

ANÁLISE TEMPORAL (1985-2020) DAS ÁREAS VEGETADAS NA SUB-BACIA DO RIO SALGADO NO SUL CEARENSE

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RESUMO: As áreas vegetadas sofrem com expansão populacional, através de mudanças do uso do solo. Com isso cabe a comunidade científica a responsabilidade de realizar análises, que possam obter informações para evitar problemas ambientais através do planejamento, possibilitando o desenvolvimento humano e consequentemente preservando a natureza. Nesse contexto o seguinte estudo, teve o objetivo de avaliar como as áreas ocupadas com formação vegetal tem se comportado ao longo dos anos na sub-bacia do rio salgado. A área de estudo corresponde a sub-bacia hidrográfica do Salgado, localizada no sul do estado do Ceará. Para as análises, foram obtidos mapas de Cobertura e Uso da Terra através do site do projeto MapBiomias para os anos de 1985, 1990, 1995, 2000, 2005, 2010, 2015 e 2020. As imagens foram classificadas como Rios e Lagos, Formação savânica, Formação campestre e Formação florestal; também foi mesurado a área que cada classe representa em cada ano. Para análise dos resultados foram construídos gráficos para cada classe. Como resultado obtivemos que as áreas vegetadas da sub-bacia do rio salgado tiveram suas áreas mantidas, contrariando o pensamento comum, de que ao longo do tempo há diminuição das áreas vegetadas.

Palavras-chaves: Natureza, Solo, Áreas vegetadas.

TEMPORAL ANALYSIS (1985-2020) OF VEGETATED AREAS IN THE SALADO RIVER SUB-BASIN IN SOUTH CEARENSE

ABSTRACT: Vegetated areas suffer from population expansion through changes in land use. Therefore, the scientific community is responsible for carrying out analyses, which can obtain information to avoid environmental problems through planning, enabling human development and consequently preserving nature. In this context, the following study aimed to evaluate how the areas occupied with vegetation have performed over the years in the Salary River subbasin. The study area corresponds to the Salgado subbasin, which is located in southern Ceará. For the analyses, land cover and use maps were obtained from the MapBiomias project website for the years 1985, 1990, 1995, 2000, 2005, 2010, 2015 and 2020. The images were classified as rivers and lakes, savanna formations, countryside formations and forestry formations. The area that each class represents each year was also measured. To analyze the results, graphs were created for each class. As a result, we determined that the vegetated areas of the Salary River subbasin had their areas maintained, contrary to the common belief that, over time, there was a decrease in vegetated areas.

Keywords: Nature, Soil, Vegetated areas.

1 INTRODUCTION

Areas occupied by vegetation suffer from population growth, use for various purposes and the effects of climate change, resulting in important consequences for these areas (Assad *et al.*, 2020). From this perspective, the scientific community has used analysis methods that can show the behavior of each aspect.

