



RESEARCH ARTICLE

GIS-Based Analysis of River Tourism Spatial Patterns in Banjarmasin City and Its Implications for Geography Learning

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ABSTRACT

Banjarmasin City, known as the “City of a Thousand Rivers,” has distinctive river-based tourism potential shaped by its extensive river network, cultural heritage, and waterfront landscapes. This study aims to examine the spatial pattern of river tourism attractions in Banjarmasin City and identify the geographical characteristics associated with their distribution. A quantitative spatial approach was employed using field observations, geographic coordinates, administrative boundaries, river network data, and tourism information. The spatial datasets were analysed using Geographic Information Systems (GIS) and Nearest Neighbor Analysis (NNA) to determine the distribution pattern of river tourism attractions. The study identified 36 river tourism attractions across Banjarmasin City, with the analysis indicating a clustered spatial pattern. The attractions are predominantly concentrated along the Martapura River corridor, where accessibility, tourism infrastructure, historical significance, and socio-cultural functions are relatively strong, while attractions in peripheral areas tend to be more dispersed. These findings demonstrate the value of spatial analysis for understanding the geographical organisation of river tourism in an urban river environment and provide spatial information to support sustainable tourism planning, destination management, and the development of a more integrated and balanced river tourism network. The GIS-based maps and spatial analysis results also have implications for geography education by providing contextual learning resources that can support students’ map-reading skills, spatial thinking, and understanding of the spatial relationships between geographical phenomena.

Keywords: spatial distribution; river tourism; geographic information systems



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1. INTRODUCTION

Banjarmasin City, widely known as the “City of a Thousand Rivers,” is an urban area whose spatial identity and social activities are closely associated with its extensive river network. Rivers function not only as transportation corridors and spaces for social interaction but also as important tourism resources that support the development of river-based attractions. Several destinations, including Siring Pierre Tendean, Kampung Hijau, Kampung Biru, Lok Baintan Floating Market, and riverside piers, represent different forms of river-oriented tourism that combine waterfront landscapes, cultural heritage, and local community activities (Pradana, 2020). The concentration of these attractions along river corridors has

strengthened Banjarmasin's identity as a river tourism destination and increased the strategic importance of understanding how tourism resources are distributed across the urban landscape.

The development of river tourism has increased the importance of spatial information for destination planning and management. River cruise activities using traditional *kelotok* boats have become an important tourism activity in Banjarmasin, particularly along routes connecting Siring Pierre Tendean with Kampung Hijau, Kampung Biru, and Lok Baintan Floating Market. The city also recorded substantial tourist activity, with 1,587,477 domestic and international tourist visits reported by the Banjarmasin Office of Culture, Youth, Sports, and Tourism. Statistics Indonesia reported 1,124,440 domestic tourist visits between January and April 2026, making Banjarmasin the municipality with the highest number of domestic tourist visits in South Kalimantan during this period. The increasing intensity of tourism activities highlights the need to understand the spatial configuration of attractions, particularly because the location and proximity of tourism resources can influence accessibility, connectivity, and the integration of destinations within an urban tourism network.

From the perspective of tourism geography, the spatial arrangement of attractions is an important component of destination development because tourism resources are rarely distributed uniformly across space. Their concentration or dispersion can reflect differences in accessibility, physical environment, infrastructure, historical functions, and patterns of human activity. Geographic Information Systems (GIS) provide an effective framework for representing and analysing these spatial relationships by integrating geographic coordinates, administrative boundaries, transportation networks, and tourism-related information. Recent studies have demonstrated the application of GIS to identify tourism-resource distributions, accessibility, and spatial characteristics, providing a stronger spatial basis for tourism planning and destination management (Hasana et al., 2025; Warlina & Afredi, 2025). GIS-based spatial analysis therefore extends tourism mapping beyond the simple identification of attraction locations by enabling researchers to examine the geographical relationships among tourism resources.

Despite the growing application of GIS and spatial statistics in tourism research, an important gap remains in the study of river-based tourism within urban environments. Existing GIS-based tourism studies have largely focused on tourism inventories, destination mapping, accessibility, supporting facilities, or the spatial distribution of tourism resources in general. For example, recent studies have examined the spatial distribution and influencing factors of tourism resources using multiple spatial-statistical techniques (Ding et al., 2024), while other studies have focused on GIS-based mapping and spatial analysis to support tourism development (Hasana et al., 2025). However, relatively limited attention has been given to the spatial pattern of tourism attractions that are specifically associated with an urban river network. This distinction is important because river tourism is spatially influenced by linear water corridors, riverfront accessibility, waterfront infrastructure, and the historical and socio-cultural functions of rivers. In the context of Banjarmasin, the absence of a quantitative assessment of the spatial pattern of river tourism attractions limits the understanding of whether these attractions form concentrated clusters, random distributions, or more dispersed configurations across the city.

