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Physiography of the Productive Zones of the Dairy Basin of Juína-MT

Fisiografia das zonas produtivas da bacia leiteira de Juína-MT

Josemir Paiva Rocha[1]; João dos Santos Vila da Silva[2]

[1] Federal Institute of Education, Science and Technology of Mato Grosso (IFMT), Graduate Program in Geography (PPGGEO), State University of Mato Grosso (UNEMAT), Cáceres, Mato Grosso, Brazil. E-mail: josemir.paiva@ifmt.edu.br
ORCID:https://orcid.org/0000-0002-6995-211X

[2] Embrapa Digital Agriculture, Graduate Program in Geography (PPGGEO), State University of Mato Grosso (UNEMAT), Cáceres, Mato Grosso, Brazil. E-mail: joão.vila@embrapa.br
ORCID: https://orcid.org/0000-0003-3973-9745

Abstract: This article presents a physiographic analysis of the productive zones that make up the dairy basin of the municipality of Juína, located in the northwest of Mato Grosso. The research aimed to characterize the natural elements—relief, soils, geology, hydrography, vegetation, and climate—of the six identified productive zones: Gleba Iracema, MT-170, Lines 04 and 05, Terra Roxa, Vale do Juínão Settlement, and Green Belt. To achieve this, fieldwork was conducted, including on-site observations, photographic records, and the collection of cartographic and bibliographic data. The results show that the dairy basin is established in a territory marked by significant environmental diversity, influenced both by the transition between the Amazon and Cerrado biomes and by the local geomorphological and pedological compartmentalization. The integrated analysis revealed the impact of natural conditions on the organization of the agrarian space and the modes of land use, highlighting the importance of rural planning based on regional specificities. The proposed regionalization and the physiographic description of the productive zones contribute to guiding public policies and technical actions aimed at the sustainability of dairy farming and the strengthening of family farming in the Amazonian-Mato Grosso context.

Keywords: Juína; Dairy basin; Physical geography.

Resumo: Este artigo apresenta uma análise fisiográfica das zonas produtivas que compõem a bacia leiteira do município de Juína, situado no noroeste de Mato Grosso. A pesquisa teve como objetivo caracterizar os elementos naturais – relevo, solos, geologia, hidrografia, vegetação e clima – das seis zonas produtivas identificadas: Gleba Iracema, MT-170, Linhas 04 e 05, Terra Roxa, Assentamento Vale do Juínão e Cinturão Verde. Para isso, foram realizados trabalhos de campo com observações *in loco*, registros fotográficos e levantamento de dados cartográficos e bibliográficos. Os resultados evidenciam que a bacia leiteira está assentada em um território marcado por significativa diversidade ambiental, influenciada tanto pela transição entre os biomas Amazônia e Cerrado quanto pela compartimentação geomorfológica e pedológica local. A análise integrada revelou o impacto das condições naturais na organização do espaço agrário e nos modos de uso da terra, ressaltando a importância do planejamento rural com base nas especificidades regionais. A regionalização proposta e a descrição fisiográfica das zonas produtivas contribuem para orientar políticas públicas e ações técnicas voltadas à sustentabilidade da atividade leiteira e à valorização da agricultura familiar no contexto amazônico-matogrossense.

Palavras-chave: Juína; Bacia leiteira; Geografia física.

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1. Introduction

The municipality of Juína, located in the northwestern region of Mato Grosso, stands out as an agricultural area marked by the presence of family farming and significant milk production. This municipality, with an area of 26,397.173 km², has an estimated population of 47,800 inhabitants and a population density of 1.74 inhabitants/km² (IBGE, 2025). It was colonized in the late 1970s and has dairy farming as an important sector of the economy. According to the Mato Grosso Research, Assistance and Rural Extension Company (Empaer, 2017), approximately 216 rural properties develop dairy farming in the municipality, an activity that produced approximately 10.5 million liters of milk in 2019, injecting around 12 million reais into the local economy (IBGE, 2021). Furthermore, this activity significantly contributes to keeping people in rural areas by providing a fixed monthly income, thus preventing the expansion of cultural erosion processes and rural exodus, common in several cities in Mato Grosso. Hence the importance of the dairy basin in the municipality of Juína.

A dairy basin is a supply zone where several rural properties are dedicated to milk production. They generally encompass one or more municipalities belonging to a specific region, and the production is usually channeled to a group of specific dairy industries that process and distribute this production to a consumption center. According to Guerra (2019, n.p.), "the term dairy basin means a region formed by several agricultural properties dedicated to the activity. Generally located in the same region, milk production is delivered to only one processor (dairy) or to the same final consumption center." Therefore, since it is a spatial area with its own characteristics that can differentiate it from other areas, the term Dairy Basin is, above all, a region. And this can be divided into sub-regions based on the objects analyzed in this space.