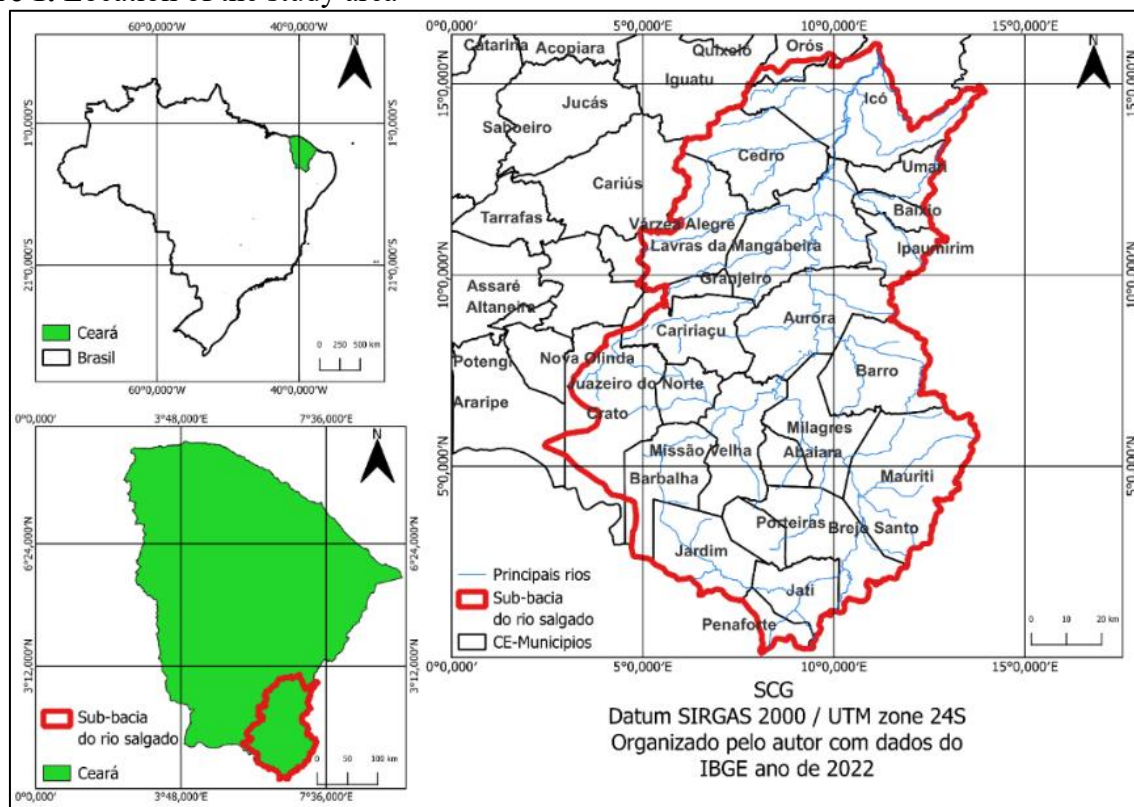
Various methods can be applied, such as temporal and spatial analysis. This method makes it possible to understand the processes of altering geographic space and the effects of these actions on the site, providing a broad view of how society in general interacts with the environment (Ferreira *et al.*, 2022). Providing the prevention of environmental impacts through the transformation of the knowledge obtained in planning, for example, the location of irregular urbanization processes that may become environmental or urban problems (Ataídes; Silva; Rosa, 2020).

In this context, the following study aimed to evaluate how the areas occupied by vegetation have behaved over the years in the Salgado subbasin.

2 MATERIALS AND METHODS

The area of this study corresponds to the Salgado hydrographic subbasin, located south of the state of Ceará, in the range of UTM coordinates 9150000S and 9300000S in latitude and 450000W and 550000W in longitude (Figure 1). It has a drainage network with 308 km of branched extension distributed throughout 23 municipalities and presents a drainage area of 12,623.89 km², with its main drainage being the Salgado River.

The coordinates of the perimeter of the Salgado River subbasin were obtained from the website of the Water Resources Management Company - COGERH. After delimiting the subbasin, the land use and coverage maps of all of Brazil were obtained in *GeoTiff format* through the project website. MapBiomas – collection 8.0 (MAPBIOMAS, 2023) comprises a range of five years, and the years chosen were 1985, 1990, 1995, 2000, 2005, 2010, 2015 and 2020. The image processing was performed in the QGIS *software* version 3.30.3, using the SIRGAS 2000/UTM zone 24S coordinates, with a scale of 1:100,000 and a spatial resolution of 30 meters.

Figure 1. Location of the study area

Source: Authors (2022) and IBGE (2022).

The land use and occupation map was classified according to the value of each *pixel* in the images, using the captions developed by MapBiomas, thus adopting four classes (Rivers and Lakes; Savannah Formation, Grassland Formation and Forest Formation).

The *r.report* tool was used to identify the area occupied by each classification in

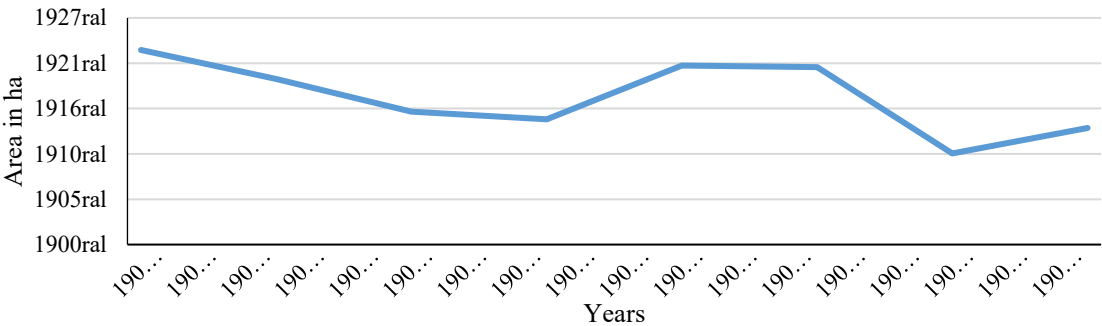
3 RESULTS AND DISCUSSION

Figure 2, shown below, is related to the areas occupied by bodies of water such as

