

## **SPATIAL DISTRIBUTION ANALYSIS OF TOURISM SUPPLY IN THE CIRCUITS OF MINAS GERAIS USING GIS**

*Análise da Distribuição Espacial da Oferta Turística em Circuitos de Minas  
Gerais Utilizando SIG*

*Análisis de la Distribución Espacial de la Oferta Turística en los Circuitos de  
Minas Gerais Utilizando SIG*



**Laís Murta Alves Maia** 

Universidade Estadual de Montes Claros (UNIMONTES)  
E-mail: [laismurtalves@gmail.com](mailto:laismurtalves@gmail.com)

**Guilherme Fortes Drummond Chicarino Varajão** 

Universidade Federal dos Vales do Jequitinhonha e Mucuri (UFVJM)  
E-mail: [guilhermefdcv@ufvjm.edu.br](mailto:guilhermefdcv@ufvjm.edu.br)

### **ABSTRACT**

This study examines the spatial distribution of tourism supply within the 45 tourist circuits of Minas Gerais, utilizing the 2022 official inventories, which contain over 22,000 records of services, facilities, and attractions categorized as B and C. The data were geocoded and cleaned to address gaps and inconsistencies in coordinates, after which density maps were produced in ArcGIS using kernel interpolation and natural-breaks statistical classification. Results reveal an intense concentration of supply in the Circuito do Ouro, which alone accounts for 1,966 inventoried items, whereas most circuits show very low density; the extreme case is the Circuito Nascente do Rio Doce, with only 90 records. The pattern exhibits a south–north gradient in the availability of tourism infrastructure, indicating regional disparities in access to investment and the quality of inventory. The resulting Mini Atlas, accompanied by public shapefiles, provides practical support for managers to identify priority areas for incentives and to improve inventory updates. The study concludes that the integrated use of Geographic Information Systems and official inventories enables the diagnosis of inequalities and guides policies for decentralization and technical capacity building, contributing to more balanced tourism development in Minas Gerais.

**Keywords:** Tourism Supply; Tourism Distribution; Tourist Region; Geographic Information System; GIS; Tourism Planning.

#### **Article History**

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## RESUMO

Este estudo analisa a distribuição espacial da oferta turística nos 45 circuitos turísticos de Minas Gerais a partir dos inventários oficiais de 2022, que reúnem mais de 22 mil registros de serviços, equipamentos e atrativos das categorias B e C. Os dados foram geocodificados e corrigidos quanto a lacunas e coordenadas inconsistentes, seguido da elaboração de mapas de densidade no ArcGIS por meio da interpolação kernel e da classificação estatística por quebras naturais. Os resultados evidenciam forte concentração da oferta no Circuito do Ouro, que, sozinho, reúne 1.966 itens inventariados, enquanto a maioria dos circuitos apresenta densidade muito baixa; o caso extremo é o Circuito Nascente do Rio Doce, com apenas 90 registros. O padrão revela um gradiente Sul-Norte na disponibilidade de infraestrutura turística e sugere desequilíbrios regionais no acesso a investimentos e na qualidade do inventário. O miniatlas gerado, acompanhado de *shapefiles* públicos, oferece subsídios práticos para que gestores identifiquem áreas prioritárias de incentivo e aprimorem a atualização do inventário. Conclui-se que o uso integrado de Sistemas de Informação Geográfica e de inventários oficiais permite diagnosticar desigualdades e orientar políticas de descentralização e de capacitação técnica, contribuindo para um desenvolvimento turístico mais equilibrado em Minas Gerais.

**Palavras-chave:** Oferta Turística; Distribuição Turística; Região Turística; Sistema de Informação Geográfica; SIG; Planejamento Turístico.

## RESUMEN

Este estudio analiza la distribución espacial de la oferta turística en los 45 circuitos turísticos de Minas Gerais a partir de los inventarios oficiales de 2022, que reúnen más de 22 000 registros de servicios, equipamientos y atractivos de las categorías B y C. Los datos fueron geocodificados y depurados para corregir lagunas y coordenadas inconsistentes, y luego se elaboraron mapas de densidad en ArcGIS mediante interpolación kernel y clasificación estadística por rupturas naturales. Los resultados evidencian una fuerte concentración de la oferta en el Circuito do Ouro, que concentra 1.966 ítems inventariados, mientras que la mayoría de los circuitos presenta densidades muy bajas; el caso extremo es el Circuito Nascente do Rio Doce, con solo 90 registros. El patrón revela un gradiente sur-norte en la disponibilidad de infraestructura turística y sugiere desequilíbrios regionales en el acceso a las inversiones y en la calidad del inventario. El miniatlas generado, acompañado de *shapefiles* públicos, ofrece insumos prácticos para que los gestores identifiquen áreas prioritarias de incentivo y mejoren la actualización del inventario. Se concluye que el uso integrado de Sistemas de Información Geográfica y de los inventarios oficiales permite diagnosticar desigualdades y orientar políticas de descentralización y de capacitación técnica, contribuyendo a un desarrollo turístico más equilibrado en Minas Gerais.

**Palabras clave:** Oferta Turística; Distribución Turística; Región Turística; Sistema de Información Geográfica; SIG; Planificación Turística

## 1 INTRODUCTION

Tourism activity often emerges spontaneously and, when it is not planned or develops in a disorganized manner, it can generate negative impacts (Pereira, 2014). Beni (2006) notes that tourism without planning leads to the unsustainable exploitation of cultural and natural resources, resulting in social, environmental, and economic effects that hinder



the very growth of the activity. In this context, it becomes essential to produce scientific research that supports tourism planning and guides more accurate decision-making.

Because it involves travel and demands infrastructure and services to meet visitors' needs, tourism must be analyzed from a spatial perspective. This approach enables planning that is capable of preventing adverse impacts and promoting sustainable practices across economic, social, cultural, and environmental dimensions.

In Minas Gerais, regional tourism development was initiated in 2001 with the introduction of the Tourist Circuits Policy by the State Secretariat of Tourism, and it was formalized in 2003. Decree No. 48,804, of April 25, 2024, defines tourist circuits as Regional Governance Bodies (IGRs): groups of municipalities with common social, cultural, and economic characteristics that coordinate efforts to organize and develop tourism in a decentralized and sustainable manner, involving civil society and the private sector (Minas Gerais, 2024).

This policy decentralizes management by prioritizing regional planning and development. According to Franklin, Stepan, and Reis (2021), when a municipality lacks the resources to invest on its own, collective action within a circuit strengthens local and regional development capacity. Regionalization, therefore, allows neighboring municipalities to share investments, resources, and tourism-related initiatives.

Conceptually, a region is a portion of territory characterized by natural and cultural indicators and potentialities that are interconnected through uses and economic activities. Regional development must therefore consider local specificities and avoid the simple transfer of policies from one place to another (Coriolano & Vasconcelos, 2013).

To plan tourism at the regional scale, it is essential to understand the characteristics of each locality. The tourism inventory, required for a municipality to join a circuit, compiles information on infrastructure, services, and attractions. Resolution No. 16/2020 of the State Secretariat of Culture and Tourism of Minas Gerais requires that inventory forms be completed and updated in the Integrated Tourism Platform of Minas Gerais (Minas Gerais, 2020).

The inventory consists of methods for classifying and characterizing the tourism supply, enabling its analysis for planning purposes (Fratucci & de Almeida Moraes, 2020). Tourism supply encompasses goods and services that meet visitor needs. Beni (2006) distinguishes three segments: the primary sector (agricultural goods for food), the secondary sector (infrastructure, facilities, and buildings), and the tertiary sector (transportation, financial institutions, and other services). To ensure that tourists remain in and enjoy a

destination, it is essential to provide access to accommodation, food, and other services (Beni, 2006).

This study arises from the scarcity of research on the spatial distribution of tourism supply in Minas Gerais' tourist circuits and the underutilization of the inventory as a basis for analysis. It is based on the hypothesis that supply is concentrated in specific circuits, generating inequalities in the distribution of services, facilities, and attractions.

## 2 METHODOLOGICAL PROCEDURES

The present investigation employs a descriptive design, aiming to detail the characteristics of the tourism supply in Minas Gerais' circuits, with a focus on its spatial distribution. According to Silva and Menezes (2000, p. 21), “descriptive research seeks to describe the characteristics of a given population or phenomenon, or to establish relationships between variables.”

First, a literature review was conducted on Geographic Information Systems (GIS), tourism, and regionalization policies in Minas Gerais. Subsequently, the official inventories of the State Secretariat of Culture and Tourism (Minas Gerais, 2022a) were compiled. These inventories classify tourism supply into two categories: Category B, which includes food services, lodging, transportation, travel agencies, event and leisure facilities, technical-scientific and artistic sites, and tourism-related production activities, among others; and Category C, which encompasses natural and cultural attractions. Completed by the municipalities themselves, these inventories constitute the empirical basis of this study and were complemented by the territorial boundaries provided by IBGE (2022a).

The data were organized in Microsoft Excel spreadsheets. To clean the geographic coordinates, empty cells were first identified, and ArcGIS Desktop 10.5 was used to locate points without references or positioned outside the boundaries of Minas Gerais. Corrections involved consulting Google Maps and Street View; records without reliable coordinates were excluded from the maps. Subsequently, shapefiles<sup>1</sup> were created for each tourist circuit based on the list provided by the State Secretariat (Minas Gerais, 2022a). Thematic density maps were produced in ArcGIS using kernel density interpolation, which estimates the concentration of points within a radius of influence (Bailey & Gatrell, 1995; Silverman, 1986; Bergamaschi, 2010), and natural breaks (Jenks) classification, an algorithm that minimizes

<sup>1</sup> A shapefile is a vector format developed by Esri that records the position, geometry, and attributes of geographic features (Portal for ArcGIS, n.d.).



within-class variance and maximizes between-class variance, enhancing the visualization of uneven distributions (Jenks, 1967; Brewer & Pickle, 2002; Monmonier, 1996; Esri, n.d.). The five resulting classes were represented by colors ranging from dark red (very high density) to yellow (very low density).

Conceptually, GIS is a set of tools for collecting, storing, processing, and representing real-world data (Burrough et al., 2015). It enables the overlay of independent layers—points, lines, polygons, and imagery—facilitating complex analyses of spatial relationships (Henriques et al., 2010; Cvetković & Jovanović, 2016). In this study, polygons of circuits, administrative boundaries, and points corresponding to services, facilities, and attractions were overlaid, allowing the identification of concentration patterns and gaps in the tourism supply.

The final maps and their corresponding shapefiles are publicly available, enabling replication and further analysis of the results.