In Juína, a fundamental aspect of territorial organization is the significant presence of Indigenous Lands (T.I.). In total, there are four: Serra Morena, Aripuanã, and Parque Aripuanã, inhabited by the Cinta Larga people, and the Enawenê Nawê Indigenous Territory, belonging to the people of the same name. Together, these lands represent a significant 63% of the municipality's territorial area, encompassing almost the entire western and southern portion of Juína. In contrast, areas belonging to non-indigenous people are concentrated mainly in the eastern part and in a small strip in the extreme southwest of the municipality.

It is in this territory of non-indigenous occupation that the municipality's dairy basin is located. Dairy cattle farming, as highlighted by Vecchi et al. (2013), represents the main economic activity in many family farms in the state of Mato Grosso, a reality also observed in Juína. However, factors such as the low genetic standard of the herd, pasture degradation, lack of adequate feed supplementation, low level of education among producers, and scarcity of technical assistance result in low productivity rates (ROCHA E SILVA, 2024).

In this scenario, it becomes fundamental to understand the natural conditions of the territory, since physiographic elements such as geology, relief, soils, hydrography, vegetation, and climate directly interfere with the spatial organization of agricultural production and the management practices adopted by producers (CHRISTOFOLETTI, 1985; CORRÊA, 1994). The concept of region, according to Haesbaert (2002) and Bernardes (1969), contributes to the integrated analysis of these elements, allowing the delimitation of zones with homogeneous characteristics and differentiated productive potential.

Knowledge of the physiography of regions, combined with an analysis of socioeconomic aspects, allows for a broader understanding and can support the development of efficient public policies. Soil, for example, directly affects pasture conditions, which in turn are essential for good herd productivity. Therefore, knowing the predominant soil characteristics in a region allows for the proper planning of soil management actions for forage production for the herd. Climate, in turn, directly affects both forage production and animal welfare (heat stress, increased risk of disease). Knowledge of this aspect of physiography allows public and private organizations that provide technical assistance to offer solutions that mitigate the effects of climate on milk production. Based on the regionalization proposed by Rocha and Silva (2024), this article aims to describe the physiographic characteristics of the six productive zones that make up the Juína dairy basin: Gleba Iracema, MT-170, Linhas 04 and 05, Terra Roxa, Assentamento Vale do Juinão, and Cinturão Verde. The analysis of these zones seeks to support rural planning and offer technical support for public policies aimed at the sustainable development of dairy farming.

2. Methodology

2.1 Research Area

This research was developed focusing on the dairy basin of the municipality of Juína, in the state of Mato Grosso, Brazil, as characterized by Rocha and Silva (2024). Located in the Northwest-1 planning region, this municipality was

colonized starting in the 1970s and became independent in 1982. Situated between parallels 10º and 12º South and meridians 58º and 60º, its seat is located in the eastern portion of the municipal territory at coordinates 11º 25' 10" South – 58º 45' 27" West. It has a territorial extension of 26,397.173 km², of which 63% are indigenous lands (Figure 1).

