

DEFORESTATION AND AGRICULTURAL EXPANSION: TEMPORAL DYNAMICS OF LAND USE AND LAND COVER IN THE MUNICIPALITY OF VITÓRIA DA CONQUISTA, BAHIA, BRAZIL

Desmatamento e expansão agropecuária: Dinâmica temporal do uso e cobertura da terra no município de Vitória da Conquista, Bahia, Brasil

Deforestación y expansión agrícola: Dinámica temporal del uso y cobertura de la tierra en el municipio de Vitória da Conquista, Bahía, Brasil



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ABSTRACT

O The aim of this study was to present a geospatial analysis of land use and land cover in the municipality of Vitória da Conquista using historical images and data from MapBiomass between 1985 and 2024. The analysis of the last 39 years revealed a 55.16% reduction in native forest cover within the municipality. Areas occupied by agricultural activities showed a significant increase, largely driven by the expansion of pasturelands (212%), forestry plantations (4.682%), and coffee cultivation (117.39%). In addition, urban expansion was considerable: in 1985, the urban area covered 3,353 hectares, whereas by 2024 this value exceeded 12,000 hectares, representing an increase of 257.89%. These findings highlight the need for more effective management of natural resources aimed at preserving local biodiversity and promoting a better balance between economic development and sustainability in order to prevent natural resource depletion and land desertification.

Keywords: Caatinga; Conservation; Geoprocessing; MapBiomass; Atlantic Forest.

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RESUMO

O objetivo deste estudo foi apresentar uma análise geoespacial do uso e cobertura da terra no município de Vitória da Conquista, utilizando imagens e dados históricos do MapBiomas entre 1985 e 2024. A análise dos últimos 39 anos revelou uma redução de 55,16% na cobertura de florestas nativas no município. As áreas ocupadas por atividades agropecuárias apresentaram aumento significativo, impulsionado, em grande parte, pela expansão das áreas destinadas à pastagem (212%), à silvicultura (4,682%) e ao cultivo de café (117,39%). Além disso, o crescimento da área urbana foi considerável: em 1985, o perímetro urbano abrangia 3.353 hectares, enquanto, em 2024, esse valor ultrapassou 12 mil hectares, representando um aumento de 257,89%. Esses dados evidenciam a necessidade de uma gestão mais eficaz dos recursos naturais, voltada à preservação da biodiversidade local e ao estabelecimento de um melhor equilíbrio entre o desenvolvimento econômico e a sustentabilidade, a fim de evitar o esgotamento dos recursos naturais e a desertificação da terra.

Palavras-chave: Caatinga; Conservação; Geoprocessamento; MapBiomas; Mata Atlântica.

RESUMEN

El objetivo de este estudio fue presentar un análisis geoespacial del uso y cobertura de la tierra en el municipio de Vitória da Conquista, utilizando imágenes y datos históricos de MapBiomas entre 1985 y 2024. El análisis de los últimos 39 años reveló una reducción del 55,16% en la cobertura de bosques nativos en el municipio. Las áreas ocupadas por actividades agropecuarias presentaron un aumento significativo, impulsado en gran medida por la expansión de las áreas destinadas al pastoreo (212%), a la silvicultura (4,682%) y al cultivo de café (117,39%). Además, el crecimiento del área urbana fue considerable: en 1985, el perímetro urbano abarcaba 3,353 hectáreas, mientras que, en 2024, este valor superó las 12 mil hectáreas, representando un incremento del 257,89%. Estos datos evidencian la necesidad de una gestión más eficaz de los recursos naturales, orientada a la preservación de la biodiversidad local y al establecimiento de un mejor equilibrio entre el desarrollo económico y la sostenibilidad, con el fin de evitar el agotamiento de los recursos naturales y la desertificación de la tierra.

Palabras clave: Caatinga; Conservación; Geoprosesamiento; MapBiomas; Mata Atlántica.

1 INTRODUCTION

The relationship between humans and nature has been the subject of numerous contemporary studies, with landscape dynamics analysis being an important approach for highlighting transformations resulting from land use and land occupation, influenced by economic factors and population growth (Beskow et al., 2013; Jaafari et al., 2015; Miceli et al., 2015; Dutra et al., 2020). In this context, the analysis of land use and land cover becomes essential for environmental studies, as it helps to understand the pressures and impacts on the natural elements present in the landscape (Lima et al., 2019).