This study addresses this gap by integrating GIS-based tourism mapping with Nearest Neighbor Analysis to examine the spatial pattern of river tourism attractions in Banjarmasin City. The novelty of this study lies in its specific focus on the spatial organization of river tourism attractions within an urban river environment, rather than tourism attractions in general. The study aims to (1) identify and map river tourism attractions in Banjarmasin City using GIS and (2) determine their spatial distribution pattern using Nearest Neighbor Analysis. By quantitatively characterizing the spatial pattern of river tourism, this study contributes to tourism geography by demonstrating how spatial-statistical analysis can be applied to river-based urban tourism. The findings are expected to provide a spatial basis for destination planning, tourism connectivity, and the development of a more integrated and balanced river tourism network in Banjarmasin City.

2. LITERATURE REVIEW

2.1 River Tourism Development

River tourism has increasingly been recognised as an important component of sustainable tourism because rivers function simultaneously as natural resources, cultural landscapes, transportation corridors, and spaces for community activities. Although rivers traditionally served primarily as transportation routes, contemporary tourism development has expanded their functions to include recreation, cultural experiences, environmental education, and local economic activities (Hall & Page, 2014). This multifunctional character distinguishes river tourism from conventional destination-based tourism and makes its development closely dependent on the interaction between environmental, social, cultural, and spatial characteristics.

Recent studies emphasise that sustainable river tourism requires an appropriate balance between tourism utilisation, environmental quality, and community involvement. Chan et al. (2024) demonstrated that local community support is an important component of sustainable river tourism because residents contribute directly to tourism experiences and environmental stewardship. Similarly, Wang et al. (2023) highlighted the importance of water quality and river ecosystem health in maintaining the attractiveness and competitiveness of waterfront tourism destinations. Zhu et al. (2023) further argued that sustainable tourism development in river basins requires coordination between ecological management, regional planning, and tourism policies. Collectively, these studies indicate that river tourism cannot be evaluated solely through visitor growth or economic performance; its sustainability also depends on how tourism activities are organised within the river environment.

However, these studies predominantly emphasise environmental sustainability, community participation, and tourism management, while the spatial organisation of river tourism attractions receives comparatively less attention. The location, proximity, and concentration of attractions are important because river tourism activities are often organised along linear waterways and interconnected waterfront spaces. Understanding these spatial characteristics can therefore complement existing sustainability-oriented approaches by providing information on how tourism resources are geographically structured. This spatial perspective is particularly relevant in Banjarmasin, where tourism attractions are closely connected to the city's river network. Consequently, spatial analysis provides an important basis for extending the understanding of river tourism from sustainability and management issues toward the geographical organisation of tourism resources.

2.2 Advances in GIS-Based Tourism Planning

Geographic Information Systems (GIS) have become an important analytical framework in tourism planning because they enable the integration, management, analysis, and visualisation of geographically referenced tourism information (Longley et al., 2021). The development of GIS in tourism has expanded its function beyond conventional mapping toward spatial analysis and decision support. Through GIS, tourism researchers can identify the location of attractions, examine accessibility, integrate environmental and socioeconomic information, and visualise spatial relationships among tourism resources.

Recent studies illustrate the increasing application of GIS for tourism planning. Withanage et al. (2024), for example, integrated GIS with Multi-Criteria Decision Analysis to identify suitable areas for ecotourism by considering environmental, accessibility, and land-suitability variables. This approach demonstrates the ability of GIS to integrate multiple spatial criteria into tourism planning. Jiang et al. (2024) used Point of Interest data and GIS-based spatial analysis to identify tourism-resource distribution patterns and examine relationships with socioeconomic, transportation, and environmental characteristics. Similarly, Tao et al. (2025) applied GIS-based accessibility modelling to investigate relationships between attraction accessibility and tourism demand. These studies demonstrate that GIS can support tourism planning through different analytical perspectives, ranging from site suitability and accessibility to spatial distribution.

Despite these advances, the application of GIS in tourism research varies considerably according to research objectives. Suitability analysis focuses primarily on identifying potential development areas, accessibility analysis evaluates spatial connectivity, and tourism inventory studies focus on documenting and mapping resources. These approaches provide valuable information but do not necessarily explain whether tourism attractions are spatially concentrated, randomly distributed, or dispersed. Therefore, mapping tourism attractions using GIS represents only the first stage of spatial tourism analysis. A more explicit statistical assessment is required to identify the underlying spatial pattern of tourism resources. This limitation provides a methodological link between GIS-based tourism mapping and spatial statistical approaches such as Nearest Neighbor Analysis.

2.3 Spatial Distribution Analysis of Tourist Attractions

Spatial distribution is a fundamental concept in geography because the location of geographical phenomena reflects spatial interactions between physical conditions, accessibility, infrastructure, and human activities. Tourism attractions are similarly unlikely to be distributed uniformly because their locations are influenced by environmental characteristics, transportation networks, population concentration, economic activity, and historical development (O'Sullivan & Unwin, 2014). Identifying whether attractions are clustered, randomly distributed, or dispersed can therefore provide a more systematic understanding of the spatial structure of tourism destinations.