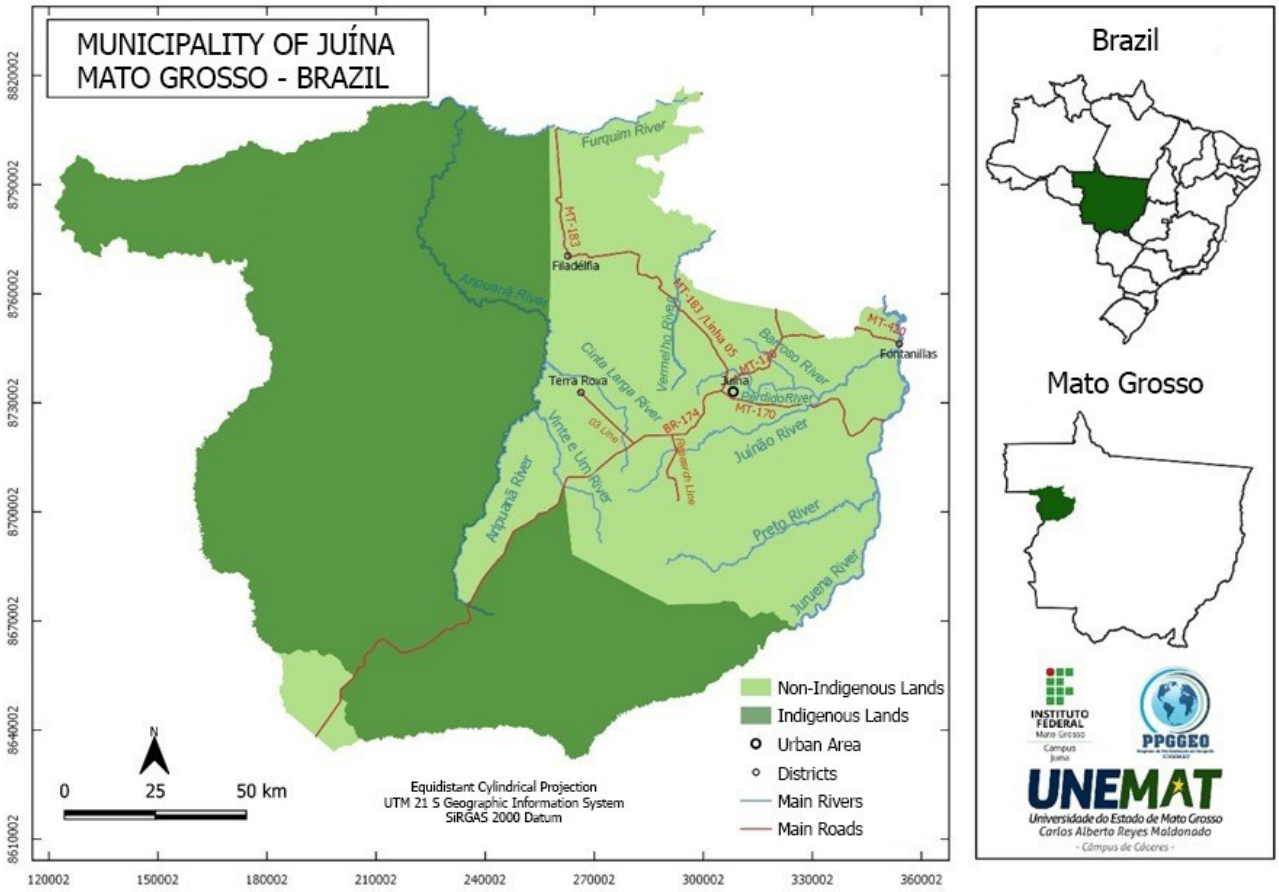

Figure 1 – Map of the municipality of Juína.
Source: Authors (2021).

Regarding the characteristics of the physical geography, the predominant climate in the municipality of Juína, according to Santos (2000), Piaia (2003) and Miranda and Amorim (2000), is the Hot Humid Equatorial climate with 3 to 4 months of drought. However, it should be noted that in the last 10 years the drought period has been more severe and extensive, and the climatic characteristics may have changed, making it necessary to even reclassify the climate type to Humid Tropical Climate.

The geology of Juína is marked in the north by the presence of the Serra da Providência Suite, the Rio Pardo, Rio do Sangue and Vitória Intrusive Suites; Metavolcanic-sedimentary and Metavolcanic Units with ages between 1 and 1.8 billion years belonging to the Amazonian Craton, and frequently occurring in this area are also the Ferruginous Detrital-Lateritic Covers of Pleistocene formation. To the south are the units belonging to the Parecis Sedimentary Basin: Utiariti Formation, Salto das Nuvens, Fazenda Casa Branca, Pimenta Bueno. Kimberlites and Lamproites also occur sporadically in this area, which is between 65 and 542 million years old. Throughout the territory, alluvial deposits formed during the Holocene occur around the most significant watercourses, as pointed out by Martins and Abdallah (2007) and Miranda and Amorim (2000).

Regarding the relief, Juína presents five geomorphological units: to the south, the Parecis Plateaus and Highlands; in the central and northeastern part of the municipality, the Northern Mato Grosso Depression alternates with the Northern Mato Grosso Residual Plateaus and Mountains; and in the northwestern portion, the Dardanellos Plateau occurs, as pointed out by Camargo (2011).

IBGE (2009) in a mapping of the soils of Mato Grosso pointed out that in the southwestern portion of the municipality of Juína, Quartzarenic Neosols predominate, in the southeastern portion there is a predominance of Red-Yellow Latosols, as well as in the extreme north. In the central-northern strip, being the most expressive soil class in the municipality, are the Red-Yellow Argisols. Scattered throughout the territory there are also Regolithic and Litholic Neosols, Petric Plinthosols and Eutrophic Red Nitosols.

Entirely within the Amazon Hydrographic Basin, the municipality is marked by the watershed that cuts Juína in a south-north direction, dividing the sub-basins of the Aripuanã River in the western portion and the Juruena River in the eastern portion. The tributaries of the Aripuanã River within the municipality are the 21, Amarelinho, Furquim, Cinta Larga and São Luiz Rivers. The Juínão, Perdido, and Vermelho Rivers are tributaries of the Juruena River.

Finally, it is worth noting that the municipality of Juína is located in a transition zone between the Cerrado and Amazon Biomes. This ecotone is most clearly expressed in the latitudinal zone that cuts through the urban area of the municipality, and moving from south to north will always distance the observer from the characteristics of the Cerrado Biome and bring them closer to aspects of the Amazon Biome.