each year, creating a table with all the captions present in the images. With the data obtained, graphs were created via *Microsoft Excel*, with the purpose of interpreting the results to obtain a better analysis of how land use has behaved over the years.

rivers, lakes, dams, reservoirs and other bodies of water, where we can observe the variation over the years, inferring that in 1985, the area in hectares decreased and then increased again in 2005.

Figure 2. Rivers, lakes, dams, reservoirs and other bodies of water

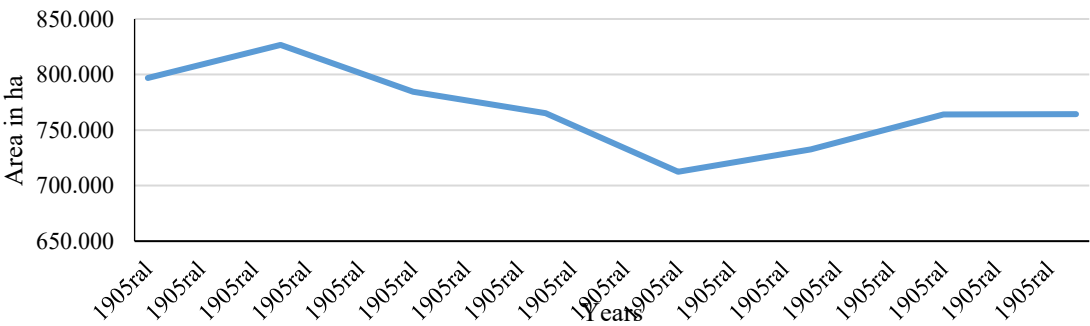


Source: Authors, 2024.

After the interval between 1985 and 2005, the region remained stable until 2010, when it experienced another reduction until 2015. In their studies, Barbosa *et al.* (2021) reported that severe drought occurred from 2012--2017 in the Salgado subbasin, with an increase only in the year 2020.

Figures 3, 4, and 5 present the plant formations present in the study area. In the analysis of the areas classified as savanna formations (Figure 3), a smooth pattern was observed, with most years being between 700 thousand and 800 thousand hectares, with the exception of 1990, which exceeded this range.

Figure 3. Savannah Formation with defined arboreal and shrub-herbaceous strata (Cerrado Strict Sense: Dense Cerrado, Typical Cerrado, Sparse Cerrado and Rocky Cerrado).

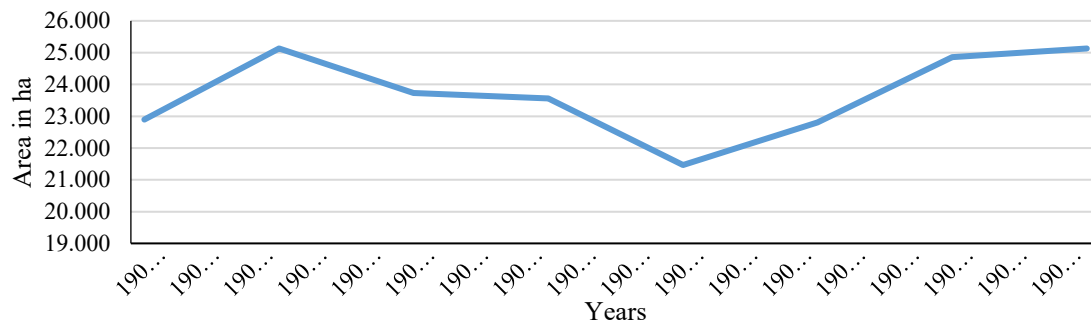


Source: Authors, 2024.

Notably, there was a decrease until 2005, but from that year onward, it began to grow, although until 2020, this increase was not enough to reach the 1985 area. Figure 4

below presents the results of the Campestre Formation, which are similar to those in Figure 3.