Nearest Neighbor Analysis (NNA), initially developed by Clark and Evans (1954), is one of the quantitative approaches used to identify point-feature distribution patterns. The method compares the observed mean distance between each feature and its nearest neighbour with the expected mean distance under a random spatial distribution. The resulting nearest neighbour ratio can be interpreted to determine whether a distribution tends toward clustering, randomness, or dispersion. A ratio below 1 generally indicates a tendency toward clustering, a ratio close to 1 indicates a random distribution, and a ratio above 1 indicates a tendency toward dispersion. This approach is particularly useful when tourism attractions are represented as point features and the primary research objective is to identify their overall spatial configuration.

Recent tourism studies have increasingly combined GIS and spatial statistical techniques to move beyond descriptive mapping. Chen et al. (2024) found that high-level tourist attractions tend to form clustered patterns associated with transportation networks, economic development, and urbanisation. Ding et al. (2024) combined Mean Nearest Neighbor Analysis, Kernel Density Analysis, and Geographic Detector models to examine tourism-resource distribution and its driving factors, showing that natural and socioeconomic conditions jointly contribute to tourism concentration. Shu et al. (2023) similarly identified relationships between tourism attraction distribution, transportation accessibility, population concentration, and regional development. These studies demonstrate that spatial statistics can provide stronger analytical evidence regarding tourism organisation than location mapping alone.

Nevertheless, previous studies have largely examined tourism attractions in general or focused on broader tourism-resource systems. The application of NNA specifically to river tourism attractions within an urban river environment remains less explored. This represents an important research gap because river tourism differs spatially from tourism systems that are distributed primarily across terrestrial landscapes. River-based attractions are often organised along linear water corridors, waterfront areas, river crossings, and river-dependent activity nodes. Their spatial configuration may therefore reflect the structure and accessibility of the river network as well as the historical and socioeconomic development of the surrounding urban area.

3. METHOD

This research was conducted in Banjarmasin City, South Kalimantan, one of the largest river cities in the country. Banjarmasin is characterized by an extensive network of rivers that has historically

functioned as a transportation corridor, settlement area, and centre of socio-economic activities. These river systems also support the development of river-based tourism, including river cruises (*susur sungai*), floating markets, riverside villages, and waterfront recreational destinations. Due to these characteristics, Banjarmasin provides an appropriate study area for examining the spatial distribution patterns of river tourism attractions using Geographic Information Systems (GIS). The study area covers the administrative boundary of Banjarmasin City, where all identified river tourism attractions were surveyed and mapped. The geographical location of the study area is presented in Figure 1.

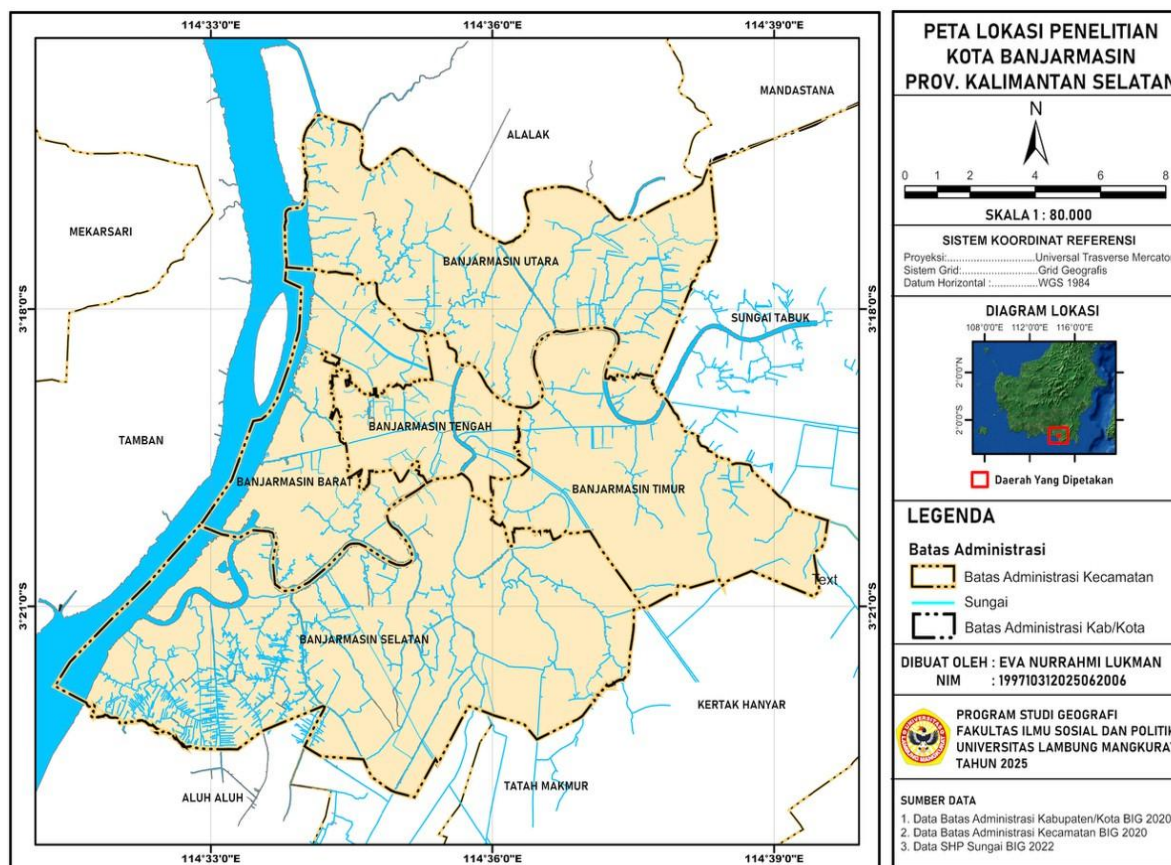


Figure 1. Map of the Research Location
Source: Author's documentation (2025).