2.2 Methodological Procedures

To characterize the physical geography of the municipality and describe the environmental aspects of the Productive Zones, where climatic, hydrographic, geomorphological, geological, pedological, and vegetational aspects were explained, the methodology used was fieldwork, with on-site visits and photographic records. To provide a greater scientific framework to this characterization, an analysis of physical maps, technical and scientific documents produced by bodies such as the State Secretariat of Planning of Mato Grosso (SEPLAN-MT), the Mineral Resources Research Company (CPRM), the Brazilian Agricultural Research Corporation (EMBRAPA), and the Brazilian Institute of Geography and Statistics (IBGE) was carried out. The works of Martins and Abdallah (2007), Camargo (2011), Santos (2000), IBGE (2009), and Embrapa (2018) stand out, serving as the basis for this characterization.

The fieldwork consisted of on-site visits focused on direct observation of the landscape and the collection of georeferenced photographic records, allowing for the identification and validation of natural features and land use patterns. Additionally, thematic maps and cartographic databases produced by official institutions, such as the Mato Grosso State Planning Secretariat (SEPLAN-MT), the Mineral Resources Research Company (CPRM), the Brazilian Agricultural Research Corporation (EMBRAPA), and the Brazilian Institute of Geography and Statistics (IBGE), were analyzed. The theoretical and methodological foundation was enriched by consulting scientific publications and technical documents, notably the works of Martins and Abdallah (2007) regarding local geology; Camargo (2011) concerning relief and vegetation cover; and Santos (2000) discussing the regional climate. IBGE (2009) and Embrapa (2018), concerning the characterization and mapping of soils, provided important conceptual and empirical references for understanding the local environmental dynamics.

3. Results and discussion

According to Rocha and Silva (2024), the dairy basin of the municipality of Juína-MT presents a territorial configuration composed of distinct Productive Zones, strategically distributed around the municipal seat (Figure 2). In the northern portion, the Productive Zones of Lines 04 and 05 stand out, as well as the Iracema Glebe, the latter associated with the district of Filadélfia, which represents an important area for the expansion of agricultural activity. To the south is the Productive Zone of the Vale do Juinão Settlement, characterized by family production units and diversified agricultural practices based on agroecological principles.