### 3 RESULTS AND DISCUSSION

With an area of 586,513.983 km<sup>2</sup> and 853 municipalities (IBGE, 2022b), Minas Gerais is the Brazilian state with the largest number of municipalities. Its territory encompasses a wide variety of climates, landforms, vegetation types, and a rich cultural diversity (Scavazza, 2003, p. 1). Given this heterogeneity, the regionalization of tourism becomes a strategic approach for managing the activity in the state. The tourist circuits, a key component of the main regionalization policy, encourage cooperation among municipalities with similar characteristics, thereby making tourism management more efficient and effective. According to 2021 legislation, Minas Gerais had 45 certified Regional Governance Bodies (Figure 1).

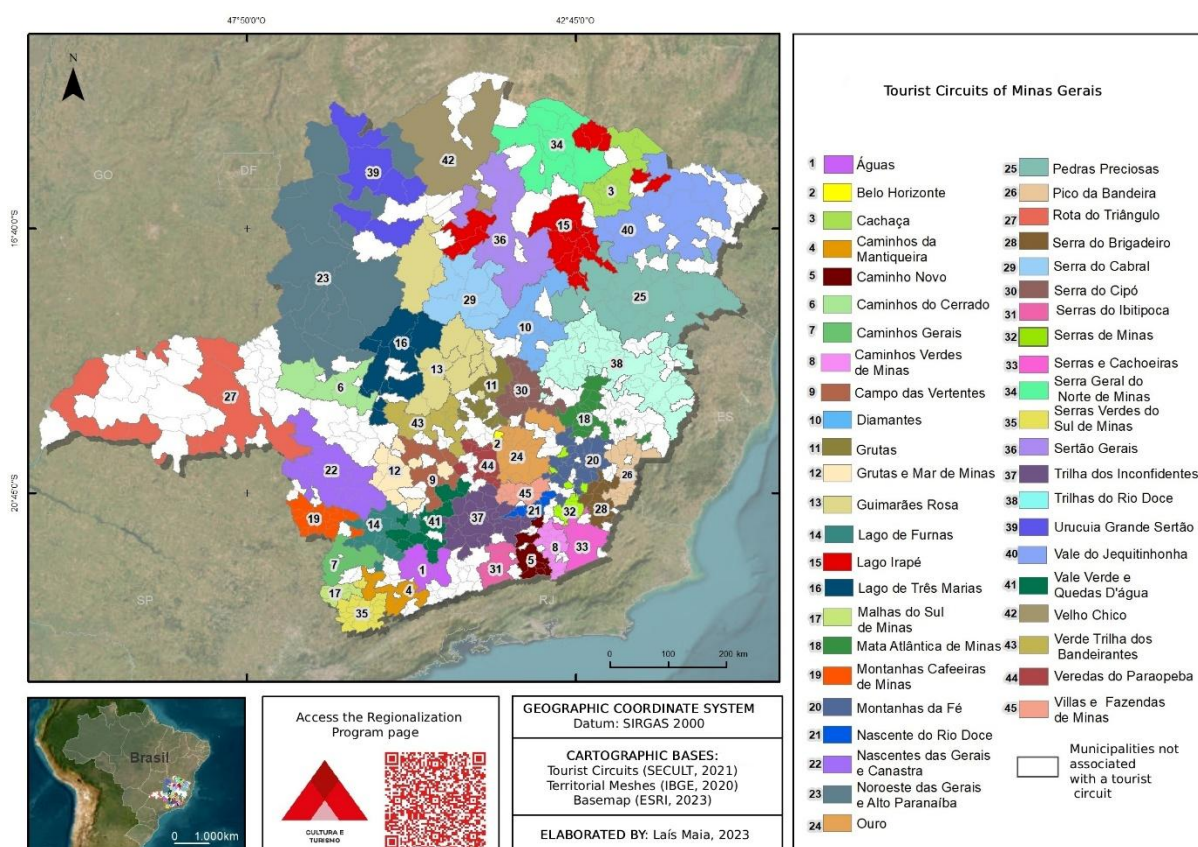
In 2021, 618 of the 853 municipalities in Minas Gerais (72%) participated in a tourist circuit, while 235 remained outside this arrangement. According to Trindade (2009), municipalities that are not part of a circuit typically stay on the margins of the official tourism policy, as they lack access to federal and state resources allocated to the sector. However, the high participation rate indicates that most local governments are interested in developing tourism activity in their territories.

Tourism—an economic, social, and cultural phenomenon resulting from the movement of people for leisure or business—depends on a network of services that meet visitors' basic needs during their stay (Oliveira, 2002). Accommodation, transportation, food



services, event organization, recreation, entertainment, and travel agency services comprise this infrastructure system, provided by both public and private actors. Mapping the spatial distribution of these services and attractions is crucial for identifying areas that lack investment and, consequently, guiding policies that promote the sustainable growth of tourism.

**Figure 01** – Location of the tourist circuits of Minas Gerais certified in 2021



Source: Authors.

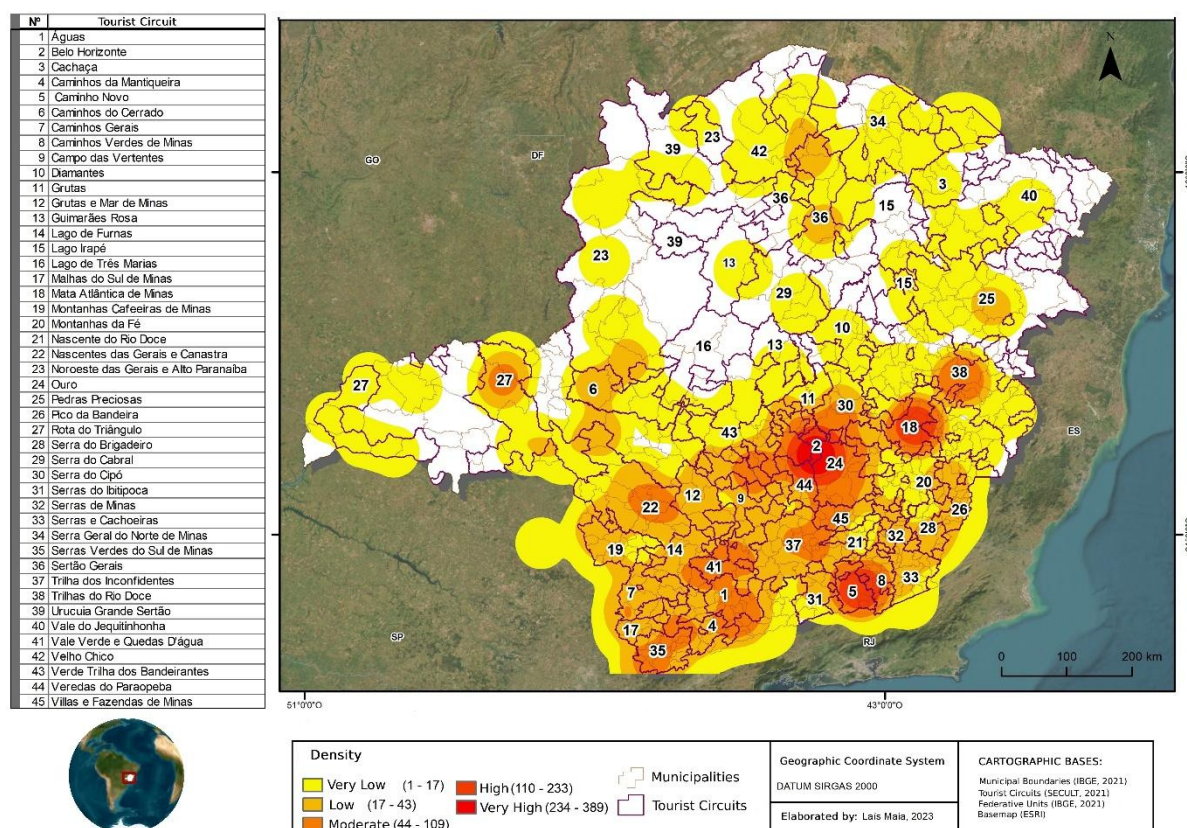
### 3.1 Tourism Agencies

The inventory records 893 tourism agencies: 579 outbound, 143 mixed (outbound and inbound), 168 inbound, and three unclassified. As shown in Figure 2, the highest concentrations occur in the Belo Horizonte Circuit (70 agencies, 7.84%), the Circuito do Ouro (67, 7.50%), and Caminho Novo (59, 6.61%), all of which are classified as having very high density. At the opposite end, the Lago de Irapé Circuit has no registered agencies, and the Nascente do Rio Doce and Urucuia Grande Sertão circuits have only one each (0.11%), representing very low density.

The Tourism Demand Survey by the Observatório de Turismo de Minas Gerais

(2022) reveals that only 3% of trips utilize the services of tourism agencies, while 83% of tourists plan their itineraries independently. This low demand, combined with the reduced population and limited tourism flow in certain municipalities, explains the scarcity of agencies in the state's less dynamic regions.

**Figure 02** – Distribution of tourism agencies in the tourist circuits of Minas Gerais in 2021



Source: Authors.

### 3.2 Food and Beverage Services

Food is a basic necessity for tourists and represents the second-largest component of their expenses, accounting for 27% of total trip spending (Observatório de Turismo de Minas Gerais, 2022). Beyond meeting physiological needs, meals can serve as leisure experiences, offering opportunities to appreciate local cuisine. In this regard, Minas Gerais is widely recognized as one of the Brazilian states with the most renowned gastronomy, ranking among the country's leading destinations for gastronomic tourism.

