by the fluvio-marine activity, but also by elements from the semi-arid climate of the place, providing a range of diversities in the sense of the scenic beauty distributed from north to south in 25 beaches. At the state limits, between Rio de Janeiro and Espírito Santo, it is the place where the evidence of the tertiary structures, the cliffs, appears. In this way, the last secretary of Environment affirmed that the elements of the local landscape are provided with aptitude for tourism investments. Pedology in São Francisco de Itabapoana has four main classes, among them: the Oxisols and Yellow Argisols, referring to the tertiary sedimentary deposits; the haplics, melanic and salic gleysols and fluvial neosols, found in the valleys in "U shaped" formed by the water bodies, sculpted by the tertiary sediments; neossols and spodosols on the coastal sand deposits; red-yellow argisols and red-yellow latosols in areas where rocks of crystalline origin predominate, with gentle hill relief (Guimarães et al., 2010).

### **3.2.3 Drainage**

The municipality is supplied by the Paraíba do Sul Hydrographic Basin (Fig. 2), comprising the most extensive rivers and their tributaries, such as Itabapoana, Paraíba do Sul, Campelo Lagoon, or water bodies that run directly into the ocean, such as the Guaxindiba River (Guimarães et al., 2010).



Figure 2. Paraíba do Sul River Hydrographic Network, representing the distribution of rivers in the municipality of São Francisco de Itabapoana. Source: IBGE – Hydrography (1:250.000) – Software QuantumGIS 2.18.16; Reis et al. (2019).



The map correlates the elements that make up the local drainage and the geomorphology (Fig. 1), where the portions represented by the flat land present an interesting configuration of lagoons, the tablelands comprise a complex network, however, less chaotic than in the areas of hills, precisely because they are embedded in the respective valleys.

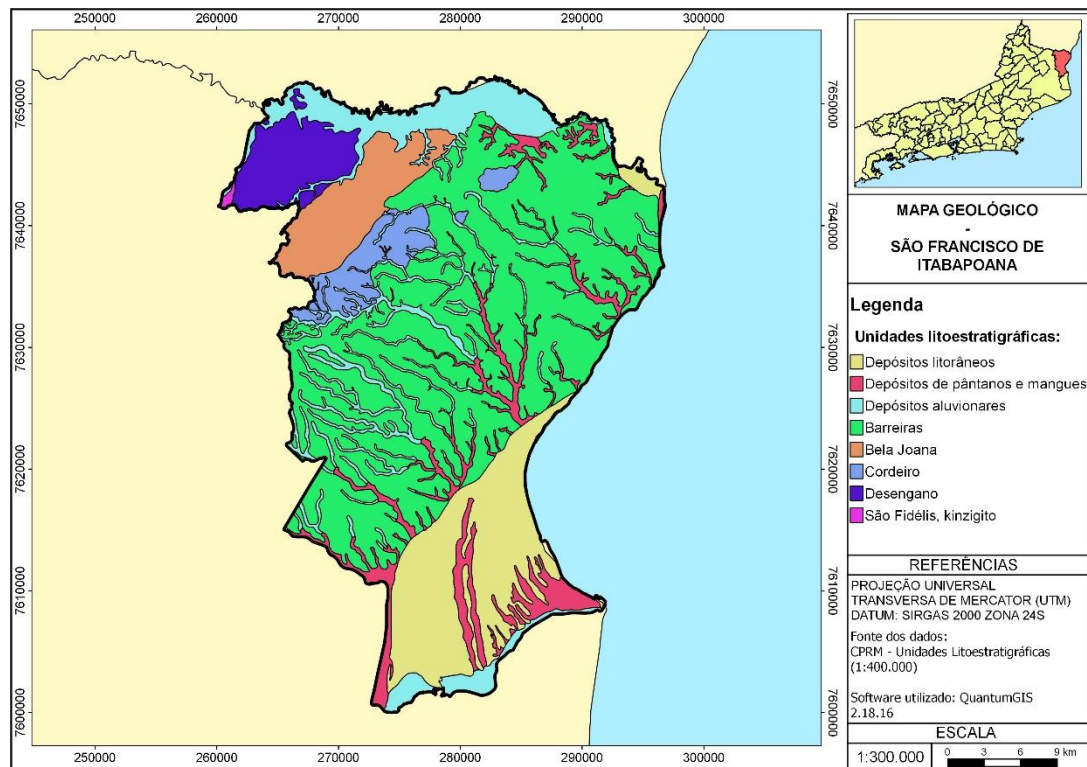
The transition area between rivers and the sea, the mouth of Paraíba do Sul, is responsible for the formation of mangrove forests. Mangroves have an enormous biodiversity, which according to verbal information, foster the local economy, through artisanal fishing, scavenging and even tourism. In addition, Alves et al. (2013) affirm that the geological conditions, show an evident tendency to the dynamics of lagoons and lagoons composing the natural scenario, which also feed the economy of the municipality, through tourism and fishing.



### 3.2.4 Geology

Silva & Cunha (2001) consider that, within the regional context, São Francisco de Itabapoana is inserted in the Ribeira Belt, which according to Almeida (1977) is a geotectonic segment dated to the Neoproterozoic. More specifically, the municipality is located on the Terrain represented by deposits of the Barreiras Group, which were formed during the tertiary period, with rocks considered to be poorly consolidated. On the coast, the Coastal Plains are made up of quaternary sediments, which have a direct relationship with the mouth of the Paraíba do Sul River. Finally, the Precambrian rock base units, composed of crystalline lithotypes, with preferential orientation N-NW-W (Guimarães et al., 2010).

Figure 3. Geological map to represent the Lithological Units present in the study area. Source: CPRM –litho-stratigraphic units (1:400.000) – Software QuantumGIS 2.18.16; Reis et al. (2019).



The Litoestratigraphic Units present in the municipality (Fig. 3) are represented by very old crystalline rocks, such as the São Fidelis Group, Desengano Suite, the carbonatic sequence of the Cordeiro Suite, Bela Joana Suite up to the Barreiras do Tertiary Group and the Quaternary Deposits : Alluvial deposits, Swamp deposits and Coastal deposits, organized respectively under a chronological analysis (Silva & Cunha, 2001).

The evidence of the tabular structures of the Barreiras Group is of exploratory interest both for tourism and for mineral extraction, since it is composed of heavy minerals and red clays and beach sands, which can be used in civil construction. The dynamics of nutrient replacement, at the mouth of Paraíba do Sul, promotes fertile soil, suitable for agricultural activities.

#### **4 CONCLUSION**

The data collected on São Francisco de Itabapoana confirm the potential for investments, especially in ecotourism, fishing and agribusiness. The former public official Ilzomar, pointed out that events are organized on site throughout the year that already promote tourist attraction.

The maps made from the GIS tool allowed a better visualization of the geological elements that make up the landscape of the territory, also serving as a pre-field stage for the next works that seek to understand and enhance the points of geoenvironmental and geotouristic interests.

Therefore, it is noticeable the interest and aptitude of the municipality so that projects that meet social concerns are elaborated, in a conscious and sustainable way, through the implementation of educational programs in the Conservation Units of the region, such as the Guaxindiba State Ecological Station, from the creation of educational scripts that promote geoconservation. In such a way, the data worked point out characteristics that serve as a subsidy for the aforementioned projects, taking into account the potential and vulnerabilities of the territory.

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