The state of Bahia is located in a transition zone between the Caatinga, the Cerrado and the Atlantic Forest and, although it holds rich biological diversity, it is among the



Brazilian states with the highest deforestation rates, with the Caatinga and the Cerrado being the most affected biomes (Evangelista, 2011). Among the main contributing factors, socio-environmental issues stand out, such as deforestation for the expansion of pasture areas, as well as the introduction of coffee cultivation and forestry (Di Lauro, 2011; IBÁ, 2016; Souza; Oliveira, 2024).

Given the need to monitor the impacts resulting from changes in land use and land cover, several studies have been conducted in recent years in municipalities in Bahia, such as Camaçari (Santos; Matos, 2025), Conde (Souza et al., 2024), Itabuna (Silva; Limoeiro, 2025), São Gabriel (Rocha-Neto et al., 2020), São Félix (Souza; Oliveira, 2024), in the Dendê region (Sampaio et al., 2024) and in the microregion of Porto Seguro (Faria-Filho et al., 2015). However, several municipalities still lack studies addressing this topic.

For the municipality of Vitória da Conquista, only one preliminary study on land use distribution has been conducted (Santos et al., 2016), in which only the image from August 10, 2016, was analyzed. This highlights the need for a more comprehensive study that demonstrates changes over the years and supports municipal authorities in defining strategies to mitigate environmental impacts. Therefore, the objective of this study is to conduct a geospatial analysis of land use and land cover in the municipality of Vitória da Conquista over the period from 1985 to 2024, as well as to provide temporal information supporting the conservation and sustainable management of natural resources in the municipality.

2 MATERIALS AND METHODS

2.1 Study area

The municipality of Vitória da Conquista (Figure 1) is located in the Centro-Sul Mesoregion, between the coordinates 14°30' and 15°30' S and 40°30' and 41°10' W, approximately 510 km from the state capital, Salvador (IBGE, 2025). It has a territorial area of 3,254.186 km², a population density of 113.97 (inhabitants/km²) and an estimated population of 394,024 inhabitants (IBGE, 2025). It presents mild temperatures ranging from 17.8 °C to 21.8 °C, and irregular rainfall throughout the year, with higher precipitation between November and March, while the dry season extends from April to September (Conceição et al., 2016).