Banjarmasin City covers an area of approximately 98.46 km² and is administratively divided into five districts (kecamatan). The city is traversed by the Barito and Martapura Rivers, which form the primary river transportation network and support the development of river-based tourism destinations.

3.1 Research Design

This study employed a quantitative descriptive-spatial research design to identify and analyse the spatial pattern of river tourism attractions in Banjarmasin City. A quantitative spatial approach was selected because the study focuses on geographically referenced point data and uses spatial statistical analysis to objectively determine the distribution pattern of tourism attractions. The research was conducted through four sequential stages: (1) identification and collection of river tourism attraction data; (2) field verification and geographic coordinate recording; (3) spatial database preparation and mapping using GIS; and (4) analysis of the spatial distribution pattern using Nearest Neighbor Analysis (NNA).

3.2 Data Sources and Collection

The study utilised primary and secondary spatial data. Primary data consisted of the geographic coordinates and field verification results of river tourism attractions. Field observations were conducted

to identify the location, name, type, and operational status of each attraction. Geographic coordinates were recorded directly at each tourism site using a Global Positioning System (GPS) receiver. Secondary data included the administrative boundary of Banjarmasin City, river network data, base maps, and tourism-related information obtained from relevant government agencies and official tourism sources. These datasets were used to establish the spatial context of each attraction and support the preparation of the GIS database.

A total of 36 river tourism attractions were identified within the study area. Because the research objective was to examine the overall spatial pattern of river tourism attractions in Banjarmasin City, all identified attractions were included in the analysis. Therefore, the study applied a census or total sampling approach rather than selecting a sample from the population of tourism attractions. This approach ensured that the spatial analysis represented the complete set of identified river tourism attractions within the study area.

Table 1. Research Data and Sources

Data	Source	Purpose
Tourism attraction coordinates	Field Survey (GPS)	Spatial Mapping
Administrative boundaries	BPS/BIG	Base Map
River network	BIG	Spatial Analysis
Tourism information	Disbudporapar Banjarmasin	Attribute Data

Source: Research data Source (2026).

3.3 Instrument and Data Validation

The primary instruments consisted of a GPS receiver for recording geographic coordinates and a field observation sheet for documenting and verifying the characteristics of each tourism attraction. Geographic coordinates were recorded during field observations and subsequently checked against base maps and available secondary tourism information to minimise positional and identification errors. Data validation was conducted through field verification and cross-checking between primary observations and secondary information. Attractions were retained in the spatial database when their location could be confirmed through field observation or reliable supporting information. This procedure ensured that the point dataset used for Nearest Neighbor Analysis represented identifiable river tourism attractions within the administrative boundary of Banjarmasin City. Spatial data processing and map production were performed using ArcGIS 10.8.2. The software was used to organise the spatial database, integrate geographic datasets, plot tourism attraction coordinates, conduct spatial visualisation, and produce the final distribution map. GIS was also used to prepare the point dataset required for subsequent spatial statistical analysis.

3.4 Data Analysis

Spatial data were analysed using Geographic Information Systems (GIS) integrated with Nearest Neighbor Analysis (NNA). GIS was employed to manage, process, visualise, and analyse the spatial distribution of river tourism attractions in Banjarmasin City. All spatial data processing, database management, and thematic mapping were conducted using ArcGIS 10.8.2. The spatial distribution pattern of river tourism attractions was evaluated using the Nearest Neighbor Analysis (NNA) tool in ArcGIS, which is based on the Nearest Neighbor Analysis developed by Clark and Evans (1954). This method compares the observed mean nearest-neighbour distance with the expected mean distance under a condition of complete spatial randomness to determine whether the distribution pattern is clustered, random, or dispersed (Esri, 2023). Finally, the results of the GIS mapping and Nearest Neighbor Analysis were integrated to identify the spatial distribution pattern of river tourism attractions in Banjarmasin City and to provide spatial information supporting river tourism planning and management. The overall research workflow is presented in Figure 2.

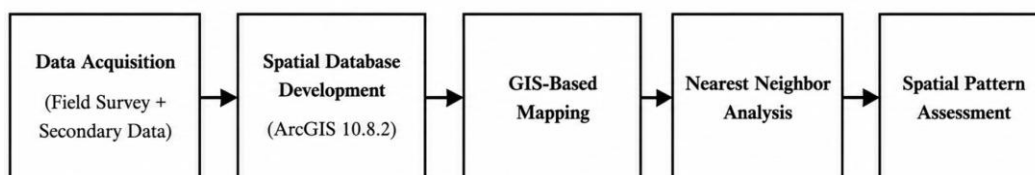


Figure 2. Research Workflow

Source: Author' (2025).