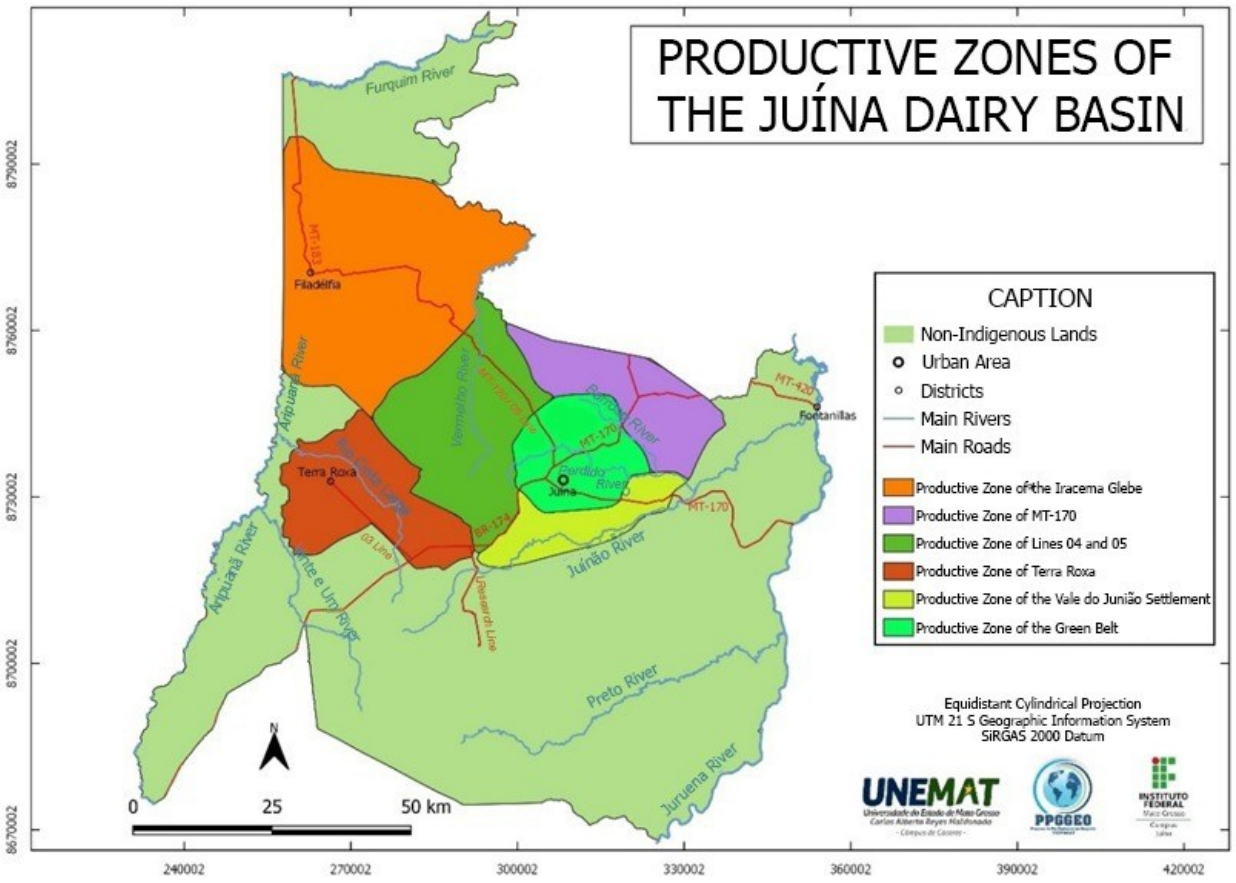

Figure 2 – Juína Dairy Basin and its Production Zones.
Source: Rocha e Silva (2024).

To the east, along the MT-170 highway, lies the Production Zone that establishes a territorial connection with the municipality of Castanheira, favoring the flow of production and regional integration. At the western end is the Terra Roxa Production Zone, linked to the homonymous district, whose dairy activity has significant representation in the local economy. Finally, distributed peripherally to the urban center, the Green Belt Production Zone is configured as an area of intensive production of short-cycle food products, with a fundamental role in supplying the urban population and strengthening short marketing circuits.

3.1. Productive Zone Gleba Iracema

This productive zone is located in the northern region of the municipality of Juína, near the district of Filadélfia. It comprises the rural settlements Gleba Iracema I, II, and III, which are situated along the MT-420 highway, approximately 60 km from the municipal seat.

This region is located on the watershed between the sub-basins of the Furquim and Vermelho rivers, which are tributaries of the Aripuanã and Juruena rivers, respectively. Martins and Abdallah (2007) highlighted that this region is within the Metavolcanic-sedimentary Unit of the Roosevelt Group, characterized by outcrops of granitoid boulders (Figure 3), and in some areas, outcrops of ferruginous metapelites. The Serra da Providência Granite unit also occurs in the western part of this area, with intense outcrops.

According to Camargo (2011), the geomorphological unit where this productive zone is located is the Chapada Dardanelos, which presents residual reliefs in this environment. There is no uniformity of topography in the terrain, which is quite rugged and can be characterized as undulating relief.

Figure 3 – Outcrop of the Serra da Providência Granite.
Source: Authors (2020).

Regarding the soils, four classes are found in this region: dystrophic red-yellow Argisols, concretionary petric Plinthosols, dystrophic lithic Neosols, and dystrophic red-yellow Latosols. Figure 4 highlights this Latosol environment on the Chapada Dardanelos.

Figure 4 – Latosol settled on the Dardanelos Plateau.
Source: Authors (2020).

The climate in this productive zone is defined by Santos (2000) as humid continental equatorial with a defined dry season in the southern Amazonian depression, an average temperature of 24 °C and annual rainfall of 2100 to 2300 mm, with a dry period from June to September. This region has higher rainfall compared to other areas of the municipality.

These climatic, hydrographic, geological, geomorphological and pedological characteristics favor the existence of the Ombrophilous Forest in the region. Camargo (2011) describes this vegetation formation as a multi-layered forest, the canopy is between 20 and 30 meters high while the emergent layers can reach 45 meters. Evergreen species predominate and it generally occurs in more humid tropical environments.

3.2. Productive Zone of MT-170 Juína-Castanheira

This region is located around the MT-170 State Highway in the stretch that connects the municipality of Juína to the municipality of Castanheira. It includes producers located along the highway, as well as milk producers from lines 09, 07, and Barroso. Regarding the geological characteristics of this region, Martins and Abdallah (2007) highlighted that the existing geological unit is the Serra da Providência Granite, a batholith of Rapakivi-textured granites. This unit supports undulating relief massifs and outcrops in boulders, such as those that can be observed on the banks of the Rio das Pedras on the border between the municipalities of Juína and Castanheira.

The relief in this productive zone is the Northern Mato Grosso Depression (CAMARGO, 2011). Regarding this geomorphological unit, Ferreira and Lemes (2011), in a study on the geomorphological compartmentalization of the municipality of Juína, highlighted that these are dissected areas in convex forms and frequently punctuated by residual reliefs, as shown in Figure 5. These conditions, associated with a gently undulating relief, give this zone a predominance of dystrophic red-yellow Argisols.