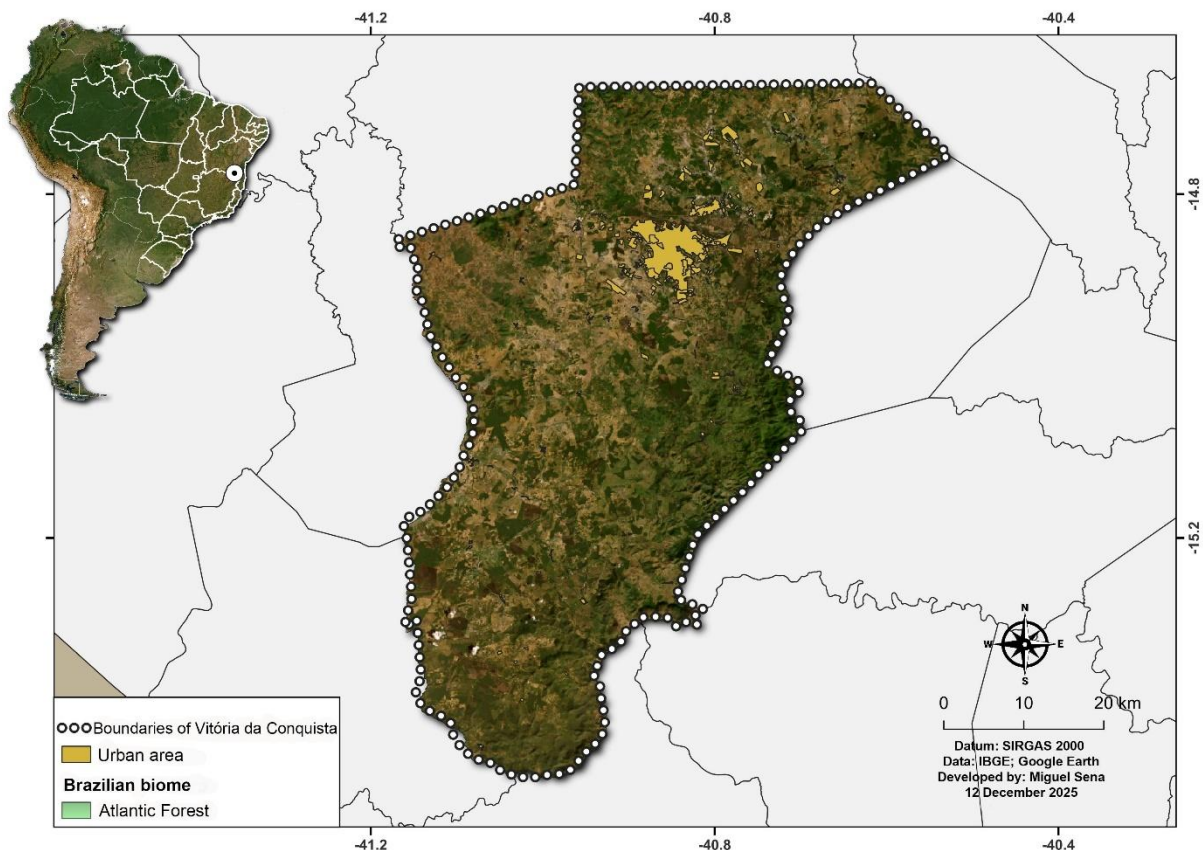
The municipality of Vitória da Conquista is located on the Conquista Plateau, within a transition zone between the Atlantic Forest and the Caatinga, characterized by the



predominance of Montane Seasonal Deciduous Forest (IBGE, 2012), also known as “mata de cipó” (Gouvêa et al., 1976). In Bahia, this vegetation is restricted to the Conquista Plateau (Mori et al., 1981).

The climate in the Vitória da Conquista Plateau region is classified as Cfa (humid subtropical climate) according to the Köppen classification (1936). The region has elevations ranging from 750 to 900 m above sea level, with annual precipitation of approximately 700 to 800 mm (Alvares et al., 2013).

Figure 01 – Map showing the municipality of Vitória da Conquista, Bahia



Source: Created by the authors based on IBGE and Google Earth data (2026).

2.2 Data analysis

To obtain land use and land cover data for the municipality of Vitória da Conquista, historical data and raster images (30 m spatial resolution) from the MapBiomias platform (Collection 10; Souza et al., 2020) were used, covering the period from 1985 to 2024. The data were analyzed using the Google Earth Engine environment, through the Python terminal, and QGIS software (v.3.34.1), using the SIRGAS 2000 datum (QGIS Development Team, 2023). The legends for the land use and land cover data were classified according to



the MapBiomias Brazil Collection 10 manual as follows: (1) Forest; (2) Shrub and herbaceous vegetation; (3) Agriculture and livestock; (4) Non-vegetated area; and (5) Water bodies.

3 RESULTS AND DISCUSSION

After analyzing the five land use and land cover classes in the municipality of Vitória da Conquista over the past 39 years, a reduction in native forest areas and an increase in both urbanized areas and those used for agriculture and livestock were mainly observed (Table 1, Figure 2). This land use and land cover trend has also been observed in other municipalities in Bahia, such as Camaçari (Santos; Matos, 2025), Conde (Souza et al., 2024), Itabuna (Silva; Limoeiro, 2025), and São Gabriel (Rocha-Neto et al., 2020), as well as in other states in the northeastern region (Pereira, 2022; Lopes et al., 2024).

Santos et al. (2016) conducted a land use and land cover mapping in the municipality of Vitória da Conquista, and their analyses revealed that, across most of its territorial extent, the municipality is characterized by the predominance of dry vegetation, accounting for 36.29% of the area. The second most representative class was bare soil, covering 29.96% of the area. This was followed by agriculture/forestry, which accounted for 14% of the territory, while forests occupied 9.99% of the municipality's area. The urban area and burned areas classes showed the lowest proportions, corresponding to 4.87% and 4.89%, respectively.

