

SPATIAL ANALYSIS OF TOURIST ATTRACTIONS FOR GEOGRAPHIC INFORMATION SYSTEM-BASED TOURISM DEVELOPMENT IN SIJUNJUNG REGENCY

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Abstract: The study utilized a quantitative descriptive methodology alongside GIS-oriented spatial analysis. Data gathering entailed conducting field surveys to obtain coordinates for 76 recognized tourist sites utilizing Global Positioning System (GPS), in addition to interviews and secondary data collecting from the Sijunjung Regency Tourism Office. Spatial configurations were examined via the Nearest Neighbor Analysis technique to ascertain distribution types, while accessibility was assessed through buffering methods within a radius of 300–800 meters from primary access points. The results indicate that nature tourism constitutes a significant majority of tourist attractions in Sijunjung Regency at 69.7%, with cultural attractions at 17.1% and man-made attractions at 13.2%. The allocation of these locations is disproportionate, with a notable concentration (exceeding 55%) in the districts of Sijunjung, Silokek, and Sumpur Kudus. Nearest Neighbor Analysis validated a clustered spatial configuration ($R \text{ index} < 1$), suggesting that attractions are inclined to congregate, especially near the urban core and prominent natural centers. In terms of accessibility, although significant natural landmarks are often within a 400-meter proximity to primary thoroughfares, numerous cultural and constructed sites experience poor accessibility, with distances beyond 800 meters and insufficient infrastructure. The research determines that GIS serves as a valuable instrument for recognizing the opportunities and limitations of regional tourism advancement. The clustered arrangement aids in the development of trip packages, although the limited accessibility of cultural places hinders the optimization of visitor numbers. Local authorities are advised to focus on enhancing infrastructure for promising yet inadequately reachable locations and to engage local populations in governance to guarantee fair economic advantages and sustainable progress.

Keywords: GIS, tourist attractions, spatial analysis, accessibility, Sijunjung Regency

INTRODUCTION

Tourism is a strategic sector that plays a crucial role in driving economic growth, creating jobs, and strengthening a region's cultural identity. This sector not only contributes to increasing Gross Domestic Product (GDP) but also drives various supporting sectors such as transportation, culinary arts, and local crafts (UNWTO, 2022; Haryanto, 2014). Globally, tourism is viewed as a pillar of sustainable development that integrates economic, social, and environmental dimensions (Gössling & Hall, 2019). Within the Indonesian framework, the nation's plentiful natural and cultural resources offer substantial prospects for the creation of highly competitive tourist destinations on the international stage. (Indonesia, 1990).

However, utilizing this potential requires accurate spatial data-based planning to ensure effective and equitable tourism development. Sijunjung Regency, located in West Sumatra Province, possesses considerable tourism potential that is yet to be fully exploited. This regency presents a varied assortment of locales, encompassing natural wonders like waterfalls, rivers, and hills, alongside cultural sites that highlight Minangkabau customs, traditional dwellings, and ceremonies, in addition to artificial attractions including swimming pools, playgrounds, and recreational amenities (Nofrizal, 2018). The Silokek Geopark is one of its most famous landmarks, known all over the country for its natural beauty and geological importance. However, the management of this

tourism potential still faces challenges, one of which is the limited availability of spatial information that can be used to plan destination development in a targeted manner (Sodikin & Susanto, 2021).

Insufficient spatial data indicates that the arrangement and interrelation of tourist sites in Sijunjung are inadequately recorded. This obstructs the strategizing for the enhancement of supporting infrastructure, including roadway access, public amenities, and transit systems. Incorporated geographical data is crucial for delineating the attributes of tourist sites, examining their distribution trends, and assessing accessibility for both domestic and foreign visitors (Millennium, 2023). Without this kind of information, tourism development could be uneven and lead to differences in how easy it is to get to and use local resources (Amar Daumi et al., 2012).

The use of Geographic Information Systems (GIS) has proven to be an effective solution in analyzing and visualizing spatial data to support decision-making in the tourism sector (Prahasta, 2009; Yuliadji et al., 1994). Several studies have employed GIS to delineate tourism potential, including those by Ridwan and Masri (2019) in the Selayar Islands Regency, which concentrated on natural tourism, and by Arifah and Putri (2019), who investigated the development of the Silokek Geopark through the lens of geotourism. However, these studies generally only highlight one type of tourism or a specific region without an integrated analysis of the characteristics, distribution, spatial patterns, and accessibility of the destination.