Figure 5 – Gently undulating relief in the areas where Argisols occur.
Source: Authors (2020).

The climate in this region is humid continental equatorial with a defined dry season in the southern Amazonian depression; the average temperature is 24 °C and the annual rainfall is 2100 to 2300 mm, with a dry period from June to September (SANTOS, 2000).

Regarding hydrography, this area is crossed by tributaries of the Rio Perdido, such as the Rio Barroso, an important tributary on the left bank, and the Rio Sete de Setembro, which has its headwaters near line 09. Land use in this already heavily anthropized region is almost entirely dedicated to agriculture and livestock farming, which means that this productive zone does not show strong evidence of past vegetation, but rather remnant formations, as discussed by Camargo (2011). These remnants of vegetation formations no longer present the original floristic, structural, and dynamic characteristics due to timber extraction, clearing, and edge effects. Thus, secondary species of low economic value prevail.

3.3. Productive Zone of Lines 04 and 05

This productive zone encompasses producers in lines 01, 04, 05, 06, Flor da Serra, and Caiabi. This area is located north of the municipality's headquarters and extends from the end of the smallholding sector to the entrance of the rural settlements of Gleba Iracema. In this region, the hydrographic sub-basin of the Rio Vermelho is formed, an important tributary of the left bank of the Rio Juruena.

Regarding the geological unit present in this region, the Serra da Providência Granite, Martins and Abdallah (2007) described it as the main body of the massive batholith of the Serra da Providência Suite, where Rapakivi-textured granites outcrop and give the relief an undulating and convex aspect. Regarding geomorphology, Camargo (2011) points out that this region is located in the North Mato Grosso Depression on the southern edge of the Chapada Dardanelos and the northern edge of the Chapada dos Parecis, but in several points of this Depression the North Mato Grosso Residual Plateaus emerge (Figure 6), evidenced in the mountain region, mainly in lines 01 and Flor da Serra, watersheds of the sub-basins of the Perdido and Vermelho Rivers.

Figure 6 – Flor da Serra Line. View of the tops of the Residual Plateaus of Northern Mato Grosso with a view of the Northern Mato Grosso Depression in the background where the urban site of Juína is located.
Source: Authors (2020).

The soils found in this productive zone are the soils that predominate in the municipality of Juína, the dystrophic red-yellow Argisols. Characteristic of these reliefs of convex hills in ancient, worn-down massifs. They are soils of low fertility

and their use in disagreement with environmental legislation can lead to serious erosion problems in these hills due to the slope of the terrain.

According to Santos (2000), the climate in this productive zone is humid continental Equatorial with a defined dry season of the southern Amazonian depression. Average temperature of 24 °C and annual rainfall of 2100 to 2300 mm, with four dry months and concentration of rain from October to May.

This area, being of older colonization (30 years) compared to other regions of the municipality, also presents immense anthropized spaces dedicated to agricultural practices.

Thus, regarding vegetation, Camargo (2011) reported that secondary formations predominate, these remnants no longer presenting the original floristic, structural, and dynamic characteristics. However, in these mountainous regions, such as in lines 01 and Flor da Serra, there are still fragments that can be classified as Seasonal Forests.

3.4. Terra Roxa Productive Zone

The Terra Roxa district is located 70 km west of the municipal seat of Juína. Surrounding it is a green belt of small farms and rural properties where family farmers develop numerous activities, mainly agriculture. However, there are also some milk producers in this region; therefore, the Terra Roxa productive zone encompasses the milk producers in the belt surrounding the district.

The geology of the region, as defined by the Mineral Resources Research Company - Geological Survey of Brazil - CPRM, according to studies by Martins and Abdallah (2007), is the Serra da Providência Suite with two units in contact: Serra da Providência Granite and Juína Gabbro. Sequences of rock outcrops of both Serra da Providência Granite, with Rapakivi texture, and Gabbros, dark-colored intrusive rocks with phaneritic texture, are common. In turn, the relief in this productive zone is the Northern Mato Grosso Depression in consonance with residual reliefs of the Chapada Dardanelos (CAMARGO, 2011).

The soils present in this area are dystrophic red-yellow Argisols, found further north in the district in the areas of the Serra da Providência Granite unit. These soils occur in areas of undulating to strongly undulating relief. They exhibit low fertility in contrast to the eutrophic red Nitosols found in the southern part of the district in the Juína Gabbro geological unit (relationship expressed in Figure 7). These are classified by Embrapa (2018) as soils constituted by mineral material, with 350 g Kg^{-1} or more of clay, already in the A horizon. As for the nitic B horizon, it should occur just below the A horizon and present clay of low or high activity if combined with an aluminic character, both in the initial 100 cm of the B horizon.