Table 01 – Changes in land use and land cover classes in the municipality of Vitória da Conquista, Bahia, for the years 1985, 1995, 2005, 2015, and 2024

Land Use and Land Cover Classes	1985 (ha)	1995 (ha)	2005 (ha)	2015 (ha)	2024 (ha)	Variation (%)
1. Forest						
1.1 Forest Formation	48,292	44,874	41,149	36,892	34,844	-27.85
1.2 Savanna Formation	152,564	135,630	134,385	122,680	110,905	-27.31
Mangrove	-	-	-	-	-	
Flooded Forest	-	-	-	-	-	
Wooded Sandbank Vegetation	-	-	-	-	-	
2. Herbaceous and Shrubby Vegetation						

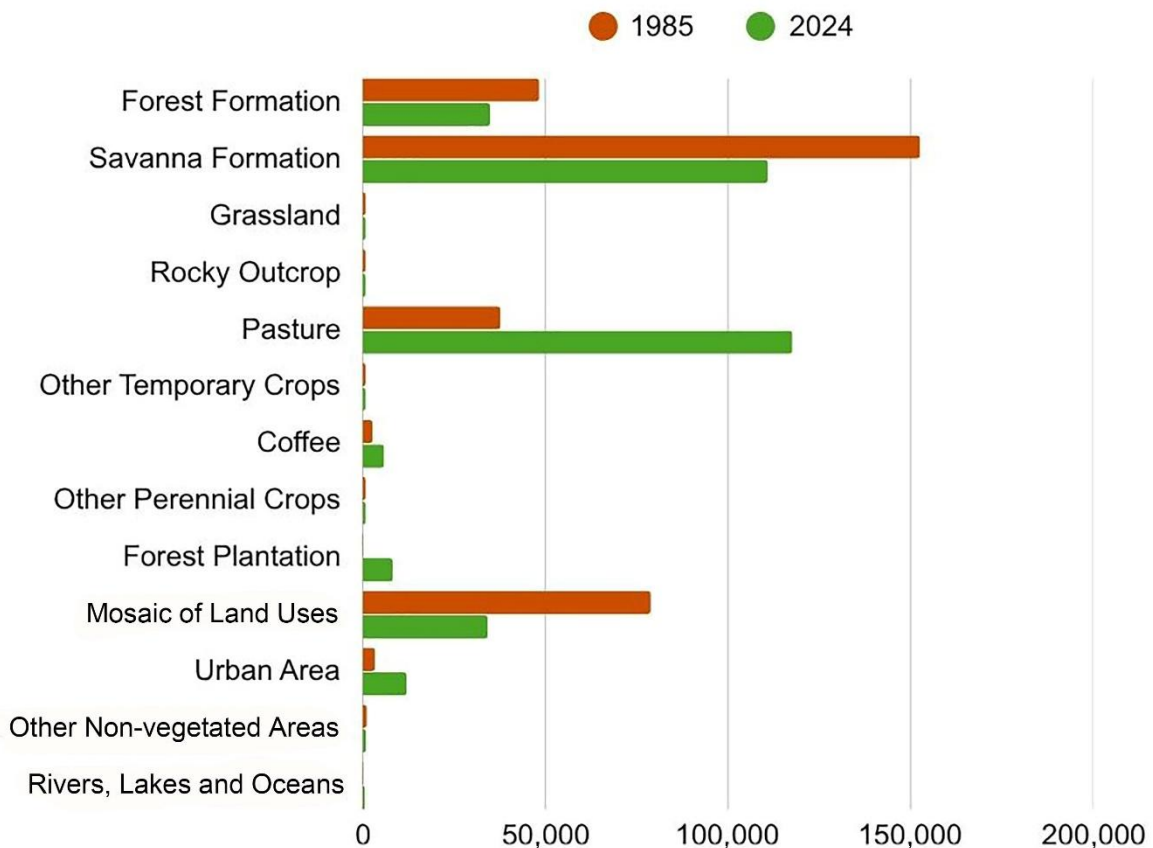


2.1. Wetland	-	-	-	-	-	
2.2. Grassland	61	2	2	2	2	-92.72
2.3. Hypersaline Tidal Flat	-	-	-	-	-	
2.4. Rocky Outcrop	48	19	19	18	18	-62.5
2.5. Herbaceous Sandbank Vegetation	-	-	-	-	-	
3. Farming						
3.1. Pasture	37,694	103,675	109,914	121,424	117,610	+212
3.2. Agriculture	-	-	-	-	-	
3.2.1. Temporary Crop	-	-	-	-	-	
3.2.1.1 Soybean	-	-	-	-	-	
3.2.1.2. Sugar cane	-	-	-	-	-	
3.2.1.3. Rice	-	-	-	-	-	
3.2.1.4. Cotton (beta)	-	-	-	-	-	
3.2.1.5 Other Temporary Crops	39	27	114	106	57	+46.15
3.2.2. Perennial Crop	-	-	-	-	-	
3.2.2.1 Coffee	2,691	4,201	4,929	5,754	5,849	+117.39
3.2.2.2. Citrus	-	-	-	-	-	
3.2.2.3. Palm Oil	-	-	-	-	-	
3.2.2.4. Other Perennial Crops	305	39	55	26	110	-63.93
3.3. Forest Plantation	172	188	678	8,013	8,227	+4.682
3.4. Mosaic of Land Uses	78,830	30,730	26,406	20,548	34,213	-56.57
4. Non vegetated area						
4.1. Beach	-	-	-	-	-	
4.2. Urban Area	3,353	5,320	6,982	9,355	12,003	+257.89
4.3. Mining	-	-	-	-	-	
4.4. Other Non-vegetated Areas	1,118	241	371	35	926	-17.17
5. Water						
5.1. Rivers, Lakes and Oceans	249	470	413	244	653	+162.25
5.2. Aquaculture	-	-	-	-	-	

Source: Created by the authors based on data from the MapBiomias Project (2025).



Figure 02 – Changes in land use and land cover classes in the municipality of Vitória da Conquista, Bahia, between 1985 and 2024 (in hectares)