4. RESULTS AND DISCUSSION

4.1 Overview of the Research Location

Banjarmasin City is the capital of South Kalimantan Province, Indonesia, and covers an administrative area of approximately 98.46 km². The city is geographically located between 3°16'46"–3°22'54" South Latitude and 114°31'40"–114°39'55" East Longitude. Administratively, Banjarmasin consists of five districts (kecamatan): Banjarmasin Selatan, Banjarmasin Timur, Banjarmasin Barat, Banjarmasin Tengah, and Banjarmasin Utara. Banjarmasin is widely recognised as the City of a Thousand Rivers because its urban landscape is characterised by an extensive river network dominated by the Martapura River and Barito River. Historically, these rivers have served as the primary transportation routes and centres of economic and social activities.

At present, the river system also functions as a major tourism asset, supporting various river-based tourism attractions, including river cruises (*susur sungai*), floating markets, waterfront recreational areas, and riverside tourism villages (Pradana, 2020). The relatively flat topography and interconnected river network have strongly influenced the spatial development of the city. Consequently, most river tourism attractions are concentrated along river corridors and waterfront areas that provide high accessibility for both residents and visitors. This spatial characteristic reflects the close relationship between the physical environment and tourism development, making Banjarmasin an appropriate case study for analysing the spatial distribution pattern of river tourism attractions.

4.2 Spatial Distribution of River Tourism Attractions in Banjarmasin City

The GIS mapping identified 36 river tourism attractions distributed across Banjarmasin City (Figure 3). The spatial distribution indicates that most attractions are concentrated along the Martapura River and, to a lesser extent, the Barito River, reflecting the dominant role of the river network in shaping the city's tourism landscape. These attractions include river cruises (*susur sungai*), floating markets, waterfront recreation areas, cultural heritage sites, riverside villages, museums, and religious tourism destinations. The highest concentration of attractions occurs along the Martapura River corridor, particularly around the Siring Pierre Tendean, Siring 0 Km, Kampung Hijau, Kampung Biru, Kampung Arab, Kampung Melayu, and Wasaka Museum.

These locations are connected by river transportation routes and are supported by tourism facilities, public spaces, and waterfront infrastructure, making them the primary tourism corridor in Banjarmasin. In contrast, tourism attractions located farther from the main river corridor are distributed more sparsely and are generally associated with local cultural or recreational activities. The observed distribution demonstrates that river tourism attractions are not evenly dispersed throughout the city but are concentrated in areas with high accessibility and strong connectivity to the river network. This finding suggests that the river functions not only as a natural feature but also as an important spatial framework supporting tourism development in Banjarmasin. The concentration of attractions along major river corridors further indicates that accessibility through water transportation and the availability of waterfront facilities have played significant roles in determining tourism location patterns.

These findings are consistent with previous studies that highlight the importance of river corridors in supporting tourism development and destination accessibility. Chen et al. (2024) reported

that tourism attractions tend to cluster in locations characterised by high accessibility and well-developed infrastructure. Similarly, Shu et al. (2023) found that transportation networks and regional development strongly influence the spatial concentration of tourist attractions. The present study extends these findings by demonstrating that, in a river-based city such as Banjarmasin, the river network itself functions as the primary determinant of tourism distribution, resulting in a spatial pattern that follows the city's fluvial landscape.



Figure 3. Map of River Tourism Locations in Banjarmasin City.

Source: Processed Primary Data (2025)

A relatively high concentration of river tourism attractions was also identified in the Kuin Floating Market, Sultan Suriansyah Tomb, Kampung Hijau Sungai Jingah, and Kuin Kecil Mangrove Forest areas, forming distinct tourism clusters along specific sections of the river corridor. These attractions are geographically connected through the river network and are supported by cultural heritage, waterfront recreational facilities, and river transportation services. Such characteristics enhance destination accessibility and encourage the spatial concentration of tourism activities within particular riverfront areas.

The observed clustering indicates that river tourism attractions in Banjarmasin tend to develop in locations that already possess strong tourism infrastructure, historical significance, and active socio-cultural functions. Rather than being evenly distributed across the city, tourism development is concentrated in riverfront areas that offer multiple complementary attractions, allowing visitors to access several destinations within a single travel route. This spatial configuration increases the attractiveness and efficiency of river tourism while strengthening the connectivity among tourism destinations.