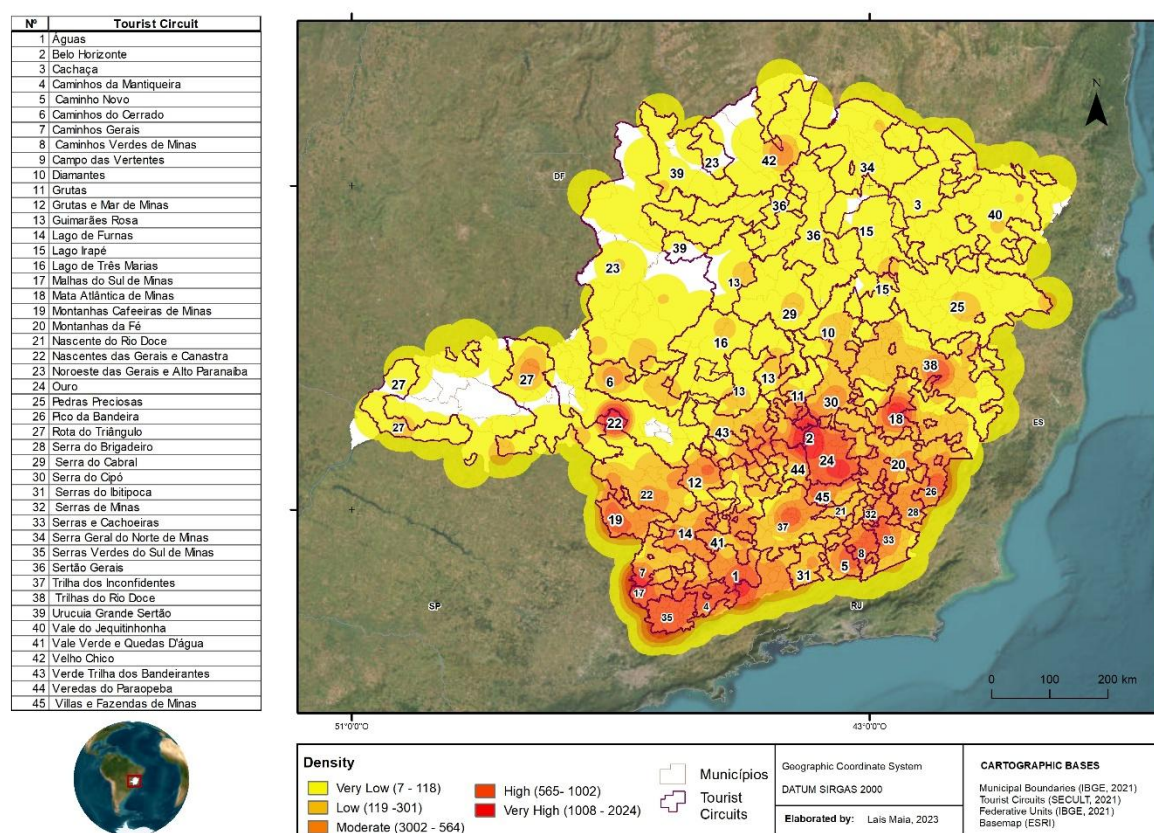
The tourist circuits of Minas Gerais encompass 8,384 food and beverage



establishments, distributed as follows: 3,832 bars, pubs, and snack bars; 2,451 restaurants; 1,027 tea houses, cafés, bakeries, and confectioneries; 449 ice cream shops; 66 kiosks or stalls; 43 breweries; 27 juice shops; and 489 establishments classified under other categories. In absolute terms, food and beverage services represent the largest group in the inventory, with a predominance of bars, pubs, and snack bars.

Figure 3 illustrates the spatial distribution of this supply. The Circuito do Ouro stands out with 610 establishments, equivalent to 7.3% of the state total, representing a very high density. Following this, the Nascentes das Geraís e Canastra Circuit comprises 541 establishments (6.45%), classified as high density. At the opposite end, the Nascentes do Rio Doce, Cachaça, and Sertão Gerais circuits present, respectively, 16 (0.19%), 32 (0.38%), and 42 (0.50%) establishments, all classified as very low density. Overall, most tourist circuits exhibit a low density of food and beverage services, indicating opportunities for expansion and investment in this segment.

**Figure 03** – Distribution of food and beverage services in the tourist circuits of Minas Gerais in 2021



Source: Authors.



According to the website of the Circuito Nascentes do Rio Doce (Circuito Nascentes do Rio Doce, n.d.), the municipalities that compose it have 14 restaurants and one bistro. In contrast, the inventory of the State Secretariat for Culture and Tourism (Secult) lists nine bars/breweries/snack bars, as well as seven restaurants. Therefore, a discrepancy exists between the information disclosed by the circuit and that recorded in the official inventory. It is worth noting, however, that this supply is dynamic: new establishments may emerge, while others may close.

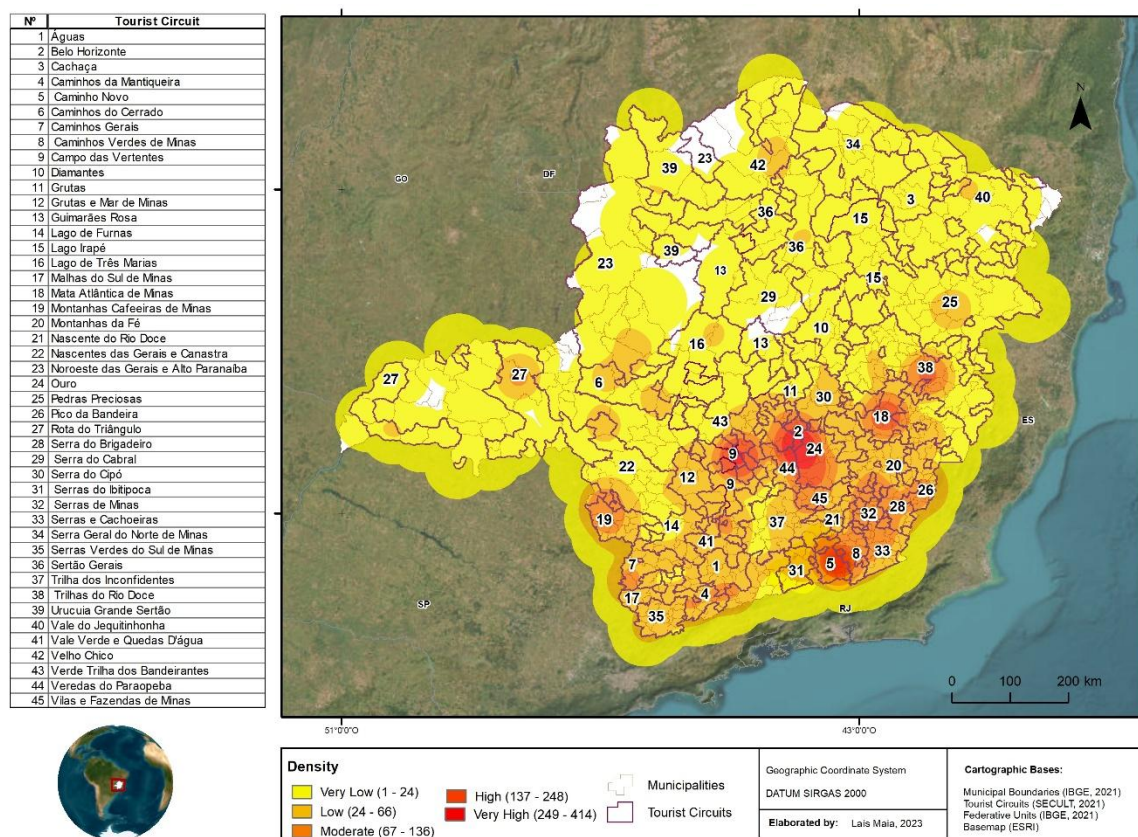
### 3.3 Event Facilities

Events and tourism maintain a close relationship, as the organization of festivities, fairs, and congresses increases hotel occupancy rates and stimulates local commerce, fostering the economic development of the destination. Events may constitute the main reason for travel or complement the visitor's experience; therefore, understanding the available infrastructure to host them is essential.

According to the inventory of the State Secretariat for Culture and Tourism of Minas Gerais (Minas Gerais, 2022a), the state's tourist circuits comprise 1,373 facilities intended for events: 231 auditoriums, 33 convention centers, 193 organizing/promoting companies, 245 alternative venues, 76 hotel meeting rooms, 146 exhibition parks/pavilions, 10 meeting rooms, 250 party halls, and 189 other specialized services. Figure 4 shows their spatial distribution.

The Circuito do Ouro concentrates 100 facilities (7.28%), characterizing a very high density—an amount higher than the sum of the Noroeste das Gerais e Alto Paranaíba, Urucua Grande Sertão, Guimarães Rosa, Velho Chico, and Sertão Gerais circuits (96 facilities). Next in prominence are the Circuito Trilhas do Rio Doce, with 83 facilities (6.05%), and the Circuito Mata Atlântica de Minas, with 64 (4.66%), both of which are classified as having high density. In addition, Belo Horizonte and Campo das Vertentes also show very high density; in the remaining circuits, very low density predominates, with rare occurrences of low density, as illustrated in Figure 04.

**Figure 04** – Spatial distribution of event facilities in the tourist circuits of Minas Gerais in 2021



Source: Authors.

### 3.4 Accommodation Services

According to the World Tourism Organization (UNWTO, 2001, p. 38), “tourism comprises the activities that people undertake during their trips and stays in places outside their usual environment, for a consecutive period of less than one year, for leisure, business, or other purposes.” Since travel implies spending the night away from home, having a place to stay is essential. The Tourism Demand Survey of Minas Gerais confirms the relevance of this item: accommodation accounts for 32.6% of visitors’ total expenditures (Observatório de Turismo de Minas Gerais, 2022).

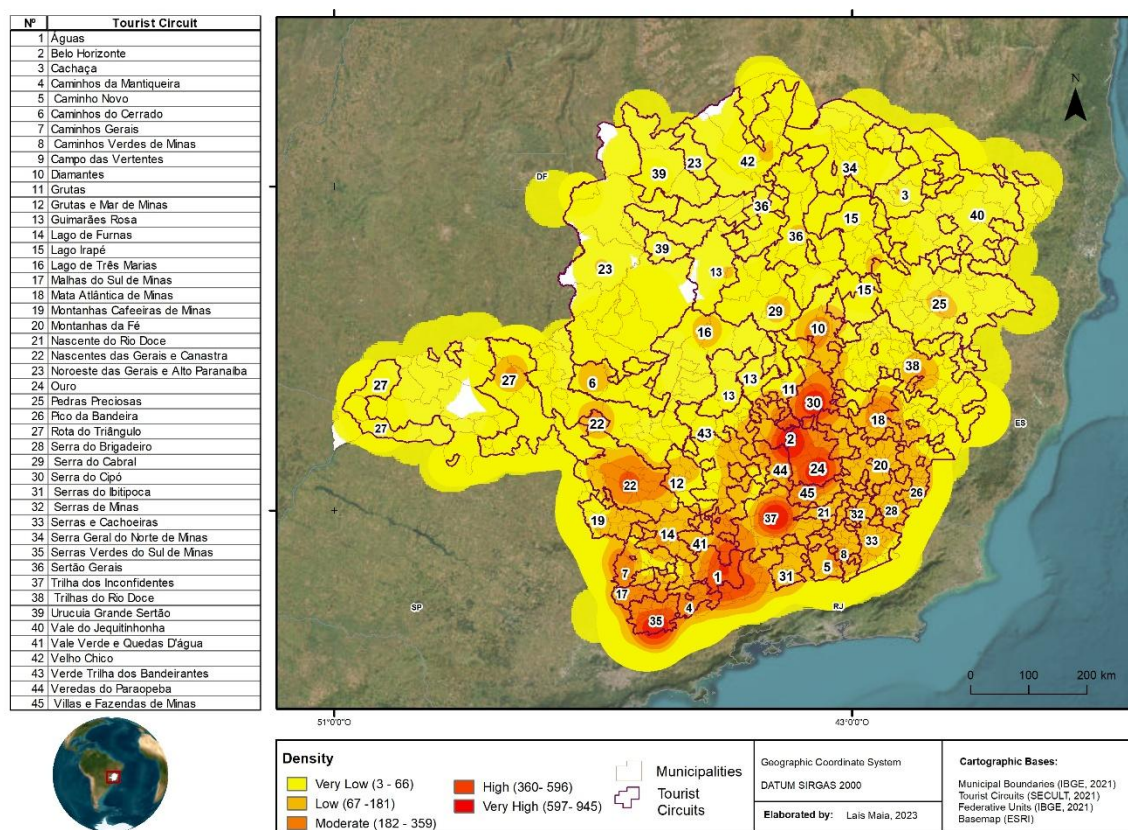
The state inventory identifies 3,985 accommodation establishments, distributed among 1,539 guesthouses (pousadas), 42 boarding houses, 1,480 hotels, 43 hostels, 88 lodging houses, 66 leisure hotels or resorts, two vacation camps, 61 campgrounds, 28 apart-hotels/flats/condo-hotels, 93 farm hotels, 26 historic hotels, 57 motels, and a small number of establishments in other categories. The predominance of guesthouses and hotels is