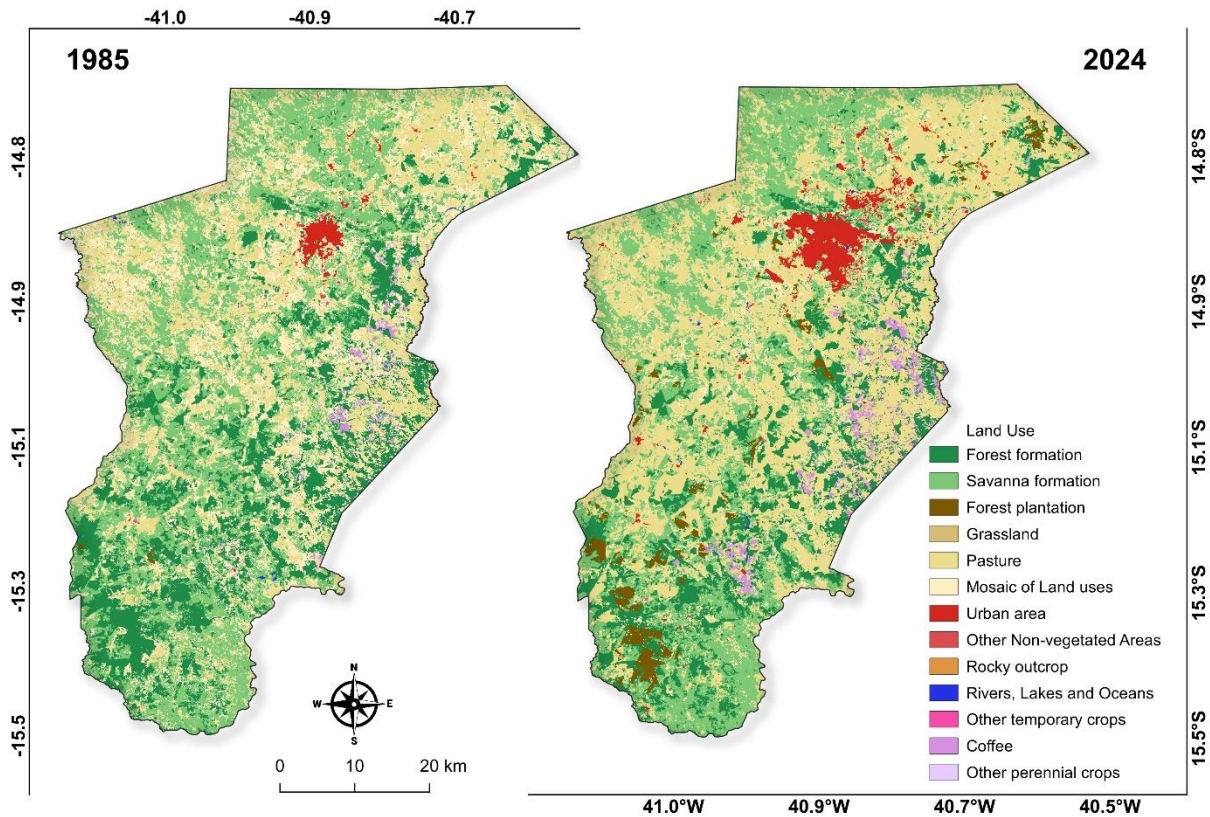


Source: Created by the authors based on data from the MapBiomias Project (2025).

During the period from 1985 to 2024, a 55.16% reduction in native forest cover was observed in the municipality, with 27.85% corresponding to forest formation (Seasonal Deciduous Forest) and 27.31% to savanna formation (Savannas, Forested Steppe Savannas, and Wooded Steppe Savannas) (Table 01, Figure 02). The main cause of the observed vegetation suppression is associated with the expansion of pasture areas resulting from agricultural and livestock activities (Figures 03 and 04). The cultivation of monocultures, such as coffee and eucalyptus forestry, has already been identified by Santos et al. (2016) as responsible for both forest replacement and soil impoverishment and erosion in the municipality of Vitória da Conquista.



Figure 03 – Comparison of land use and land cover classes in the municipality of Vitória da Conquista, Bahia, for the years 1985 and 2024



Source: Created by the authors based on data from the MapBiomias Project (2025).

Shrub and herbaceous vegetation (Table 01, Figure 02) was observed only in grassland formation areas located in the northwestern portion of the municipality (Figure 3), within the transition zone between the Caatinga and the Atlantic Forest, which in 1985 corresponded to only 61 hectares. However, this vegetation was reduced and, in 2024, it corresponded to only 2 hectares, having been converted into savanna formation areas and, mainly, pasture areas (Figure 4), as a result of the intense coffee production in the Conquista Plateau region (Dutra-Neto et al., 2017).

Maximilian Alexander Philipp Wied-Neuwied was the first naturalist to investigate the flora of the Conquista Plateau (Caires et al., 2023). During his passage through the region in 1817, he observed that the area was completely covered by forests (Wied-Neuwied, 1940). Since then, the vegetation has gradually given way first to pasturelands



and later to coffee plantations, following the introduction of coffee cultivation in the early 1970s (Di Lauro, 2011).

Areas used for agricultural and livestock activities increased significantly between 1985 and 2024, mainly due to the expansion of areas designated for pasture, forestry, and agriculture focused on coffee cultivation (Table 1, Figures 2–4). These results corroborate the data from FEP (2019), which identified agricultural and livestock socio-productive activities and pasturelands as the most intensive forms of land use and land occupation in the municipality of Vitória da Conquista between 2000 and 2014.

In the municipality, pasture areas covered 37,694 hectares in 1985 and increased to 117,610 hectares in 2024, representing a growth of 212% (Table 1, Figure 2). This substantial growth of agrosilvopastoral activities is responsible for much of the reduction in vegetation cover within the municipality's territory and has contributed to the intensification of forest fragmentation processes, resulting in biodiversity loss and environmental impacts (FEP, 2019). This highlights the need for studies on land use and land cover in the municipality to assist environmental agencies in identifying the most affected areas and developing conservation strategies.