These findings are consistent with Chen et al. (2024), who reported that tourism attractions generally exhibit clustered spatial patterns in areas characterised by high accessibility and well-

developed infrastructure. Similarly, Shu et al. (2023) demonstrated that transportation networks and regional development significantly influence the spatial concentration of tourism attractions. In the context of Banjarmasin, the river network functions not only as a transportation corridor but also as the primary spatial framework shaping the distribution and connectivity of river tourism attractions

4.3 Spatial Pattern Analysis Using Nearest Neighbor Analysis (NNA)

Based on the analysis of 36 river tourism attractions distributed across an area of 98.46 km², the Average Nearest Neighbor analysis indicated a clustered spatial distribution, consistent with the spatial distribution principles proposed by Clark and Evans (1954). The GIS analysis also revealed that clustering is not uniformly distributed across the study area. Instead, several distinct spatial zones can be identified according to the density and characteristics of river tourism attractions (Table 3).

Table 3. Spatial Zonation of River Tourism Attractions in Banjarmasin City

Spatial Pattern	Dominant Area	Main River Tourism Attractions	Spatial Characteristics
Clustered (Urban Core)	Central Banjarmasin and East Banjarmasin	Pasar Terapung Siring Pierre Tendean, Siring 0 Km, Museum Wasaka, Kampung Arab, Kampung Melayu Sungai Jingah, Taman Satwa Jahri Saleh	High concentration of attractions with relatively short inter-point distances along the Martapura River corridor.
Clustered (Historical and Cultural Corridor)	North Banjarmasin	Pasar Terapung Kuin, Makam Sultan Suriansyah, Masjid Sultan Suriansyah, Kampung Kuin	Cluster characterised by historical, religious, and cultural river tourism attractions.
Semi Clustered	South Banjarmasin	Kampung Hijau Sungai Jingah, Makam Habib Basirih, Kampung Ketupat	Attractions remain spatially connected, although the distances between locations become relatively greater than those in the urban core.
Locally Random	Urban Fringe	Pelabuhan Trisakti, Hutan Mangrove Sungai Awang, Kuin Kecil Hutan Mangrove	Attractions are more dispersed, with weaker spatial connectivity to the primary river tourism corridor.

Source: Spatial analysis using ArcGIS 10.8.2 (2025)

The strongest clustering occurs along the Martapura River corridor, where tourism attractions are interconnected by river transportation routes and supported by public facilities, commercial activities, and waterfront infrastructure. This spatial configuration enables visitors to access multiple destinations within a relatively short travel distance, thereby increasing destination connectivity and tourism efficiency. In contrast, attractions located in the urban fringe tend to be more dispersed because they primarily depend on local ecological resources rather than the main tourism corridor.

The clustered distribution observed in this study is consistent with previous international research. Chen et al. (2024) reported that tourism attractions generally concentrate in areas characterised by high accessibility, developed infrastructure, and strong urban functions. Similarly, Shu et al. (2023) demonstrated that transportation networks and regional development significantly influence the spatial concentration of tourist attractions. In Banjarmasin, the river network serves as both a

transportation corridor and the principal spatial framework that shapes the distribution of river tourism destinations.

The identification of clustered and semi-clustered tourism zones provides important implications for tourism planning. High-density tourism corridors require integrated visitor management, improved waterfront infrastructure, and sustainable environmental management to accommodate increasing tourism activities. Conversely, attractions located in the urban fringe present opportunities for developing alternative river tourism routes and ecotourism destinations, thereby diversifying tourism products while reducing visitor pressure within the city's primary tourism corridor. These findings demonstrate that integrating Geographic Information Systems with Nearest Neighbor Analysis provides robust spatial evidence for supporting sustainable river tourism planning and destination management.



Figure 4. Banjarmasin Floating Market

Source: Documentation (2025)

4.4 Geographical Characteristics Associated with the Spatial Distribution of River Tourism Attractions

- **Accessibility and Tourism Infrastructure**

The highest concentration of river tourism attractions occurs in the city centre, particularly along the Martapura River corridor, where destinations such as Pasar Terapung Siring Pierre Tendean, Siring 0 Km, Museum Wasaka, Kampung Arab, and Kampung Melayu Sungai Jingah are interconnected through integrated water- and land-based transportation networks. These attractions are located within relatively short distances of one another and are supported by various tourism facilities, including river docks, waterfront promenades, public open spaces, culinary areas, souvenir centres, and other visitor amenities. Such facilities improve destination accessibility and enable tourists to visit several attractions within a single travel itinerary, thereby increasing the efficiency and attractiveness of river-based tourism.

The concentration of tourism attractions within this corridor also reflects the role of the Martapura River as the principal tourism axis in Banjarmasin. In addition to functioning as a transportation route, the river itself represents an integral part of the tourism experience, where traditional kelotok boat tours connect multiple cultural, historical, and recreational destinations along the waterfront. The combination of accessible transportation, integrated tourism infrastructure, and close spatial proximity among attractions has encouraged the formation of a well-defined tourism cluster in the city centre.

This finding is consistent with Chen et al. (2024), who reported that tourism attractions tend to cluster in areas characterised by high accessibility, comprehensive infrastructure, and

strong urban functions. Similarly, The spatial concentration observed in Banjarmasin suggests that accessibility and infrastructure are important characteristics associated with the spatial organisation of river tourism destinations.