reflected in visitor preferences, with 43% of tourists who stay overnight choosing these two types of accommodations (Observatório de Turismo de Minas Gerais, 2022).

Figure 05 shows a very high density of accommodation in the Circuito do Ouro (306 establishments; 7.68%), Nascentes das Geraís e Canastra (272; 6.83%), Serras Verdes do Sul de Minas (274; 6.88%), Trilha dos Inconfidentes (256; 6.47%), and Serra do Cipó (220; 5.52%). This concentration in the Circuito do Ouro was confirmed by a georeferenced thematic mapping study, which found that 93% of accommodation establishments are located within a one-kilometer radius of tourist attractions (Varajão et al., 2025). In contrast, most circuits present very low density, particularly Nascente do Rio Doce (19; 0.48%), Urucua Grande Sertão (20; 0.50%), and Cachaça (25; 0.63%).

**Figure 05** – Distribution of accommodation services in the tourist circuits of Minas Gerais in 2021



**Source:** Authors.

However, the sources do not always agree. In the Nascentes do Rio Doce Circuit, the inventory of the State Secretariat for Culture and Tourism of Minas Gerais lists five guesthouses (*pousadas*), three hotels, and three lodging houses. In contrast, the circuit's



own website reports five guesthouses, eight hotels, and one lodging house (Circuito Turístico Nascentes do Rio Doce, n.d.). This discrepancy—similar to that observed for food services—suggests that one or both records may be outdated.

### 3.5 Leisure Facilities

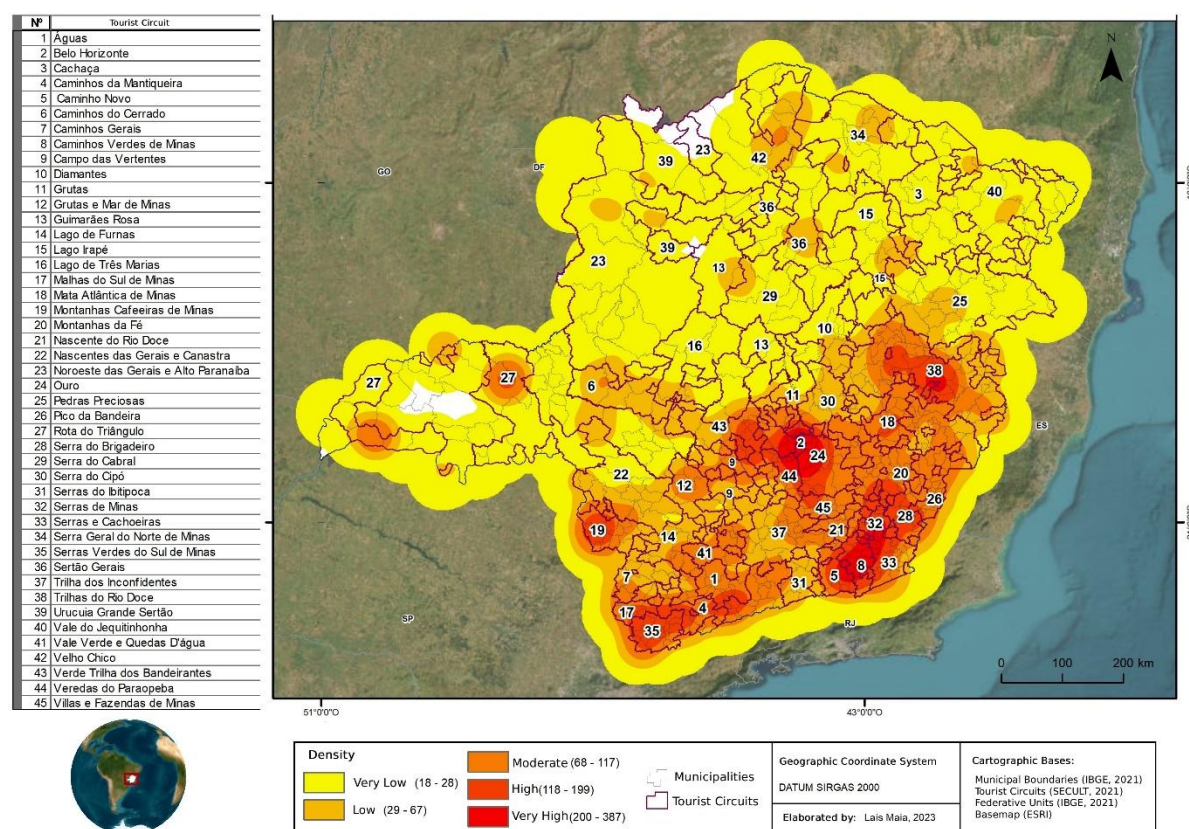
Leisure facilities are structures intended for entertainment that both tourists and residents may use. According to Coronio and Muret (1976, pp. 17–18), these facilities are defined as:

[...] a material element, the facilities being physically represented by a certain number of constructed sites and installations (a movie theater, a gymnasium) or arranged spaces (a stadium, an urban park), or even areas left more or less in their natural state (a forest with walking paths). But they are not limited to this. Indeed, closely and often intimately associated with this material aspect is an essential human element, although, at first glance, its presence is not as immediately evident as the physical setting that houses it, and is therefore more challenging to identify and perceive. This element—represented by an institution, a service, a team, an organization, or even an informal association—will, in many cases, be the ‘soul’ of the facility.

The tourist circuits of Minas Gerais encompass 2,998 registered leisure facilities, distributed as follows: 83 nightclubs/discotheques; 17 dance halls; 85 performance venues; 44 cinemas; 450 clubs; 588 stadiums, gymnasiums, or sports courts; 9 racetracks, speedways, or kart tracks; 6 marinas/piers; 25 viewpoints/belvederes; 50 agricultural parks; 7 amusement parks; 6 theme parks; 678 parks, gardens, or squares; 7 bowling alleys or golf courses; 16 skating, motocross, or BMX tracks; 141 leisure service providers; 186 other facilities; and 400 unidentified units.

Figure 6 illustrates the spatial distribution of these facilities. Two circuits stand out: Trilhas do Rio Doce, with 258 units (8.61%), and Circuito do Ouro, with 108 (3.60%), both classified as having very high density. In contrast, most circuits exhibit very low density; the most extreme case is the Nascente do Rio Doce Circuit, with only five facilities (0.17%).

Leisure facilities are essential for both residents and visitors, as the right to leisure is enshrined in the 1988 Federal Constitution as a condition for social well-being (Brazil, 1988). Thus, the expansion of this infrastructure—particularly in circuits with limited supply—is a fundamental step toward meeting the needs of local populations and enhancing the tourist experience.

**Figure 06 – Distribution of leisure facilities in the tourist circuits of Minas Gerais in 2021****Source:** Authors.

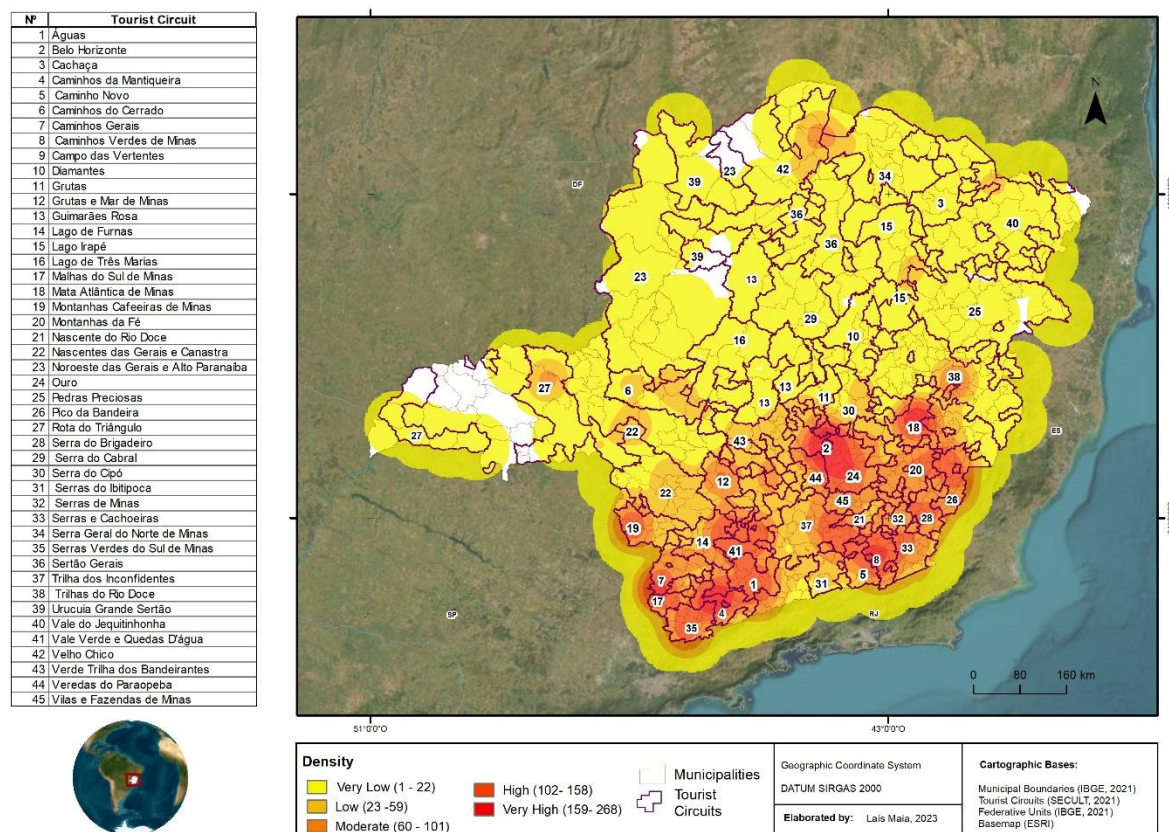
### 3.6 Transportation Services

Tourism inherently involves the movement of people; therefore, access to transportation services is essential for its realization. The Tourism Demand Survey of Minas Gerais shows that internal transportation is the fifth-largest expense item for visitors, accounting for 8.4% of total trip spending (Observatório de Turismo de Minas Gerais, 2022).