At the national level, Partono and Rahman (2016) utilized GIS to map natural and cultural tourism in Sukoharjo Regency but did not integrate spatial pattern analysis using the nearest neighbor method. Pratami et al.'s (2021) research in West Lampung also demonstrated the benefits of GIS for destination mapping, but its focus was limited to location distribution without accessibility analysis.

Afli Yardi's (2020) research in Lubuk Tarok District discussed spatial analysis of tourist attractions, but its scope only covered one district. Meanwhile, Ramadhani Putri et al.'s (2023) research focused on developing the potential of the Silokek Geopark, not providing a comprehensive overview of all destinations in Sijunjung Regency. International studies also demonstrate the widespread application of GIS in tourism. Lopez et al. (2017) in Spain developed a spatial model for national park

management, Zhang et al. (2020) in China analyzed tourism distribution based on geospatial data, Singh and Mishra (2019) in India mapped ecotourism potential in mountainous areas, and Ferreira and Harmse (2014) employed GIS for the development of conservation areas in South Africa. These results validate that GIS may amalgamate spatial and thematic analysis to facilitate sustainable destination advancement. Nonetheless, there is a scarcity of research that integrates the examination of characteristics, distribution, spatial patterns, and accessibility of attractions inside a singular area in Indonesia.

This investigation addresses the identified research void by including four essential analytical dimensions—tourist attraction attributes, distribution, spatial configurations, and accessibility—into a unified GIS-centric study in Sijunjung Regency. This methodology is anticipated to provide an extensive spatial representation to facilitate decision-making about regional tourist advancement. This research employs field data, documentation, and secondary information from the Tourism Office to delineate tourism potential while also pinpointing accessibility obstacles that may be targeted for infrastructure enhancements.

This research seeks to provide a substantive contribution to the formulation of more focused, efficient, and sustainable tourism development planning in Sijunjung Regency. The results are expected to serve as a reference for local governments, tourism operators, and academics in developing destination development strategies that can increase tourist appeal and equitably distribute economic benefits.

Specifically, this study aims to analyze the characteristics of tourist attractions, the distribution of tourist attractions, the spatial plan of tourist attractions, and the accessibility of tourist attractions in Sijunjung Regency. Through a spatial analysis approach based on a geographic information system (GIS), this study is expected to contribute to more targeted, effective, and sustainable tourism development planning in Sijunjung Regency.

LITERATURE REVIEW

The definition of a tourist attraction is anything that has uniqueness, beauty, and value in the form of diverse natural resources, culture, and man-made products that are the target or destination of tourist visits (Ridwan, 2012). Basically, tourism development is a continuous process to continuously match and adjust

between the available supply and demand sides of tourism to achieve the predetermined mission (Nuryanti, 1994).

Spatial distribution is the distribution of individuals or colonies in a specific space or based on their position in a specific habitat. In general, the spatial distribution pattern of individuals in a population is random, uniform, and clustered. According to Dwi Ari and Antariksa (2005), the pattern of tourist attractions discusses the distribution of tourist attractions. In other words, the pattern of tourist attractions in general is the distribution of tourist attractions.

A Geographic Information System (GIS) is a synthesis of three components: geography, information, and system. Consequently, comprehending these three fundamental components will be highly advantageous in the context of GIS. GIS is a type of information that emphasizes the element of "geographic information," as evidenced by the examination of these fundamental components (Prahasta, 2009).

There are two types of data processed in GIS: geospatial data (spatial data) and non-spatial data. Spatial data relates to geographic conditions, such as rivers, administrative areas, buildings, roads, and so on.

RESEARCH METHODS

Research Location

This research was conducted in Sijunjung Regency, West Sumatra Province, which has an area of 3,130.8 km² and is divided into eight sub-districts. The research location includes all tourist attractions identified by the Sijunjung Regency Tourism Office, including 76 tourist destinations consisting of natural, cultural, and man-made tourism. Sijunjung Regency is situated geographically between 0°36' and 1°40' South Latitude and 100°54' and 101°46' East Longitude. This location was selected based on the diversity of tourism potential and the need for comprehensive spatial analysis to support regional tourism development planning.