- **River Network and Physical Characteristics.**

The morphology and characteristics of the river network play a fundamental role in shaping the spatial distribution of river tourism attractions in Banjarmasin. Historical and cultural destinations such as Pasar Terapung Kuin, Makam Sultan Suriansyah, Masjid Sultan Suriansyah, and Kampung Kuin are predominantly located along navigable sections of the river that have historically functioned as transportation routes and centres of community activities. The relatively wide river channels, navigable waterways, and direct accessibility by *kelotok* (traditional motorised boats) facilitate tourist mobility while enhancing the attractiveness of river-based tourism experiences.

Beyond serving as transportation corridors, the river network also provides scenic landscapes and reinforces the cultural identity of Banjarmasin as the "City of a Thousand Rivers." These physical characteristics encourage the concentration of tourism activities along the riverbanks, where natural and cultural resources coexist within the same spatial setting. This finding supports the observations of Shu et al. (2023), who demonstrated that transportation networks and physical geographical characteristics significantly influence the spatial concentration and development of tourism destinations.

- **Socio-cultural Resources.**

Socio-cultural resources constitute another important factor influencing the spatial distribution of river tourism attractions in Banjarmasin. Several destinations, including Pasar Terapung Kuin, Makam Sultan Suriansyah, Masjid Sultan Suriansyah, Kampung Arab, and Kampung Melayu Sungai Jingah, possess strong historical, religious, and cultural significance that enhances their attractiveness to visitors. These destinations not only preserve the city's cultural heritage but also provide authentic tourism experiences that distinguish Banjarmasin from other urban tourism destinations.

The close proximity of historical and cultural attractions enables tourists to visit multiple destinations within a single river tour, thereby strengthening the functional relationship among tourism sites and increasing the overall attractiveness of the tourism corridor. In addition, the active involvement of local communities in maintaining cultural traditions, religious sites, and river-based activities contributes to the sustainability of these tourism destinations. Similar findings were reported by Chan et al. (2024), who emphasised that community participation and cultural heritage are essential components in enhancing the sustainability and competitiveness of river tourism destinations.

- **Peripheral Accessibility and Ecotourism Potential**

Unlike the highly concentrated tourism cluster in the city center, several attractions located in the urban fringe, including Trisakti Harbor, Sungai Awang Mangrove Forest, and Kuin Kecil Mangrove Forest, exhibit a relatively dispersed spatial pattern with greater distances between destinations. These peripheral attractions are characterized by lower transportation connectivity and more limited tourism infrastructure than those located along the Martapura River corridor. Consequently, accessibility to these destinations relies on fewer transportation options, resulting in weaker spatial integration within the overall river tourism network.

In addition to accessibility constraints, the spatial distribution of these destinations is strongly influenced by the natural environment. Attractions such as Sungai Awang Mangrove Forest and Kuin Kecil Mangrove Forest are situated within ecologically sensitive areas, where tourism development must adapt to existing environmental conditions rather than urban infrastructure. Similarly, destinations such as Kampung Hijau Sungai Jingah combine ecological

and cultural attractions, creating unique tourism experiences while maintaining close relationships with the surrounding river ecosystem.

Although these attractions are more dispersed than those in the city center, they represent significant opportunities for expanding river tourism through ecotourism and nature-based tourism development. Strengthening transportation connectivity, improving supporting facilities, and promoting integrated tourism routes linking the city center with peripheral destinations could help distribute visitor flows more evenly across Banjarmasin. Such an approach would not only reduce tourism pressure on the primary tourism corridor but also enhance the economic benefits received by surrounding communities while supporting sustainable tourism development. This finding is consistent with Withanage et al. (2024), who emphasized that GIS-based spatial planning plays an important role in identifying suitable areas for sustainable tourism development while balancing environmental conservation and tourism growth.

Overall, the spatial distribution of river tourism attractions in Banjarmasin is not determined by a single factor but rather by the interaction of physical, socio-cultural, and infrastructural characteristics. The river network provides the fundamental geographical framework for tourism development, while accessibility and supporting infrastructure strengthen the concentration of attractions along the main river corridor. At the same time, historical and cultural resources increase the attractiveness of specific locations, whereas ecological conditions and limited transportation connectivity contribute to the more dispersed distribution of attractions in peripheral areas.

These findings demonstrate that the spatial organisation of river tourism in Banjarmasin reflects a complex interaction between natural landscapes and human activities. Consequently, future tourism planning should adopt an integrated spatial approach that considers not only the physical characteristics of the river system but also accessibility, cultural heritage, environmental sustainability, and regional connectivity to achieve more balanced and sustainable river tourism development

4.5 Implications of GIS-Based Spatial Analysis for Geography Learning

The GIS-based map of river tourism attractions and the results of spatial analysis also have important implications for geography learning. The spatial distribution of 36 river tourism attractions in Banjarmasin City can be utilised as a contextual learning resource because it presents geographical phenomena that are directly connected to students' surrounding environment. Through the map, students can identify the location and distribution of tourism attractions, recognise their relationship with the Martapura and Barito River networks, and compare differences between highly concentrated tourism corridors and more dispersed peripheral destinations. The use of GIS-based representations in geography education has been increasingly recognised as a means of connecting geographical concepts with real-world spatial phenomena and supporting students' understanding of geographic information (Bondarenko, 2024; Cao et al., 2024).