Figure 7 – In areas where gabbros outcrop, there is an occurrence of Eutrophic Red Nitosols in the surrounding area; the color of these soils gave rise to the name of the Terra Roxa District.
Source: Authors (2020).

Regarding the hydrography of the region, the São Luiz, Arroz, and Porcão rivers stand out, all tributaries of the Cinta Larga River, which in turn is a tributary of the right bank of the Aripuanã River. According to Santos (2000), the climate is humid continental Equatorial with a defined dry season in the southern Amazonian depression. Its average temperature is 24°C with annual rainfall of 2100 to 2300 mm, with four dry months and rain in the final and initial months of the year.

According to Camargo (2011), the vegetation present in this area is the result of contact between Ombrophilous Forests and Seasonal Forests. They alternate depending on the characteristics of the substrate, with Ombrophilous elements predominating in deep, humid soils near drainage lines. Seasonal Forest elements, on the other hand, establish themselves in the higher parts of the terrain, forming enclaves. Physiognomically, they present characteristics of both formations: tall stature, between 20 and 30 m in height, with some emergent trees reaching up to 35 m. Evergreen forests occur in the lower portions, while deciduous forests occur in the residual reliefs.

3.5. Productive Zone of the Vale do Juínão Settlement

The areas where the Vale do Juínão Settlement is located today were formerly a large estate, the Taciana Farm. This region, crossed by the MT-170 highway, located between the Juínão or Juína-Mirim River and the Perdido River in the Juruena River sub-basin, is formed by the Fazenda da Casa Branca Formation Geological Unit. Martins and Abdallah (2007) highlighted that in this unit the relief is flat, as shown in Figure 8, and the terrain is sandy, resulting from the disintegration of sandstones, which occur in scarce outcrops.

Figure 8 – Flat Relief of the Productive Zone of the Vale do Juínão Settlement.
Source: Authors (2020).

Regarding the relief, this region is located on the edges of the Plateau and the Chapada dos Parecis (CAMARGO, 2011). There are two classes of soils present in this productive zone, one of which is the Latosol class, in this specific case also classified as dystrophic red-yellow. According to Embrapa (2018), Latosols are constituted by mineral material, presenting a latosolic B horizon preceded by an A horizon of any type, within 200 cm from the surface or within 300 cm if the A horizon is more than 150 cm. These fall into the suborder of red-yellow Latosols when their colors are predominantly red with less red hue or vice versa, and are dystrophic when the base saturation is less than 50%.

Furthermore, Quartzarenic Neosols occur in this area. Neosols show little evidence of pedogenetic horizons and are defined according to the Brazilian Soil Classification System as "poorly developed soils, consisting of mineral or organic material, less than 20 cm thick, not presenting any type of diagnostic B horizon" (EMBRAPA, 2018).

The climate in the region, as defined by Santos (2000), is humid continental Equatorial with a defined dry season in the southern Amazonian depression, with an average temperature of 24 °C and annual rainfall of 2100 to 2300 mm, with four dry months between June and September. Regarding the vegetation, it is necessary to highlight that this area is located in a transition zone between the Cerrado and Amazon biomes, thus having as vegetation the Seasonal Forest in transition to the Ombrophilous Forest. Because it is situated in the valley of two rivers (Juínão and Perdido), this area alternates between well-drained and flat areas with species such as Jatobás and Ipês, while in the more humid, poorly drained areas with deep soils and low-lying areas, Brazil nut trees and Itaúbas are present, as described by Gomes and Santos (2002). However, Camargo (2011) highlighted that the remnants of this past vegetation are minimal, since the use of this region for timber extraction and agricultural activities has transformed the region into an area of secondary formation.

3.6. Productive Zone of the Green Belt

In the early 1970s, during the colonization of the municipality of Juína, Codemat, responsible for the Juína project, decided to divide the land to form a belt of 5-hectare plots around the city, within a radius of approximately 10 km from the center of the urban area. They also divided 50-hectare plots around this belt, only then dividing larger areas where the large farms and estates are located.

At the height of the diamond mining period, a municipal law also prohibited mining in the Rio Perdido basin, a river that crosses this belt and prevented violent environmental degradation such as occurred in the Juína-Mirim river basin, 20 km from the city center (CÂMARA MUNICIPAL DE JUÍNA, 2015).

In this context, the possibility arises of the existence of a strong green belt formed by small farms, where there is intense family agricultural production and a strong presence of dairy farming. This condition allows the residents of Juína access to higher quality, lower priced, and more reliable agricultural products. It also provides producers with the possibility of marketing and distribution of their production, contributing to the maintenance of families in the countryside, generating employment and income, and even the possibility of pluriactivity in this small-scale farming belt.