Picture 1. Research Location Map



Research Approach

The spatial analysis method employed in this study is based on a Geographic Information System (GIS) and is quantitative descriptive in nature. This method was selected due to its ability to combine spatial data (such as the location and distribution of tourist attractions) with non-spatial data (such as characteristics, facilities, and accessibility) to offer a comprehensive understanding of the tourism conditions in Sijunjung Regency. The research design is survey-based, utilizing primary data collected through field observations and interviews, as well as secondary data from relevant agencies. Spatial analysis is performed to determine the distance that tourists must travel to reach tourist attractions, as well as to establish relationships between locations.

Research Procedures

The research process consists of the following steps: 1) the collection of secondary data from the Tourism Office, Bappeda, and the Geospatial Information Agency; 2) field surveys for data verification, coordinate point acquisition using GPS, and visual documentation of tourist attractions; 3) the processing of spatial data in ArcGIS software for map creation and distribution pattern analysis using Nearest Neighbor Analysis; 4) the analysis of the accessibility of tourist attractions using buffering techniques at a specific radius; and 5) the interpretation of the analysis results to compile development recommendations.

Data Collection Instruments

The main instruments in this study were a Global Positioning System (GPS) to capture the coordinates of tourist attractions, a structured questionnaire to collect information on tourist characteristics and facilities, and a digital camera for visual documentation. Validation of the questionnaire instrument was conducted through expert judgment by the supervising lecturer and tourism practitioners, who ensured the suitability of the indicators for the research objectives. Secondary data were acquired from the Sijunjung Regency Tourism Office's official list of tourist attractions, administrative maps, and road network maps.

Data analysis

Data analysis was conducted in stages. First, coordinate data was processed in GIS to produce a map of the distribution of tourist attractions. Second, spatial pattern analysis was conducted

using the Nearest Neighbor Analysis method to determine whether the distribution of tourist attractions was random, uniform, or clustered. Thirdly, an accessibility assessment was performed utilizing a buffering method within a range of 300–800 meters from the primary entry point, adhering to the guidelines set forth by the Indonesian Minister of Tourism Regulation. Fourth, the characteristics of tourist attractions were examined both descriptively and quantitatively using frequency and percentage calculations. The findings from this analysis were utilized to determine developmental priorities by considering potential, distribution patterns, and accessibility levels.

RESULTS AND DISCUSSION

Characteristics of Tourist Attractions

The analysis shows that of the 76 tourist attractions identified in Sijunjung Regency, 69.7% are natural attractions, 17.1% are cultural attractions, and 13.2% are man-made attractions. Natural attractions include waterfalls, caves, hilltops, and rivers, with the Silokek Geopark as the main icon. Cultural attractions include historical sites, tombs of traditional figures, and traditional villages, while man-made attractions are dominated by swimming pools and family recreation areas. These findings indicate the dominance of natural landscapes as the main attraction, in line with the area's geographic character, which is dominated by hilly topography and large rivers (BPS Sijunjung, 2024).

This dominance of nature tourism is consistent with Gunn & Var's (2002) discovery that natural landscapes are frequently the primary foundation for destination development in rural areas. Nevertheless, the absence of sufficient support facilities, including parking areas, public restrooms, information displays, and places of worship, continues to pose a challenge. The length of tourists' stays may be affected by the fact that only 48.6% of tourist attractions have comprehensive facilities (Murti, 2013).

Distribution of Tourist Attractions

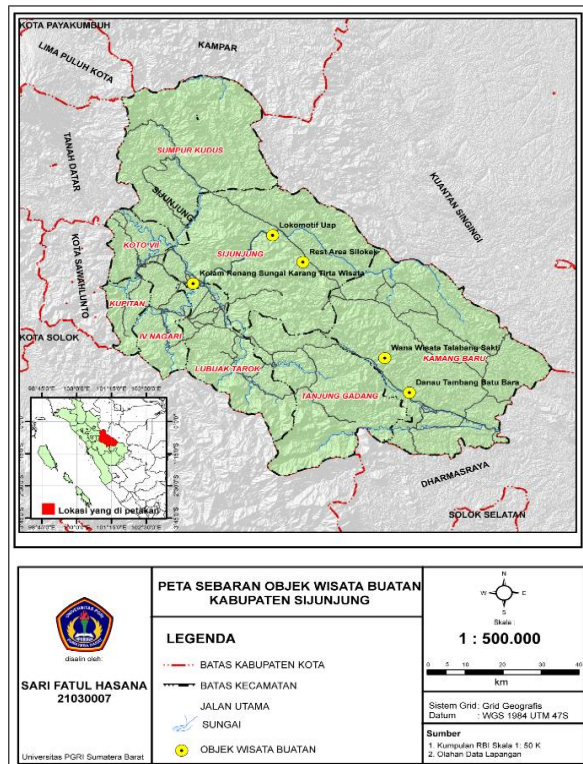
The distribution of tourist attractions is concentrated in the districts of Sijunjung, Silokek, and Sumpur Kudus, as demonstrated by coordinate mapping. Silokek is a prominent natural tourism center, and these three districts account for over 55% of the current destinations. Lubuk Tarok and Kamang Baru are regions with substantial potential; however, there are