Areas occupied by agriculture focused on coffee cultivation increased from 2,691 hectares in 1985 to 5,849 hectares in 2024 (Table 1, Figure 2), representing an increase of 117.39% over the past 39 years. Since the 1970s, coffee cultivation has been present in the municipality and is considered one of the main drivers of local economic development, favored by the municipality's natural conditions (Jesus, 2010). However, in recent decades, the expansion of coffee cultivation has been gradually replaced by the expansion of eucalyptus forestry (Santos et al., 2016).

In the state of Bahia, areas planted with eucalyptus (*Eucalyptus urophylla* S.T. Blake) totaled 614,000 hectares in 2015 (IBÁ, 2016). This expansion can also be observed in Vitória da Conquista, where the area occupied by forestry increased from 172 hectares in 1985 to 8,227 hectares in 2024 (Table 1, Figures 2 and 3). Despite the economic benefits, its expansion is associated with socio-environmental impacts such as biodiversity loss, contamination of water resources and, mainly, high deforestation rates in the Atlantic Forest (Lopes et al., 2014). Therefore, a better balance between economic, ecological, and social aspects is necessary in order to ensure more efficient and sustainable land-use management (Vieira et al., 2005).

Within the category of non-vegetated areas, the growth of the urban area in the municipality stood out (Figure 3). In 1985, the urban perimeter covered 3,353 hectares,



whereas in 2024 it expanded to occupy approximately 12,000 hectares (Table 1, Figures 2 and 3). Accelerated urban growth has also been observed in other municipalities in Bahia, such as Conde (Souza et al., 2024), São Gabriel (Rocha-Neto et al., 2020), and Itabuna (Silva; Limoeiro, 2025), and may be related to the high concentration of pulp industries responsible for generating employment and income not only in southwestern Bahia but throughout the state (IBÁ, 2016; Santos et al., 2016).

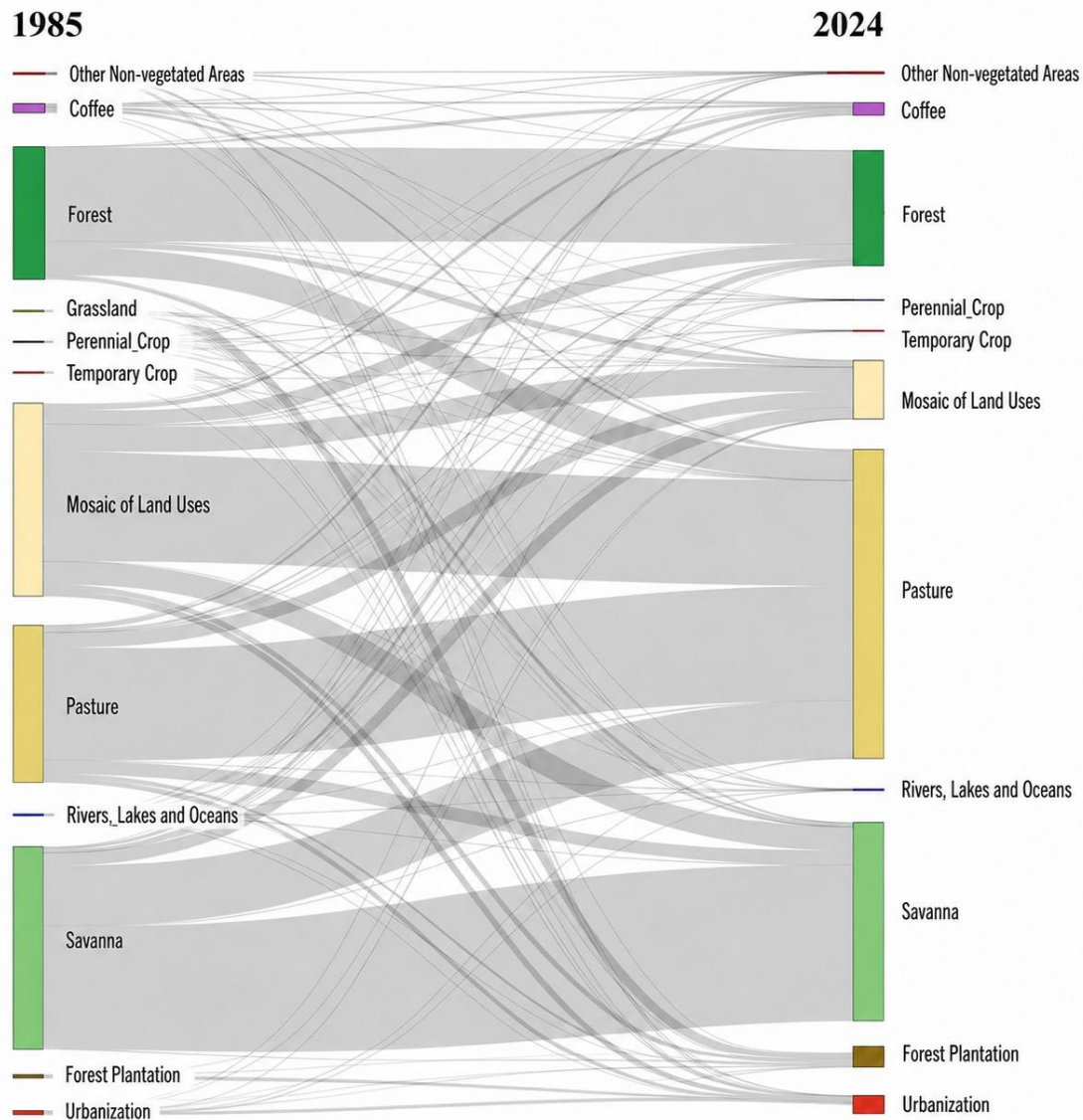
One of the negative consequences of unplanned urban growth in Vitória da Conquista is related to the pressure and environmental impacts exerted on the three conservation units located within the municipality's urban area. These impacts are associated with different structural, economic, and cultural demands, such as the removal of woody species for energy supply, the extraction of minerals used in civil construction, irregular water withdrawal, as well as the illegal hunting and trade of wild animals (Vitória da Conquista, 2022).