The presence of agricultural products from this belt in supermarkets and, especially, in the municipal market, is notable, clearly expressing the prominence of Juína's green belt. Thus, this productive zone, inserted in this context, stands out as a dairy production hub in the municipality, perhaps the most thriving of them all.

This entire productive zone is drained exclusively by the Perdido River. This river, a tributary of the Juínão River, which in turn is a tributary of the Juruena River, cuts through the green belt, passing north of the city of Juína, running in a northwest-southeast direction. It acts as a biogeographical barrier in this transition zone between the Cerrado and Amazon biomes.

Regarding this transition area, Camargo (2011) described that it occupies a large part of the state and is concentrated in the area between the 10° and 14° South parallels, expressing the Cerrado Domain in contact with the Amazonian Domain and various subcategories.

Regarding the climate, Santos (2000) described that in this green belt the climate is humid continental Equatorial with a defined dry season of the southern Amazonian depression. With average temperatures of 24 °C and annual rainfall of 2100 to 2300 mm, concentration of rain from October to May and dry season from June to September.

The relief of this region also expresses this transitional characteristic, as shown by Camargo (2011), in the central portion of the area occurs the North Mato Grosso Depression unit, where the Rio Perdido is located; In the northern portion, the Residual Plateaus of Northern Mato Grosso occur, expressed by the Sabão hill, Capeta hill, hills of line 01, among others located north of the city. To the south, we have the Chapada dos Parecis, a unit that becomes visible within the urban area in the Padre Duílio neighborhood and extends towards the JBS Frigorífico (meat processing plant).

Regarding geology, the Serra da Providência Granite unit predominates in this area, but there is a small stretch of the Juína Gabbro geological unit on the left bank of the Rio Perdido near Parque Laranjeiras, a smallholding area on the way out to Aripuanã, via MT-420 (Line 05), near the Sabão hill where these Gabbro outcrops can be found.

To the east of the city lies the geological unit known as Ferruginous Detrital-Lateritic Coverings, which in this area occur between 350 and 400 meters of altitude, as seen in Figure 9. It consists of lateritic soils and dystrophic red-yellow latosols that cover almost the entire area of this Green Belt, except for the region located on the left bank of the Rio Perdido, where dystrophic red-yellow Argisols predominate, in the areas where the Serra da Providência Granite unit predominates (MARTINS; ABDALLAH, 2007; IBGE, 2009).

Figure 9 – View of Morro do Capeta, northeast of the city, within the Green Belt in the area of the Ferruginous Detrital-Lateritic Coverings, off the area drained by the Rio Perdido.
Source: Authors (2020).

According to Embrapa (2018), dystrophic red-yellow Argisols are soils of low fertility (dystrophic), with the presence of a textural B horizon, formed from mineral material, with low activity clay or high activity clay combined with low base saturation or aluminic character in the B horizon. These reddish-yellow soils occur in areas of undulating to strongly undulating relief, such as those found in the northern portion of the belt. Dystrophic red-yellow Latosols are defined in the SIBCS by Embrapa (2018) as soils composed of mineral material, presenting a latosolic B horizon, preceded by an A horizon, within 200 cm from the surface or within 300 cm when the A horizon contains more than 150 cm, are reddish-yellow or yellowish-red in color, with base saturation less than 50% in most of the initial 100 cm of the B horizon.

Because it is extensively anthropized, this region retains few traces of its past vegetation; there are small fragments located on the banks of watercourses and on hills, which also tend to be secondary vegetation. This degradation, according to Camargo (2011), confers classification as an area of Anthropic Use on the vegetation and land use map of Mato Grosso and is the result in the landscape of 40 years of occupation of the territory.

4. Final Considerations

This study demonstrated that the dairy basin of the municipality of Juína-MT is composed of productive zones with distinct physiographic characteristics, the understanding of which is essential for territorial planning and environmental management of agricultural production. The integrated analysis of elements such as geology, relief, soils, hydrography, vegetation, and climate allowed for the outlining of a detailed physical-environmental panorama of the six zones studied, supporting the geographical understanding of the rural space.

It is noteworthy that the heterogeneity of natural conditions directly influences agricultural suitability and the spatial organization of dairy production. The diversity of soils – especially Argisols, Latosols, and Nitosols – and the topographic

variations between plateaus, highlands, and depressions demand differentiated land use and management practices. Detailed knowledge of these features constitutes a fundamental tool for the formulation of public policies aimed at promoting family farming, environmental conservation, and strengthening the local economy.

In this sense, the physiographic characterization of the dairy basin regionalization zones proposed by this work contributes to the construction of a more balanced rural development model, which considers physiographic specificities as a basis for decision-making. Valuing the environmental singularities of each production zone represents an important step towards a technically oriented and ecologically adjusted dairy production.

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