relatively few managed destinations. This uneven distribution pattern has implications for disparities in accessibility and economic benefits between districts. This concentrated distribution parallels the research results of Zhang et al. (2020) in China, which indicated that tourist

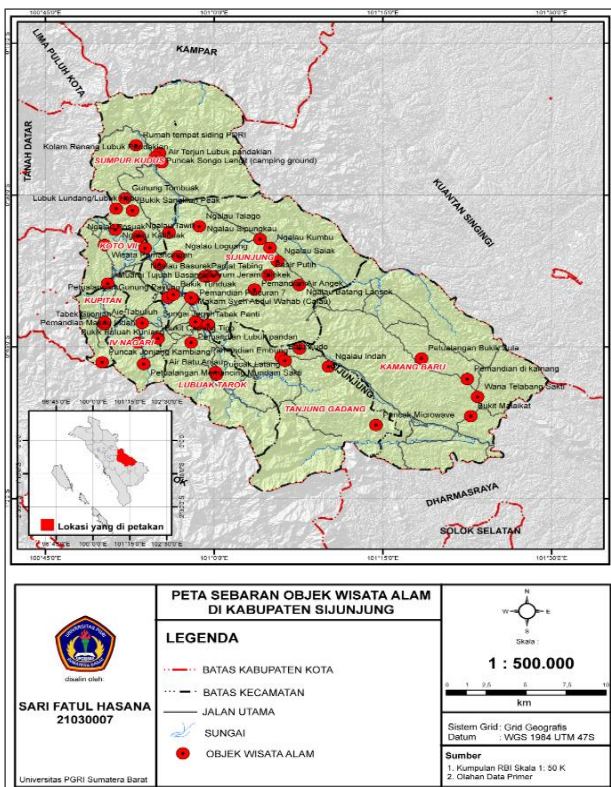
attractions are likely to aggregate in regions with superior road access and infrastructure. Closeness to district capitals likewise affects the intensity of development, as it enhances promotional efforts and management coordination.



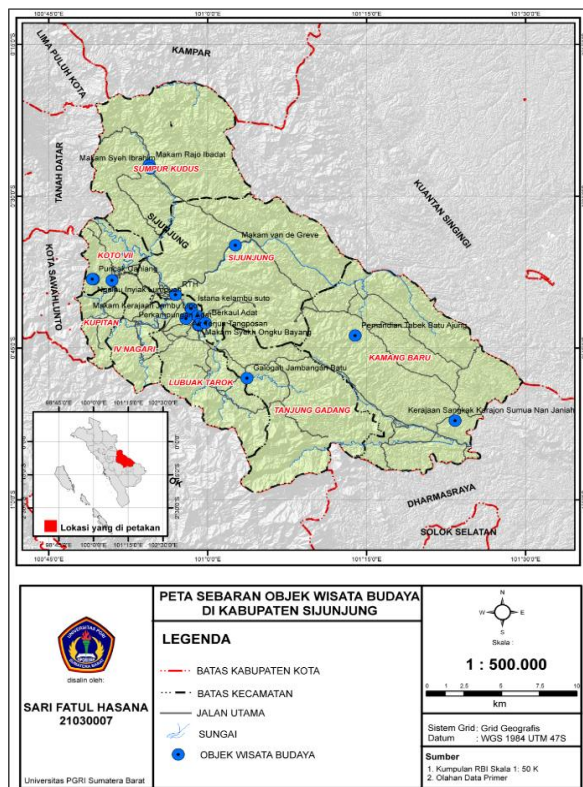
(a)



(b)



(c)



(d)

Explanation :