The state inventory records 1,753 transportation services, distributed among 409 car rental companies, 556 taxis, 653 tourism transport providers, and 135 establishments classified as “other.” Figure 7 depicts their spatial distribution. Three circuits exhibit very high density: Circuito do Ouro (99 services; 5.65%), Caminhos da Mantiqueira (90; 5.13%), and Mata Atlântica de Minas (75; 3.71%). In most circuits, however, density is very low. The smallest numbers appear in the Urucua Grande Sertão Circuit, with four services (0.23%), and in the Cachaça Circuit, with six (0.34%).



**Figure 07 – Distribution of transportation services in the tourist circuits of Minas Gerais in 2021**



Source: Authors.

### 3.7 Other Tourism Services and Facilities

The category “Other Tourism Services and Facilities” in the inventory of Minas Gerais' tourist circuits includes associations, service providers, tourist information centers, and other entities directly related to tourism activities. Among the items listed are tourist routes, cultural centers, museums, libraries, tourism departments, visitor assistance centers, artistic houses, and artisans' associations, among others.

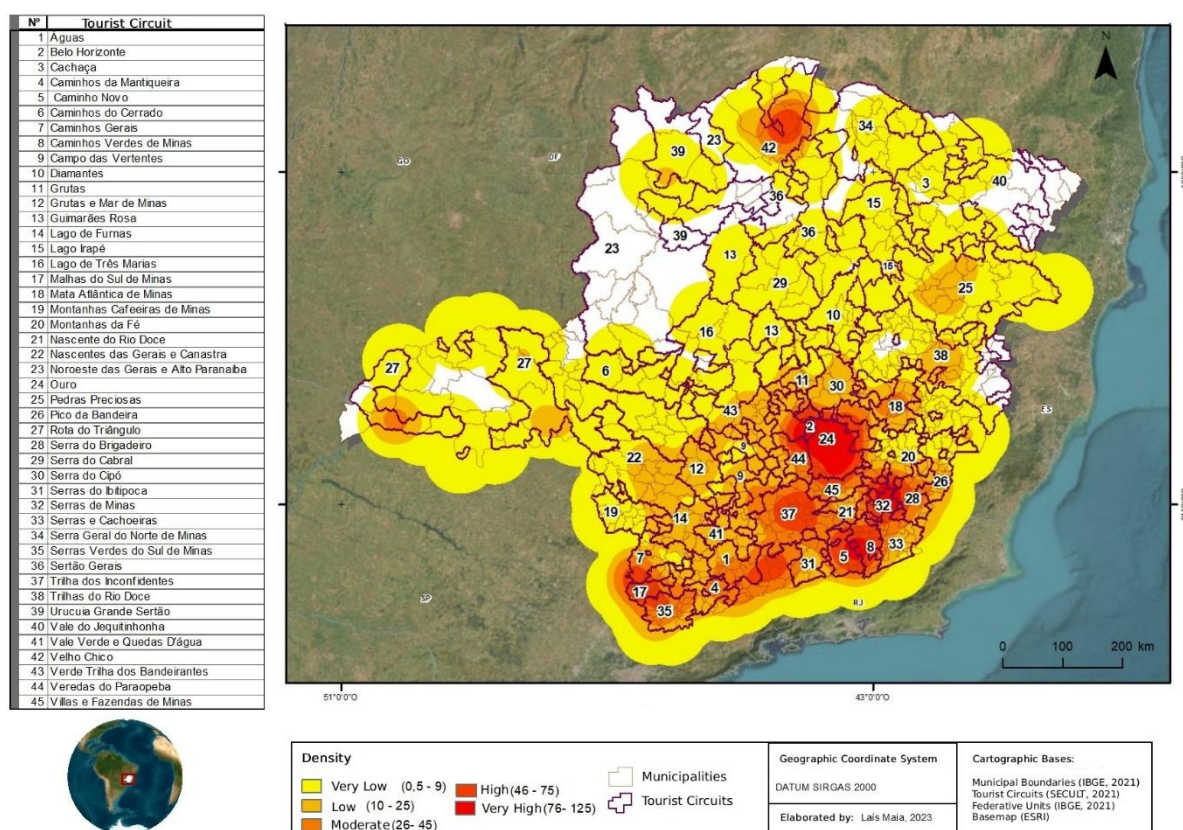
In total, 608 such services and facilities were catalogued: 185 associations, 168 tourist information centers, 122 tourism service providers, 24 entities, and 109 items classified as “other.”

Figure 8 shows a very high density in the Circuito do Ouro (64 units; 10.53%), Serras de Minas (32 units; 5.26%), and, for the first time, Velho Chico (36 units; 5.92%). On the other hand, the Cachapa and Campo das Vertentes circuits have no records in this category. Several circuits exhibit very low density: Nascente do Rio Doce has only one unit (0.16%),



while Noroeste das Gerais e Alto Paranaíba has three (0.16%), concentrated near the border with the Urucuia Grande Sertão Circuit; in the remainder of this territory, no other services or facilities were inventoried.

**Figure 08** – Distribution of other tourism services and facilities in the tourist circuits of Minas Gerais in 2021



Source: Authors.

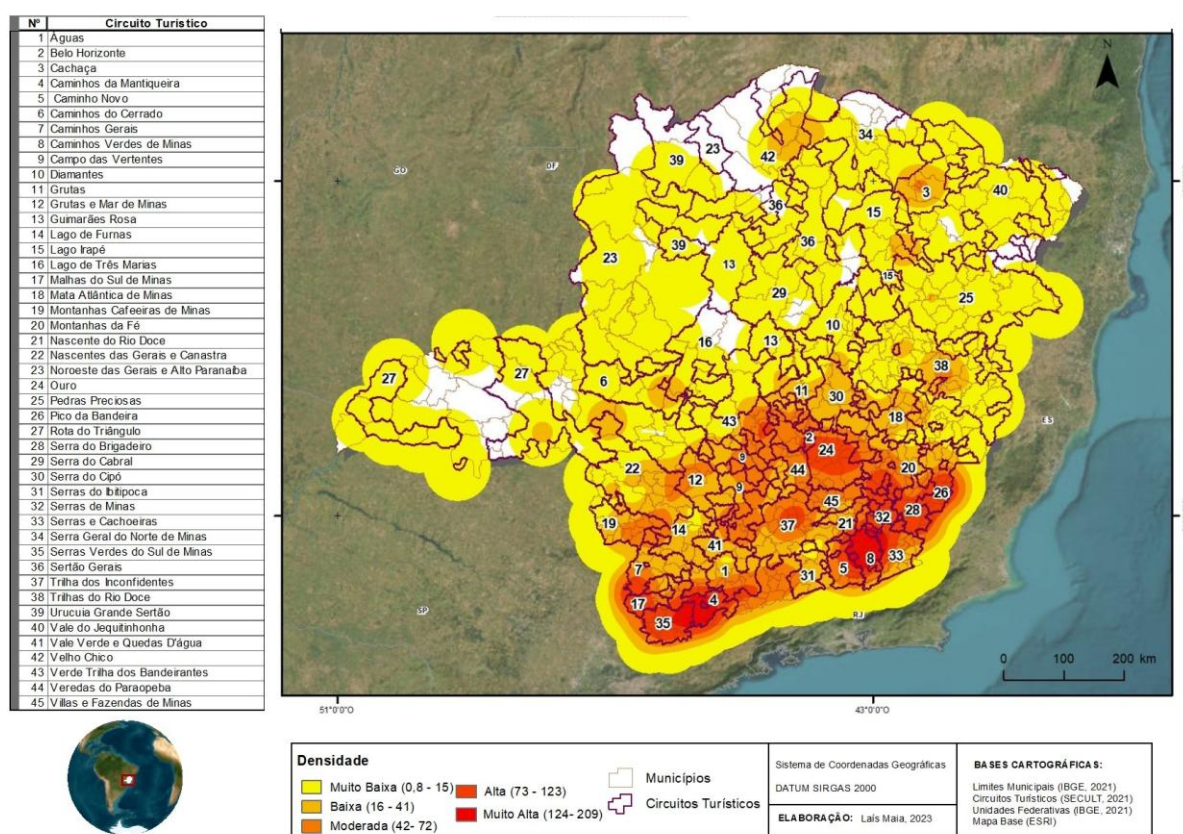
### 3.8 Economic Activities of Tourism-Related Production

Economic activities related to tourism production encompass industrial, artisanal, and agricultural enterprises that utilize local natural and cultural resources, thereby enhancing the visitor experience. Examples cited in federal legislation include handicrafts, cultural expressions, gastronomy, and agricultural production (Brazil, 2011). In the Minas Gerais inventory, this category contains mining areas, breweries, dairy plants, candy and biscuit factories, rapadura mills, coffee roasteries, cachaça distilleries, and cheese producers.

A total of 1,065 such activities were recorded, distributed among 433 industrial

establishments, 385 agricultural enterprises, 190 handicraft units, and 57 initiatives related to extractivism or mineral exploitation. Figure 09 shows that the Caminhos Verdes de Minas (68 activities; 6.38%), Caminhos da Mantiqueira (62; 5.82%), and Circuito do Ouro (59; 5.54%) circuits present very high density. Most of the remaining circuits exhibit very low density. The weakest numbers appear in the Urucuia Grande Sertão, Belo Horizonte, and Diamantes circuits, with three (0.28%), four (0.38%), and six (0.56%) activities, respectively—marking the first instance among the segments in which the state capital appears with a reduced supply.

**Figure 09** – Distribution of economic activities of tourism-related production in the tourist circuits of Minas Gerais in 2021



Source: Authors.