Figure 4. Forest formation - types of vegetation with a predominance of tree species, with continuous canopy formation

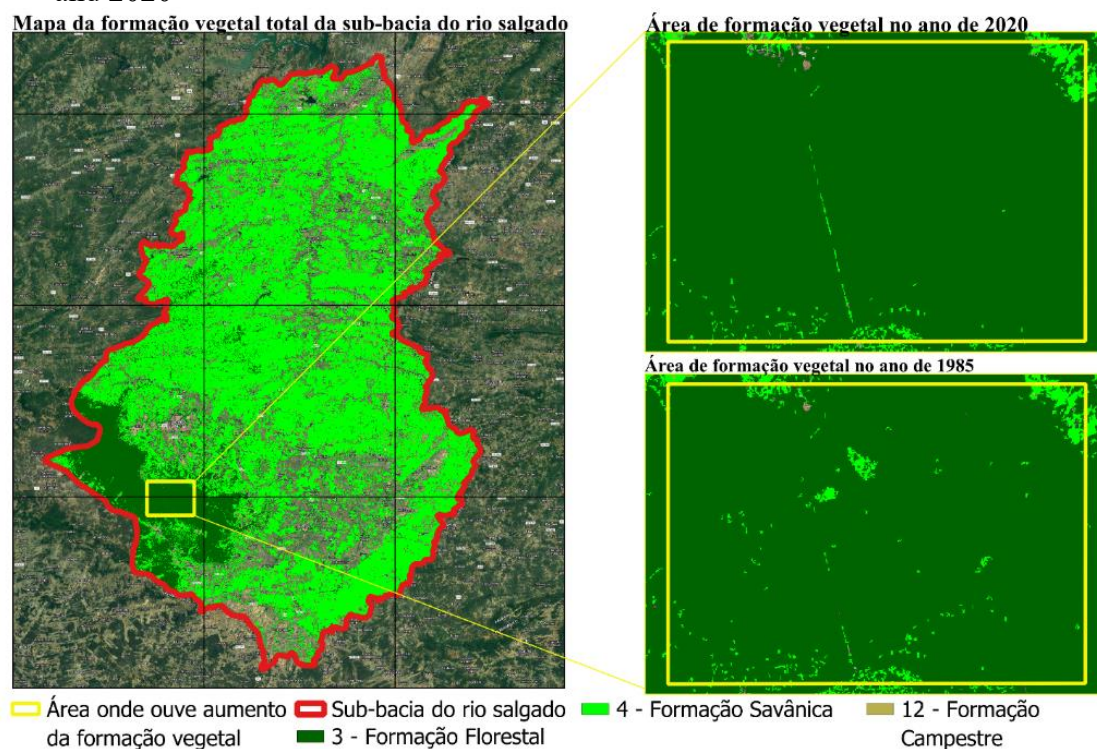


Source: Authors, 2024.

In a general analysis of the plant formations, we can say that the graphs showed stable behavior, with growth and a decrease in areas over the years, but they remained in this

pattern, as shown in Figure 5, which represents the comparison between two different years (1985 and 2020) in the Salgado River subbasin.

Figure 5. Comparison of the areas occupied by the Vegetation and Savannah Formations in 1985 and 2020



Source: Prepared by the authors on the basis of land use and coverage maps (MAPBIOMAS 2023).

Thus, as shown in Figure 2, we can infer that, in 2020, there was a significant increase in the area of forest formation compared with that in the previous year. This result is positive because, according to Michel *et al.* (2021), vegetation has a beneficial impact on the river basin, such as preventing the eutrophication of rivers and lakes and

minimizing the effects of soil erosion. Vegetation becomes extremely important for the preservation of biomes and the protection of existing fauna and flora. Another reason for this result is that, over time, vegetation tends to decrease due to anthropic processes.

4 CONCLUSIONS

Given the results presented, it is possible to infer that the vegetation formation present in the Salgado subbasin presents an oscillation in the occupation of the occupied area. There are periods of increase and decrease in area. In conclusion, the areas occupied by vegetation have significantly evolved over the years in the Salgado subbasin. A significant increase in vegetated areas was noted, which contradicts the current idea that development tends to reduce vegetated areas.

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