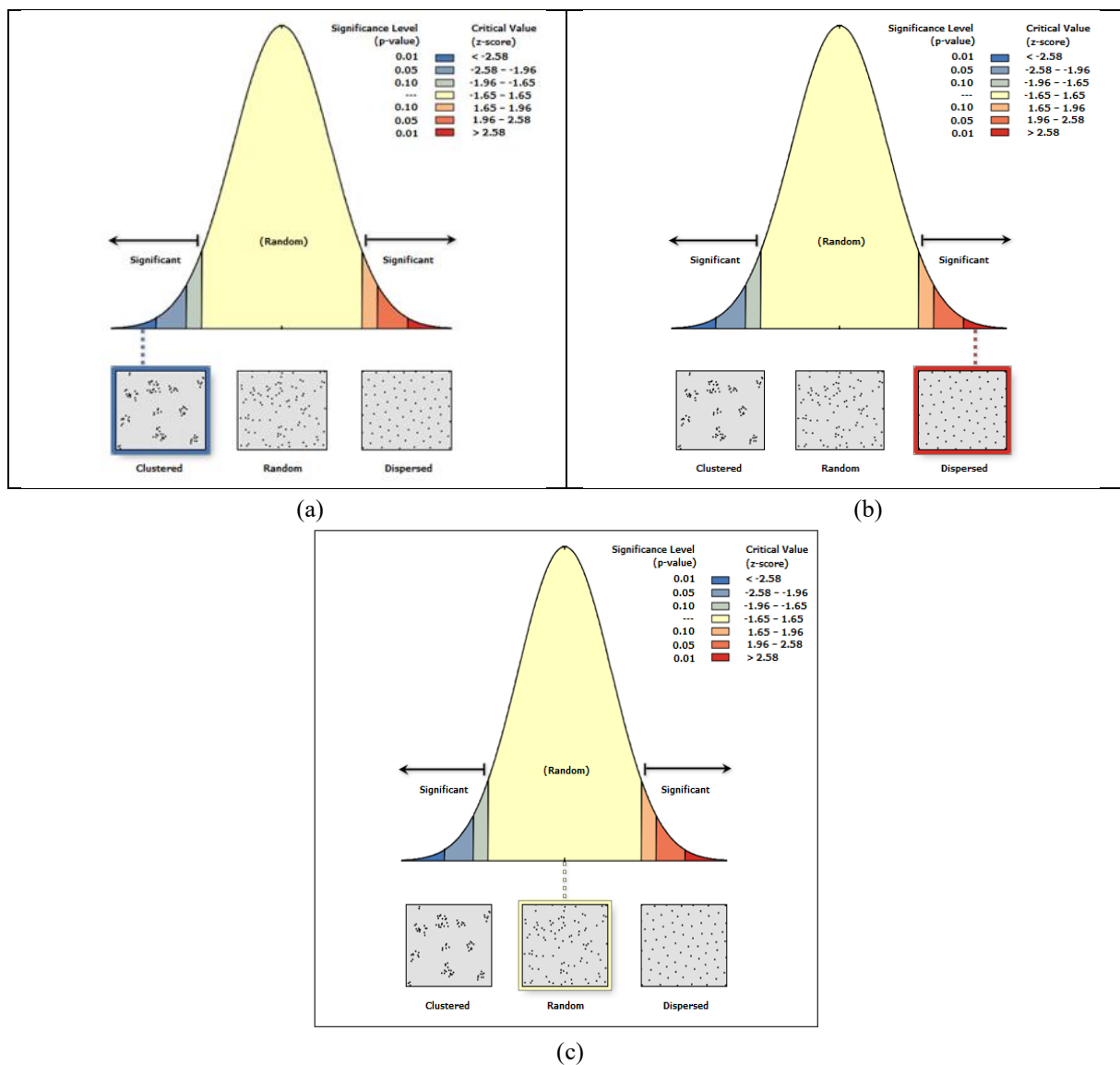
- Figure a. Map of the distribution of tourist attractions in Sijunjung Regency
- Figure b. Map of the Distribution of Artificial Tourist Attractions in Sijunjung Regency
- Figure c. Map of the Distribution of Natural Tourist Attractions in Sijunjung Regency
- Figure d. Map of the Distribution of Cultural Tourism Objects in Sijunjung Regency

Spatial Pattern of Tourist Attractions

The results of the Nearest Neighbor Analysis show an R index value of less than 1, which means that the data is clustered. This indicates a tendency for tourist attractions to cluster together in one area, particularly around Silokek and the Sijunjung city center. This pattern is advantageous for promoting tour packages, as tourists can visit several destinations in one trip (Cooper et al., 2008). However, this clustered pattern also poses challenges for remote areas, as

destinations in these areas receive fewer visitors due to their distance from tourist centers.