### 3.9 Tourist Attractions

A tourist attraction is any element that motivates the movement of visitors and, therefore, constitutes the primary impetus for a trip. These attractions are crucial to the sector's development and may have either natural or cultural origins (Brazil, n.d.). Law No.



22,765 of December 20, 2017, which establishes the state tourism policy of Minas Gerais, reinforces this notion: according to Article 3, section IV, a tourist attraction is “the natural or cultural resource, the economic activity, or the scheduled event that triggers the tourism process and is capable of motivating the movement of people to visit it, whether or not it is part of a tourism product” (Minas Gerais, 2017, n.p.).

The quality of access and the preservation of these resources are fundamental. Identifying local potential and adequately structuring visitation areas ensures that tourism develops safely and sustainably; moreover, the attractiveness of these resources directly influences a destination’s ability to retain tourists. Minas Gerais, for example, combines renowned gastronomy, artistic and cultural expressions, and landscapes that vary from mountain ranges suitable for adventure activities to historic towns, offering visitors unique experiences (Agência Minas, 2022).

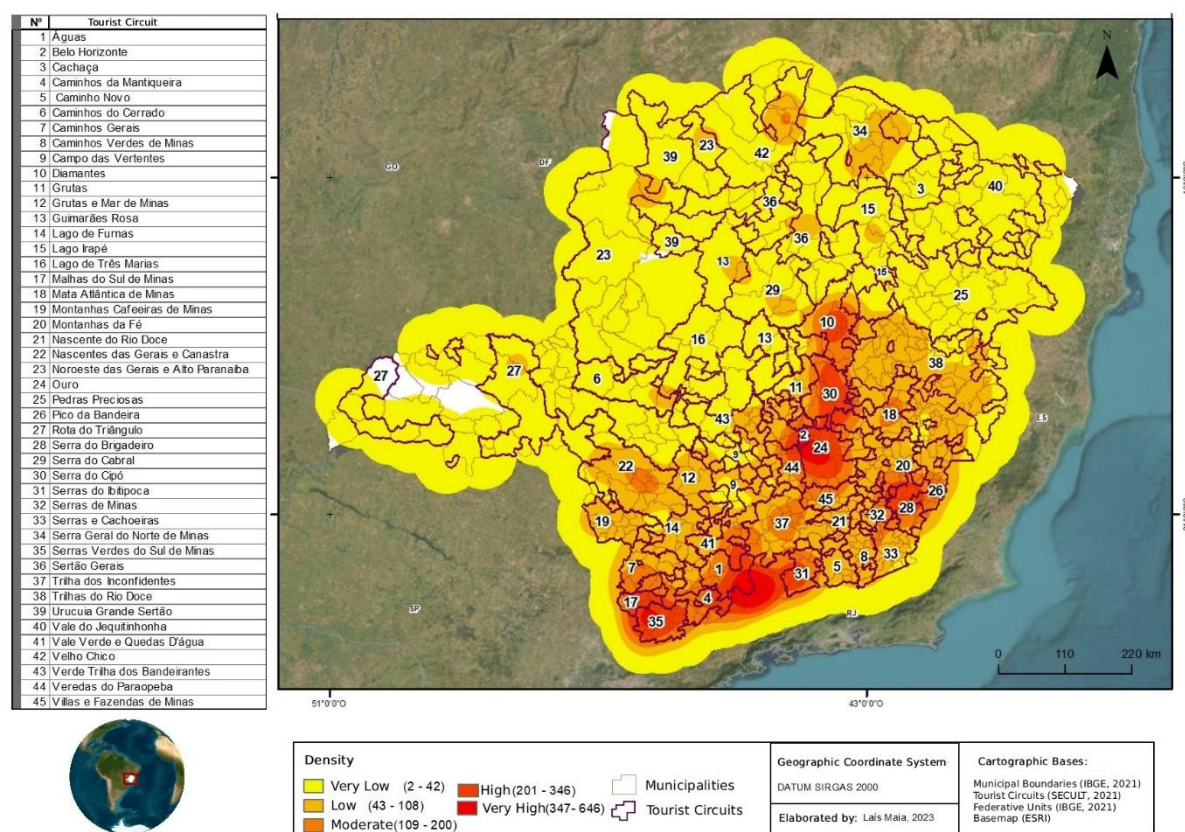
### 3.10 Natural Attractions

The Brazilian Service of Support for Micro and Small Enterprises (SEBRAE) describes a natural attraction as a “natural resource structured as a business and meeting all the specifications required for commercialization and for receiving tourists” (SEBRAE, n.d., p. 14). In other words, it is a natural element not created by humans but organized for tourism use.

The state inventory records 2,912 natural attractions: 1,284 waterfalls, 511 mountains, 357 hydrographic features (rivers, reservoirs, lakes, pools, etc.), 258 conservation units, 158 caves, 62 plateaus and plains, 32 flora areas of interest, 31 mineral-water or thermal springs, 29 fishing areas, seven fauna records, three islands, and 180 attractions classified in other categories.

Figure 10 shows very high density in the Circuito do Ouro (185 attractions; 6.35%) and Serras Verdes do Sul de Minas (175; 6.01%). The Trilha do Rio Doce Circuit has the third-highest absolute quantity, but its 51 municipalities dilute the concentration, resulting in low density. Conversely, the Circuito das Águas, with 72 attractions (2.47%), reaches a very high density due to its intense concentration in a small number of municipalities.



**Figure 10** – Distribution of natural attractions in the tourist circuits of Minas Gerais in 2021**Source:** Authors.

Although most circuits present very low density, several of them still maintain expressive numbers of registered attractions. The weakest totals appear in the Nascente do Rio Doce and Cachaça circuits, both with nine records (0.31%).

The Portal Minas Gerais lists “17 natural spectacles” that highlight the state’s environmental diversity, including the largest concentration of caves in Brazil, the highest number of Private Natural Heritage Reserves, the third-highest waterfall in the country (Tabuleiro Waterfall, 273 m), the source of the São Francisco River, elevated peaks such as Pico da Bandeira (2,892 m), as well as singular formations such as “the world’s largest stalactite” and the vast Furnas Lake (Minas Gerais, 2022c).

Given this richness, it becomes crucial to identify, develop, and promote attractions in circuits with low density. As primary motivators of travel, such resources require high-quality access, adequate infrastructure, and targeted promotional strategies for tourism to achieve better performance across the territory of Minas Gerais.

### 3.11 Cultural Attractions

Cultural attractions correspond to “tangible and intangible assets that express or reveal the memory and identity of populations and communities” (Brazil, 2010, p. 16). In Minas Gerais, culture forms a mosaic of expressions associated mainly with the colonial period and African heritage.

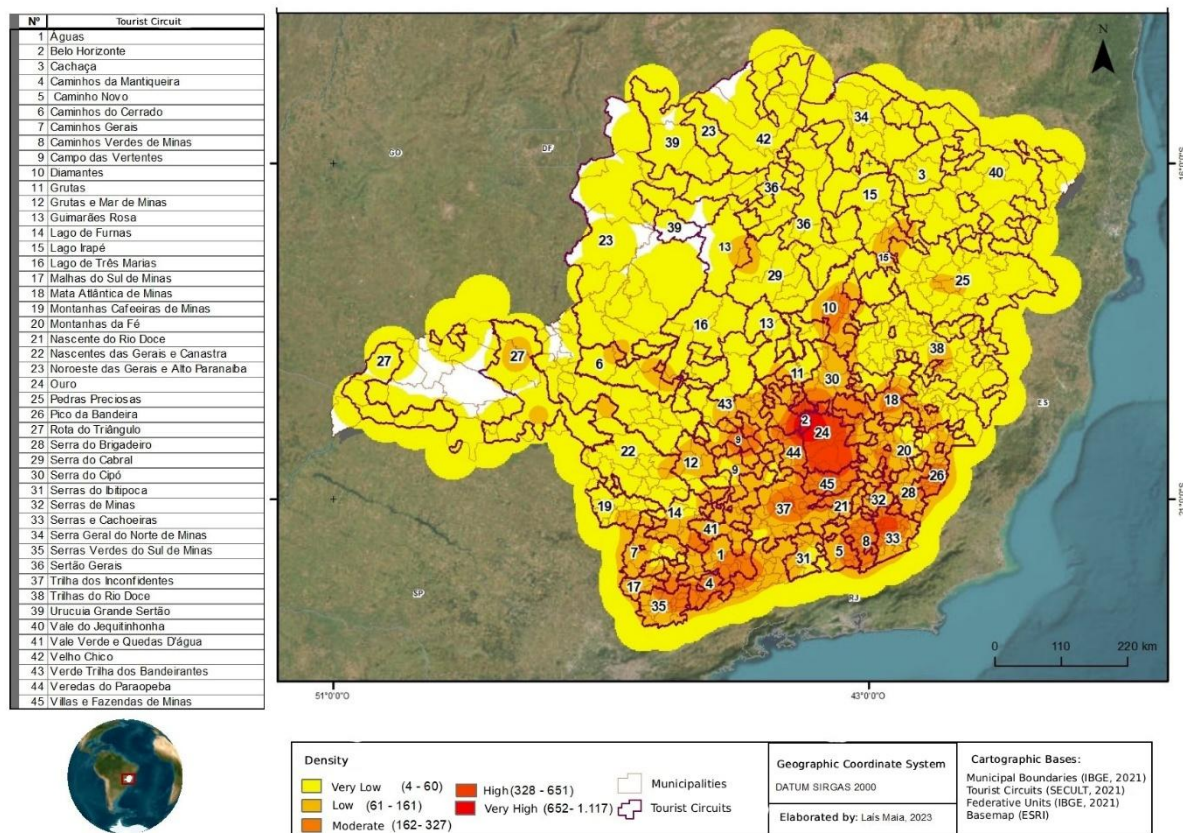
Prominent manifestations include congado and caxambu; colonial architectural structures; religious festivities such as Folia de Reis and the Festa de Nossa Senhora do Rosário; as well as distinctive cuisine featuring dishes and products such as chicken with okra, feijão-tropeiro, angu, coffee, cachaça, costelinha com ora-pro-nóbis, cheese bread, and a wide variety of cheeses. Sertanejo culture is also present, both in gastronomy and in horseback rides that symbolize rural life, alongside Indigenous heritage, evident in archaeological sites such as the Parque Nacional Cavernas do Peruaçu, designated as both cultural and natural heritage (Minas Gerais, 2022b).

The inventory of the tourist circuits of Minas Gerais records 3,000 cultural attractions: 1,568 buildings, 579 cultural institutions, 165 historic sites, 244 craft fairs/markets, 155 cultural manifestations, 152 monuments and art works, 78 handicraft units, 29 festivals and celebrations, 23 forms of traditional knowledge and practices, and seven references to typical gastronomy.