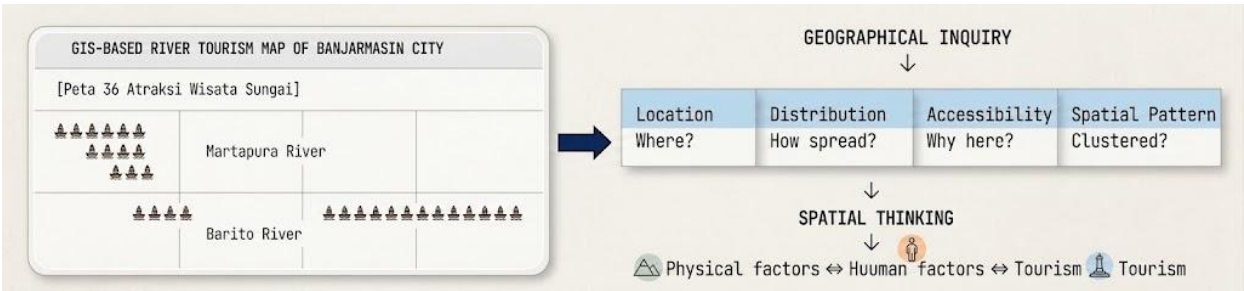


Figure 5. From GIS-Based Spatial Analysis to Spatial Thinking in Geography Learning
Source : Author's analysis and conceptualisation (2026)

The river tourism distribution map can particularly support the development of map-reading and geographical interpretation skills. Students can use the map to interpret geographical symbols, identify spatial locations, analyse the relationship between point distributions and river networks, and recognise

differences in the spatial concentration of tourism attractions across Banjarmasin City. Rather than using maps solely as visual illustrations, GIS-based spatial data can therefore be transformed into learning materials that encourage students to actively interpret geographical information and understand spatial concepts. Previous studies have similarly demonstrated that GIS and digital mapping technologies can support the development of geographical skills and students' understanding of spatial concepts, particularly when learners are actively engaged in analysing and interpreting spatial information (Hickman, 2023; Bondarenko, 2024).

The results of the Nearest Neighbor Analysis can also support the development of spatial thinking. The identification of a clustered distribution pattern provides an opportunity for students to investigate why tourism attractions are concentrated in particular locations and how accessibility, river networks, infrastructure, historical functions, and socio-cultural characteristics influence this pattern. Students can be encouraged to formulate spatial questions, identify patterns, analyse spatial relationships, and explain the interaction between physical and human geographical factors. Such learning activities are consistent with geographic inquiry approaches that encourage students to investigate geographical patterns and relationships rather than merely memorising the locations of geographical phenomena. Recent studies have shown that GIS-supported learning, geographic inquiry, and digital geospatial media can contribute to the development of students' spatial thinking skills (Hickman, 2023; Oktavianto, 2022; Purwanto et al., 2024).

In addition, the Banjarmasin river tourism case provides an example of place-based geography learning. Students can relate abstract concepts such as spatial distribution, accessibility, connectivity, clustering, and human–environment interaction to geographical phenomena within their own urban environment. The use of local geographical cases enables learning activities to be connected with places that are familiar and meaningful to students, while providing opportunities to apply geographical knowledge to real-world spatial problems. Recent research on place-based GIS education has likewise highlighted the value of using local contexts and community-related spatial issues to strengthen students' engagement, critical thinking, and understanding of geographical problems (Soucy et al., 2024).

5. CONCLUSION

This study demonstrates that river tourism attractions in Banjarmasin City exhibit a clustered spatial pattern, primarily concentrated along the Martapura River corridor. The integration of GIS and Nearest Neighbor Analysis (NNA) effectively identified the spatial characteristics of these attractions and highlighted the role of river accessibility, tourism infrastructure, cultural heritage, and the urban river network in shaping their distribution. These findings contribute to tourism geography by demonstrating the value of spatial analysis for understanding river-based tourism in urban environments.

From a practical perspective, the findings can support local governments and tourism stakeholders in developing cluster-based tourism strategies, improving connectivity among attractions, and strengthening supporting infrastructure along the main river tourism corridor. The identified concentration also provides opportunities to connect peripheral tourism areas with the main corridor and promote a more balanced and sustainable development of river tourism. However, this study is limited by its focus on spatial distribution and does not examine visitor movement, tourism demand, land use, or environmental quality. Future studies should integrate these variables and conduct comparative research in other river cities to provide a more comprehensive understanding of river tourism patterns.

The study also has implications for geography education. GIS-based maps of river tourism attractions and NNA results can be utilised as contextual learning resources for teaching spatial distribution, location, connectivity, and geographical relationships. Visualising clustered and dispersed tourism patterns can help students develop map-reading, spatial analysis, and spatial thinking skills

through real-world geographical phenomena. Thus, the study contributes not only to river tourism planning and management but also to contextual geography learning.

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