This analysis aligns with Ridwan & Masri's (2019) findings in Selayar Regency, where clustering patterns occurred in natural resource-based destinations with complementary attractions. In Sijunjung, the proximity of destinations in Silokek facilitates integration with rafting and hiking attractions but also requires zoning planning to prevent overtourism in any one location.

**Explanation :**

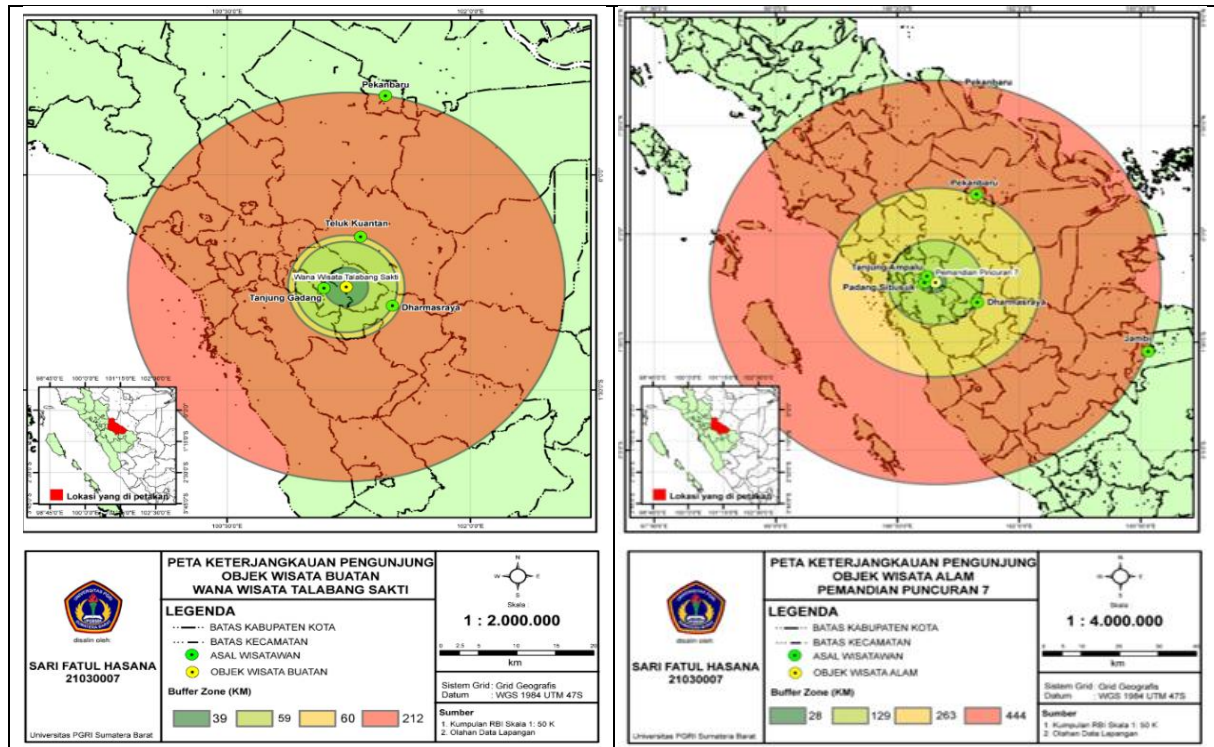
- Figure a. Nearest Neighbor Analysis of Natural Tourism Object Distribution Patterns
- Figure b. Nearest Neighbor Analysis of Cultural Tourism Object Distribution Patterns
- Figure c. Nearest Neighbor Analysis of Artificial Tourist Object Distribution Patterns

Accessibility of Tourist Attractions

Buffering analysis revealed that some cultural and man-made tourist attractions have low accessibility, with access distances exceeding 800 meters from main roads and some roads being unpaved. In contrast, popular natural attractions such as the Pincuran 7 Baths and the Silokek White Water Rafting are located within a radius of <400 meters from main roads or transportation facilities, making them accessible. Poor accessibility to some cultural attractions,