Figure 11 illustrates the distribution of these attractions. A very high density is observed in the Circuito do Ouro, adjacent to the Belo Horizonte Circuit, with 354 items (11.8%). The Trilhas do Rio Doce and Serras e Cachoeiras circuits show high density, with 142 (4.73%) and 101 (3.37%) attractions, respectively. Most of the other circuits present very low density. The weakest totals are found in the Nascente do Rio Doce Circuit, with 14 attractions (0.47%), and the Serras de Minas Circuit, with 17 (0.57%).



**Figure 11 – Distribution of cultural attractions in the tourist circuits of Minas Gerais in 2021**



Source: Authors.

### 3.12 Technical, Scientific, and Artistic Achievements

Technical, scientific, and artistic achievements of tourist interest include museums, creative expressions, exhibitions, zoos, nurseries, gardens, parks, and research centers, among other structures that enrich the visitor experience. In the inventory of the tourist circuits of Minas Gerais, 248 such achievements were recorded—the smallest total among all categories analyzed. This group comprises 46 research centers, 42 hydroelectric plants, dams, locks, or reservoirs, 35 nurseries, 31 studios, 21 art exhibitions, 12 industrial parks, seven zoos, six technical exhibitions, six botanical gardens, five technology parks, four technological museums, two planetariums, one orchidarium, and 29 items classified as “other.”

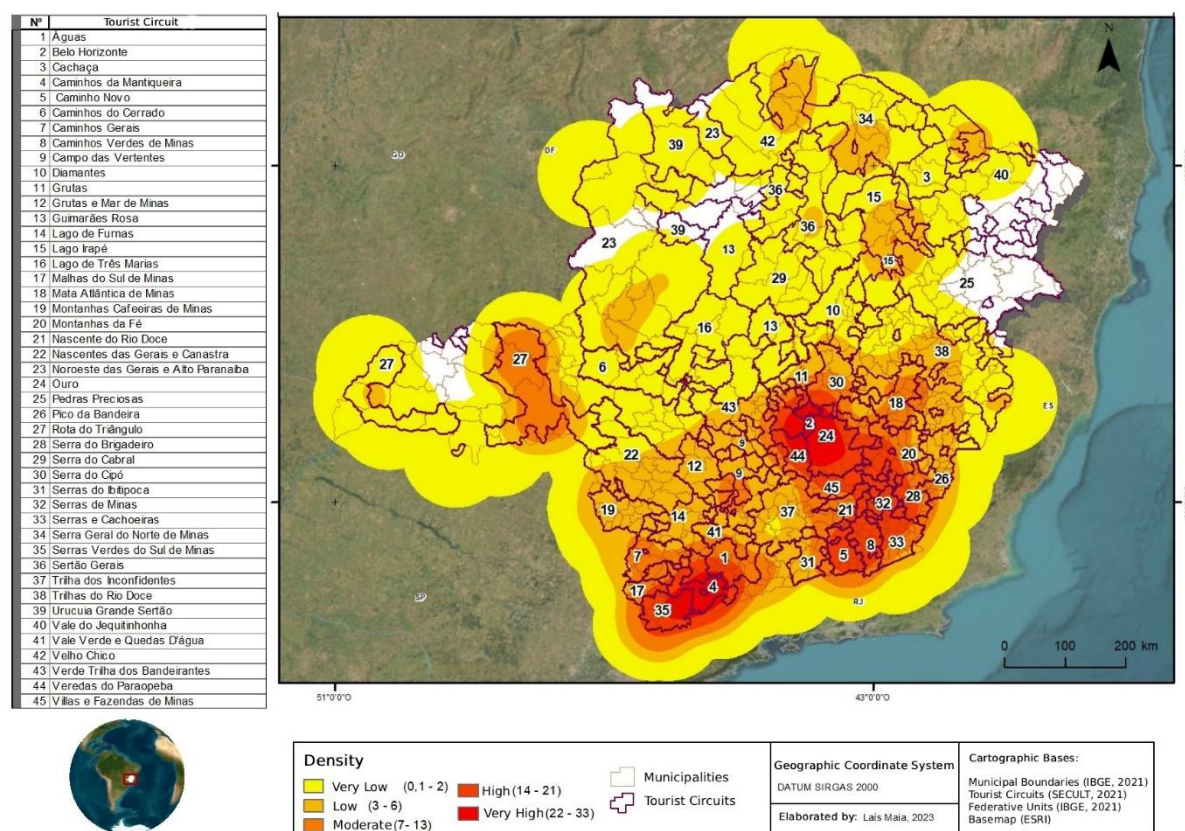
Figure 12 shows the spatial distribution of these facilities. The Circuito do Ouro and Caminhos da Mantiqueira circuits present very high density, with 14 (5.65%) and 17 (6.85%) items, respectively. Although the Rota do Triângulo Circuit concentrates the highest



absolute number—23 units (9.27%)—the facilities are dispersed across its territory, resulting in densities that range from very low to moderate.

Several circuits exhibit very low density; the Guimarães Rosa Circuit has no items in this category. In the Diamantes, Lago de Três Marias, Serra do Cabral, and Urucuia Grande Sertão circuits, there is only one record each (0.40%), indicating a significant scarcity or underreporting of technical, scientific, or artistic achievements.

**Figure 12** – Distribution of technical, scientific, and artistic achievements of tourist interest in the tourist circuits of Minas Gerais in 2021



**Source:** Authors.

Across all categories analyzed, most tourist circuits exhibit very low density. In contrast, the Circuito do Ouro displays very high density in every category represented in the figures. At the same time, Caminhos Verdes de Minas also stands out, frequently presenting high or very high densities. The spatial distribution of attractions, food services, and accommodation facilities reveals similar patterns: the same circuits concentrate extreme values—either positive or negative—highlighting which territories have a more consolidated tourism activity or a more comprehensive inventory of tourism supply.

The study required verifying inconsistencies in the inventory, particularly concerning geographic coordinates. A high rate of errors was detected in the collection and entry of these data; points lacking reliable coordinates were removed from the maps. Such shortcomings can be mitigated through joint efforts by the State Secretariat for Culture and Tourism (Secult), circuit managers, and associated municipalities. Training programs must emphasize the importance of inventory, explain each field, and guide users on how to classify elements within categories, highlighting the need to report geospatial data accurately. Additionally, the circuits must oversee the process of data collection and entry, as the inventory is mandatory for a municipality to remain compliant with the regionalization policy (Minas Gerais, 2020, art. 8).

The identified gaps indicate that the inventory is not being properly prepared; consequently, an essential planning tool fails to fulfill its role of accurately representing the local tourism supply. Among the main issues are the numerous null fields, suggesting difficulties or a lack of technical knowledge among those responsible for data collection. Added to this is the complexity of the task and the high cost of hiring specialized companies—factors that can compromise the quality of the final document.

#### 4 FINAL CONSIDERATIONS

Tourism manifests itself differently in each territory; therefore, planning the activity requires detailed knowledge of local specificities. However, in many municipalities, tourism management is still carried out without support from scientific studies. This research seeks to address this gap by providing inputs for planning the tourist circuits of Minas Gerais. By utilizing the tourism supply inventory as the primary data source and converting it into cartographic representations, we demonstrate the practical utility of this document and reinforce the importance of its proper preparation.

The spatial analyses were conducted in a GIS environment (ArcGIS), based on the official inventory of the circuits compiled by the State Secretariat for Culture and Tourism of Minas Gerais. According to Nodari et al. (2006, p. 217), “the quantity and type of data in the tourism sector require a management tool that addresses the need for an instrument capable of optimizing the storage, analysis, and manipulation of such data.” By applying this technology to the 45 circuits listed as Regional Governance Bodies (IGRs) in 2021, it was possible to produce a diagnostic assessment of the distribution of tourism supply, providing valuable information for guiding public policies and investments, given tourism’s potential to

stimulate local economic development.

As a practical result, a website was created containing a Mini Atlas of Tourism supply, along with vector files (shapefiles) of circuit boundaries for the years 2021 and 2024 (Maia & Varajão, 2025). These files enable the monitoring of changes in municipal associations and serve as a basis for other analyses, including cross-referencing with IBGE Census data.

The maps reveal an intense concentration of tourism supply in the Circuito do Ouro, which contains 1,966 services, facilities, and attractions—characterized by a very high density across all categories. In contrast, most circuits exhibit very low density; the Nascente do Rio Doce Circuit has only 90 inventoried items, although the circuit's own website indicates a larger supply. These findings support the hypothesis of concentration in the southern part of the state and relative scarcity in the north.

The analysis of data sources also revealed numerous inconsistencies: missing or incorrect coordinates, blank fields, and misclassified items. Such problems compromise the inventory's role as a planning tool. According to Secult Resolution No. 16/2020 (art. 8), the inventory is a requirement for a municipality to remain within the regionalization policy; therefore, the state secretariat, circuits, and municipalities must strengthen training for those responsible for data entry and oversee the quality of the information provided (Minas Gerais, 2020).

In light of these results, several research and action agendas are suggested: (a) investigate the historical and economic causes of the concentration of tourism supply; (b) assess whether low-density circuits truly lack attractions or lack detailed inventories; (c) study managers' perceptions of the importance of the inventory; (d) compare tourism supply before and after COVID-19; and (e) monitor municipal turnover within the circuits over time. Adopting policies that strengthen tourism entrepreneurship and promote local potential is crucial for decentralizing tourism activities and enhancing the quality of life for the communities involved.