The Water Body class showed an increase in flooded areas corresponding to the municipality's rivers. In 1985, the area occupied by rivers was 249 hectares and, in 2024, it increased to 653 hectares (Table 1, Figure 2). Although river areas showed an increase of 404 hectares (162.25%) over the past 39 years, measures are still needed to address the contamination of rivers, lakes, and groundwater caused by the use of pesticides and fertilizers.

The analysis of the period demonstrates significant fluctuations in the Water Body class, with variations from 249 hectares in 1985 to 413 hectares in 2005 and 244 hectares in 2015. It should be noted that these variations may be related to the time of year in which each image was captured, since rainfall in Vitória da Conquista occurs irregularly. The period of highest rainfall occurs between November and March, while the dry season extends from April to September (Conceição et al., 2016; Campos et al., 2020). Therefore, images acquired at different stages of the hydrological cycle tend to record differences in the extent of water bodies, which may contribute to the fluctuations observed among the analyzed years.



Figure 04 – Changes in land use and land cover in the municipality of Vitória da Conquista, Bahia, for the years 1985 and 2024



Source: Created by the authors based on data from the MapBiomias Project (2025).

4 CONCLUSION

The data mainly revealed the significant conversion of native vegetation areas into pasture and agricultural lands. The 55.16% reduction in native forest cover in the municipality indicates an intense process of environmental degradation, with most of its original area already converted into pasturelands and coffee plantations. Montane Seasonal Deciduous Forest, or “mata de cipó,” is a phytophysiology restricted to the Conquista Plateau in the state of Bahia, a fact that highlights the urgency of initiatives aimed at preserving this vegetation formation.



Thus, the data indicate the need for more efficient management of natural resources aimed at preserving local biodiversity and achieving a greater balance between economic development and sustainability. The development of public policies in collaboration with the relevant environmental agencies, focused on monitoring and implementing sustainable strategies, may contribute to slowing the expansion of agricultural and livestock activities and deforestation, thereby helping to prevent the depletion of natural resources and soil desertification.

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