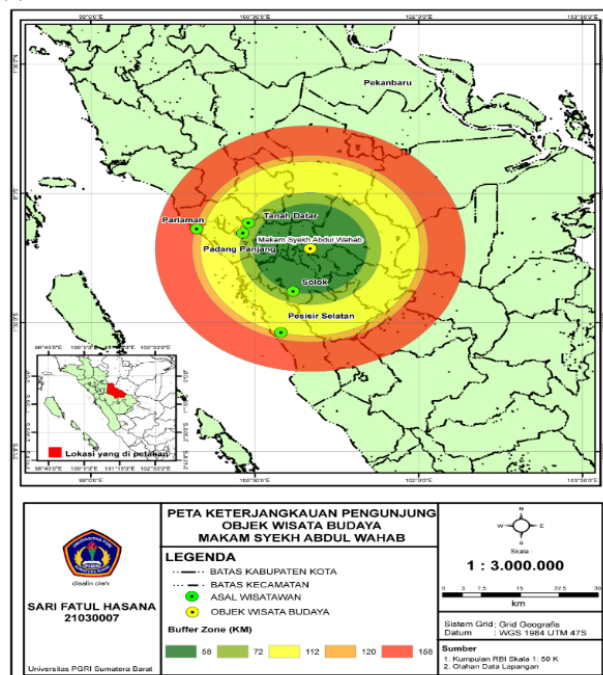
such as the Tomb of Sheikh Abdul Wahab and the Tomb of Rajo Ibadat, is a contributing factor to low visitor numbers.

These results confirm Yoeti's (1997) assertion that accessibility is a key determinant of successful tourism destination development. Infrastructure interventions and cultural narrative-based promotions are necessary to sustain visitor interest in tourist attractions with limited access, even if they necessitate longer journeys.



(a)

(b)



(c)

Explanation :

- Figure a. Map of Accessibility of Artificial Tourist Attractions in Sijunjung Regency
- Figure b. Map of Accessibility of Natural Tourism Objects in Sijunjung Regency
- Figure c. Map of Accessibility of Cultural Tourism Objects in Sijunjung Regency

Overall, the results of this study demonstrate that GIS is effective in identifying the potential and constraints of tourism development in Sijunjung Regency. The predominantly natural tourism sector presents significant opportunities for developing community-based ecotourism. The clustered distribution facilitates the development of tourism packages, but equitable distribution strategies are needed to ensure the development of destinations in other regions. Improving accessibility is crucial, particularly for cultural destinations with significant historical value.

This approach aligns with the principles of sustainable tourism development, which emphasize equitable distribution of economic benefits, environmental preservation, and respect for local culture (UNWTO, 2022; Singh & Mishra, 2019). With accurate spatial data, local governments can prioritize infrastructure development, focus promotion on potential destinations, and design thematic tourism routes connecting various tourist attractions in Sijunjung.

CONCLUSION

This investigation confirms that Sijunjung Regency possesses a diverse array of significant tourism potential, with natural attractions (69.7%) being the most prevalent, followed by cultural (17.1%) and artificial (13.2%) sites. The geographical distribution of the 76 recognized attractions is erratic, with a significant majority (over 55%) located in the Sijunjung, Silokek, and Sumpur Kudus districts. In addition, the Nearest Neighbor Analysis verified that the geographical distribution of these attractions is aggregated ($R \text{ index} < 1$), particularly in the vicinity of the district headquarters and recognized natural centers like Silokek.

Regarding accessibility, the study identifies a clear disparity: leading natural attractions are generally well-integrated into the transport network with access distances under 400 meters, whereas many cultural and artificial sites suffer from low accessibility, exceeding 800 meters from main roads with inadequate infrastructure. These results demonstrate that Geographic Information Systems (GIS) are highly effective in visualizing both the potential and the constraints of regional tourism, providing a

substantive basis for more targeted and equitable planning.

To promote sustainable tourism growth in Sijunjung Regency, it is advisable for the local administration to focus on enhancing infrastructure for culturally and artificially significant areas that presently have inadequate access. Moreover, it is essential to establish fair development strategies throughout all districts to avert regional inequalities and to execute community-oriented tourism management to optimize local economic advantages while safeguarding the area's distinctive socio-ecological traits.

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