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## REFERENCES

- AGÊNCIA MINAS. **Minas é o segundo estado mais procurado por turistas; conheça os destinos favoritos**. 2022. Disponível em: <https://www.agenciaminas.mg.gov.br/noticia/minas-e-o-segundo-estado-mais-procurado-por-turistas-conheca-os-destinos-favoritos> Acesso em: 15 jun. 2024.
- BAILEY, Trevor C.; GATRELL, Anthony C.; PALMER, Michael W. **Análise interativa de dados espaciais**. Essex: Longman Scientific & Technical, 1995.
- BENI, M. C. Análise estrutural do turismo. 14. ed. São Paulo: Editora SENAC, 2006.
- BERGAMASCHI, R. B. **SIG aplicado à segurança no trânsito-Estudo de caso no município de Vitória-ES**. Trabalho de Conclusão de Curso. Vitória: Universidade Federal do Espírito Santo, 2010.
- BRASIL. Ministério do Turismo. Dados e fatos. S.d.. Disponível em: <http://www.dadosefatos.turismo.gov.br/> Acesso em: 22 jun. 2025.
- BRASIL. Ministério do Turismo. **Diretrizes para valorização e promoção do patrimônio cultural**. 2010. Disponível em: <https://www.gov.br/turismo/pt-br/centrais-de-conteudo/publicacoes> Acesso em: 05 mai. 2024.
- BRASIL. Ministério do Turismo. Serviço Brasileiro de apoio às micro e pequenas empresas. Associação de Cultura Gerais. **Manual para o desenvolvimento e a integração de atividades turísticas com foco na produção associada**, Brasília: Ministério do Turismo, 2011b. Disponível em: <https://sebrae.com.br/Sebrae/Portal%20Sebrae/Anexos/Manual%20de%20Integracao%20da%20Producao%20Associada%20ao%20Turismo.pdf> Acesso em: 08 de jun de 2024.
- BREWER, C. A.; PICKLE, L. Evaluation of Methods for Classifying Epidemiological Data on Choropleth Maps in Series. **Annals of the Association of American Geographers**, v. 92, n. 4, p. 662-681, 2002.
- BURROUGH, P. A.; MCDONNELL, R. A.; LLOYD, C. D. **Principles of geographical information systems**. Oxford University Press, USA, 2015.
- CIRCUITO TURÍSTICO NASCENTE DO RIO DOCE. **Cidades**. s.d. Disponível em: <https://circuitonascentedoriodoce.tur.br/> Acesso em: 01 jun. 2024.
- CORIOLOANO, L. N.; VASCONCELOS, F. P. Região, desenvolvimento regional e turismo comunitário. **Revista brasileira de desenvolvimento regional**, v. 1, n. 1, p. 095-111, 2013.
- CORONIO, G.; MURET, J.P. **Loisirs: guide pratique des équipements**. 1. ed. Paris: Centre de Recherche d'Urbanisme, 1976. 713 p.
- CVETKOVIC, M.; JOVANOVIC, S. S.. The application of GIS technology in tourism. **Quaestus**, n. 8, p. 332, 2016.
- ESRI. **Classificação do mapa**. s.d. c Disponível em: <https://doc.arcgis.com/pt-br/insights/latest/create/map-classification.htm>. Acesso em: 25 jun. 2024.



FRANKLIN, A. Z.; STEPHAN, Í. I. C.; REIS, L. F. O Turismo em Pequenas Cidades de Minas Gerais: circuitos turísticos e ICMS turístico. **PIXO-Revista de Arquitetura, Cidade e Contemporaneidade**, v. 5, n. 19, p. 167-183, 2021.

FRATUCCI, A. C.; ALMEIDA MORAES, C. C. de. Inventário da oferta turística: Reflexões teóricas para o planejamento e ordenamento do espaço turístico. **Caderno Virtual de Turismo**, v. 20, n. 1, 2020.

HENRIQUES, F.; GONÇALVES, A.; CALVO, A.. Caracterização da densidade das lacunas em superfícies pictóricas com recurso a Sistemas de Informação Geográfica (SIG). **Conservar Património**, n. 11, p. 3-11, 2010.

IBGE. **Malha Municipal de Minas Gerais e Unidades da Federação**. 2022a. Disponível em: <<https://www.ibge.gov.br/geociencias/organizacao-do-territorio/malhas-territoriais/15774-malhas.html>>. Acesso em: 25 jun. 2023.

IBGE. **Panorama Minas Gerais**. 2022b. Disponível em: <https://cidades.ibge.gov.br/brasil/mg/panorama>. Acesso em: 23 nov. 2023.  
JENKS, G. F. The Data Model Concept in Statistical Mapping. **International Yearbook of Cartography**, v. 7, p. 186-190, 1967.

MAIA, L. M. A.; VARAJÃO, G. Fortes D. C. **Miniatlas da oferta turística dos circuitos turísticos de Minas Gerais em 2022**. Disponível em: <https://sites.google.com/view/miniatlas-circuitos-turisticos/p%C3%A1gina-inicial>. Acesso em: 26 nov. 2025.

MINAS GERAIS. Lei 22.765, de 20 de dezembro de 2017. Institui a política estadual de turismo e dá outras providências. **Secretaria de Estado de Fazenda**. Belo Horizonte - MG. 2017. Disponível em: [http://www.fazenda.mg.gov.br/empresas/legislacao\\_tributaria/leis/2017/l22765\\_2017.html](http://www.fazenda.mg.gov.br/empresas/legislacao_tributaria/leis/2017/l22765_2017.html). Acesso em: 05 de set. 2023.

MINAS GERAIS. **Resolução Secult No 16, de 08 de Abril de 2020**. Minas Gerais: 2020. Disponível em: [http://www.regionalizacao.turismo.gov.br/images/RESOLU%C3%87%C3%83O%20SECULT%20N%C2%BA%2016\\_2020%20%20Certifica%C3%A7%C3%A3o%20IGRs.pdf](http://www.regionalizacao.turismo.gov.br/images/RESOLU%C3%87%C3%83O%20SECULT%20N%C2%BA%2016_2020%20%20Certifica%C3%A7%C3%A3o%20IGRs.pdf). Acesso em: 01 nov 2023.

MINAS GERAIS. **Os 10 destinos mais procurados por turistas em Minas Gerais; confira**. 2021. Disponível em: <https://www.secult.mg.gov.br/noticias-artigos/7577-os-10-destinos-mais-procurados-por-turistas-em-minas-gerais-confira>. Acesso em: 01 nov. 2023.  
MINAS GERAIS. Inventário da oferta turística dos circuitos turísticos de Minas Gerais [Base de dados não publicada]. 2022 a. Belo Horizonte, MG.

MINAS GERAIS. **26 dicas de roteiros gastronômicos imperdíveis para conhecer em Minas**. 2022 b. Disponível em: <https://www.minasgerais.com.br/pt/blog/artigo/28-dicas-de-roteiros-gastronomicos-imperdiveis-para-conhecer-em-minas>. Acesso em: 20 jun. 2024



MINAS GERAIS. **17 Espetáculos da Natureza em Minas Gerais**. 2022 c. Disponível em: <https://www.minasgerais.com.br/pt/blog/artigo/17-espetaculos-da-natureza-em-minas-gerais> Acesso em: 22 jun. 2024.

MINAS GERAIS. Decreto 48.804 , de 25 de abril de 2024. Dispõe sobre a certificação dos circuitos turísticos como Instâncias de Governança Regionais. **Secretaria de Estado de Cultura e Turismo de Minas Gerais (SECULT)**. Belo Horizonte - MG. 2024. Disponível em: <https://www.secult.mg.gov.br/programas-e-acoess/turismo/regionalizacao> . Acesso em: 05 mai. 2024.

MONMONIER, M. **How to Lie with Maps**. 2. ed. Chicago: University of Chicago Press, 1996.

NODARI, L. D. T.; BECKER, T.; CANALE, D. P. A aplicação do geoprocessamento como ferramenta de auxílio ao turismo. In: CONGRESSO DE CADASTRO TÉCNICO MULTIFINALITÁRIO E GESTÃO TERRITORIAL, 7, 2006, Florianópolis. **Anais [...]**Florianópolis: UFCS, 2006.

OBSERVATÓRIO DE TURISMO DE MINAS GERAIS. **Pesquisa de Demanda Turística 2022**. 2022. Disponível em: <https://www.dropbox.com/scl/fi/bzv6w650e1o0x4qkwo0y9/Boletim-PDT-Consolidada-2022.pdf?rlkey=nv4dhpu2eu2z4qt3zhp0tvzx5&e=1&dl=0>. Acesso em: 09 mai. 2024.

OLIVEIRA, A. P. Turismo e desenvolvimento: planejamento e organização. **Atlas**, 4a edição São Paulo: Cortez, 2002.

OMT - Organização Mundial de Turismo. Introdução ao turismo. São Paulo: **Roca**, 2001. PEREIRA, T. N. C. Planejamento e Desenvolvimento Turístico: um Estudo Sobre os Balneários da Barra do Chuí e Alvorada, no Sul do Brasil. In: FÓRUM INTERNACIONAL DE TURISMO DO IGUAÇU, 8, 2014. Foz do Iguaçu. **Anais eletrônicos[...]** Foz do Iguaçu, 2014. Disponível em: <https://www.anaisforumturismoiguassu.com.br/2015/11/anais-2014.html>. Acesso em: 09 mai. 2023.

PORTAL FOR ARCGIS. **Shapefiles**. s.d.a Disponível em: <https://doc.arcgis.com/pt-br/arcgis-online/reference/shapefiles.htm>. Acesso em: 23 jul. 2023.

SCAVAZZA, J. F. DA ASSEMBLÉIA LEGISLATIVA, Consultora. Diferençassocioeconômicas das regiões de Minas Gerais. Belo Horizonte: **Assembléia Legislativa do Estado de Minas Gerais**, 2003.

SEBRAE SP. **Cadernos de Atrativos Turísticos: Entendendo o Atrativo Turístico**. s.d. Disponível em: [https://bibliotecas.sebrae.com.br/chronus/ARQUIVOS\\_CHRONUS/bds/bds.nsf/e6ab735ac11e71802d2e44cbce6d63f4/\\$File/SP\\_cadernodeatrativosturisticoscompleto.16.pdf.pdf](https://bibliotecas.sebrae.com.br/chronus/ARQUIVOS_CHRONUS/bds/bds.nsf/e6ab735ac11e71802d2e44cbce6d63f4/$File/SP_cadernodeatrativosturisticoscompleto.16.pdf.pdf) Acesso em: 22 jun. 2024.

SILVA, E. L.; MENEZES, E. M. **Metodologia da pesquisa e elaboração de dissertação**. Florianópolis: UFSC/PPGEP/LED, 2000.





SILVERMAN, B. W. Density estimation for statistics and data analysis. **Chapman & Hall**. 1986.

TRINDADE, R. da. **Circuitos turísticos mineiros: descentralização, autonomia e gestão em relação ao turismo com base local (finais dos anos 90 - tempo presente)**. 2009. 119 f. Dissertação (Mestrado Profissional em Turismo) - Universidade de Brasília, Brasília, 2009.

VARAJÃO, G. F. D. C.; MAIA, L. M. A.; BARBOSA DE JESUS, Á. G.; PIMENTEL, Thiago Duarte. Cartografia da oferta turística do Circuito do Ouro, Minas Gerais, Brasil. **Geo UERJ**, Rio de Janeiro, v. 48, p. 1-50, 2025. DOI: 10.12957/geouerj.2025.87210. Disponível em: <https://www.e-publicacoes.uerj.br/geouerj/article/view/87210>. Acesso em: 26 nov. 2025.

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