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Analysis of Land Use Patterns in the Kampung Minang Tourism Village, Nagari Sumpur, Based on Geographic Information Systems (GIS)

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Abstract: The method used is descriptive quantitative, with primary data collected through field observations and interviews, and secondary data obtained from drone imagery and spatial planning documents. The analysis involved land classification, thematic mapping, and Nearest Neighbor Analysis (NNA). The results show that land use is dominated by sapodilla plantations (48.89%) and rice fields (33.86%), reflecting the village's agrarian character. Regional facilities are evenly distributed, supporting educational, health, and cultural functions. The NNA indicates a clustered settlement pattern, with a Nearest Neighbor Ratio of 0.329755 and a z-score of -28.470036, signifying concentrated residential areas due to geographical factors and accessibility. These findings emphasize the importance of spatial planning in sustainable tourism village development.

Keywords: tourism village, land use, GIS, spatial, sumpur

INTRODUCTION

Rural development is an integral part of the national development strategy, particularly in promoting economic growth based on local potential. One of the strategic approaches currently being developed is the establishment of tourism villages, which not only serve as a driver of local economic activity but also as a medium for cultural preservation, community capacity building, and environmental conservation that prioritizes local wisdom. In this context, the Kampuang Minang Tourism Village in Nagari Sumpur offers unique attractions in terms of natural landscapes, cultural richness, and ecotourism potential that hold great promise for sustainable development (Budhi Pamungkas Gautama et al. 2020).

However, this potential cannot be fully realized without proper land use planning. Land use planning is a crucial instrument in spatial and environmental management, including in the development of tourism villages. The limitations of natural resources necessitate the use of innovative Geographic Information Systems (GIS) technology to make land management more effective and efficient. Land use serves as a critical instrument in spatial and environmental management, including in the development of tourism villages (Putri and Amrullah 2024). Unregulated land use can lead to negative impacts such as uncontrolled land conversion, environmental degradation, and spatial conflicts that threaten social stability. Conversely, well-planned land use supports ecologically, socially, and economically balanced tourism village development (Nurlisa Ginting and Habibi Lubis 2020).

The technology of Geographic Information Systems (GIS) has become a highly effective tool for analyzing and planning land use (Meidodga et al. 2023). GIS allows for the accurate collection, storage, analysis, and visualization of spatial data, which can be used to evaluate existing regional conditions, analyze spatial patterns, and formulate evidence-based policies (Lestariningsih, Mangurai, and Munadian 2023). In the context of Sumpur Village, GIS can assist in identifying land use patterns, the distribution of public facilities, and the opportunities and challenges in tourism-based regional development.

The sustainable development of tourism villages requires a holistic and integrated approach. Tourism village development is a planned transformation that necessitates the holistic participation of the local community (Resnawaty, Riyani, and Nulhakim 2023).This development encompasses tourist attractions and objects by strengthening potentials and creating tourism packages, as well as developing both physical and non-physical infrastructure (Sugiarti, Aliyah, and Galing Yudana 2016). This highlights that the use of GIS technology in land use planning for tourism villages involves not only technical aspects, but also takes into account the social, cultural, and economic dimensions of the local community (Moh. Erkamim, S.Kom. et al. 2023).

Based on this background, this study aims to analyze the condition and patterns of land use in the Kampuang Minang Tourism Village, Nagari Sumpur, using a GIS-based spatial approach. The research also explores the distribution of regional facilities and tourism attractions that support the village's tourism development. The findings are expected to serve as a reference for spatial planning and sustainable tourism development policy, as well as to strengthen the spatial database available to local stakeholders.

RESEARCH METHOD

This study employs a descriptive quantitative approach using spatial analysis methods based on Geographic Information Systems (GIS) (Rachmah, Rengkung, and Lahamendu 2018). The primary objective of this approach is to map, describe, and analyze land use and the distribution of regional facilities accurately and systematically, without intervening in the observed variables.

The research was conducted in the Kampuang Minang Tourism Village, Nagari Sumpur, Batipuh Selatan Subdistrict, Tanah Datar Regency, West Sumatra. Geographically, the area is located on the northern side of Lake Singkarak, with central coordinates approximately at -0.687388° S and 100.894650° E. Field observations were carried out on April 23–24, 2025, while data analysis took place between April 25 and May 8, 2025.

The population in this study includes all land units within the study area, while the sampling technique was purposive, targeting strategic areas that represent key land functions such as residential zones, tourism areas, agriculture, and conservation. Primary data were collected through field observations using GPS devices and visual documentation, as well as semi-structured interviews with local residents and traditional leaders. Secondary data were obtained from high-resolution drone imagery, spatial planning documents, and statistical data from relevant institutions.

The data analysis stages were as follows:

1. Image and Map Processing: This involved geometric correction, digitization, and land classification using both manual and supervised classification methods.
2. GIS Spatial Analysis: Techniques such as overlay, buffer, and Nearest Neighbor Analysis were used to examine the spatial distribution patterns of land use and facilities, and their alignment with tourism and economic functions.
3. Data Presentation: Results were visualized in the form of thematic maps, tables, and quantitative narratives to support descriptive interpretation.

Data validity was ensured through methodological and source triangulation, as well as ground checks to verify spatial accuracy and land use classification.

RESULT AND DISCUSSION

General Overview of the Kampuang Minang Tourism Village, Nagari Sumpur

The Kampuang Minang Tourism Village is located in Nagari Sumpur, Batipuh Selatan Subdistrict, Tanah Datar Regency, West Sumatra Province. This area lies on the northern side of Lake Singkarak and is rich in well-preserved cultural heritage, marked by the presence of 68 *Rumah Gadang* (traditional Minangkabau houses) that are still inhabited and maintained by the local community. The village's strong cultural context, deeply rooted in Minangkabau customs, makes it one of the leading cultural and local wisdom-based tourist destinations.

Visitors to Kampuang Minang can enjoy a variety of activities such as traditional art performances, local cooking classes, hands-on fishing experiences (*manjalo*), trekking to hilltop viewpoints, agro-tourism in sapodilla orchards, and overnight stays in *Rumah Gadang*. The availability of homestays in *Rumah Gadang* provides an authentic experience for tourists to engage in the daily life of the Minangkabau community, which upholds the values of kinship and mutual cooperation—most notably through the traditional communal meal known as *makan bajamba*.

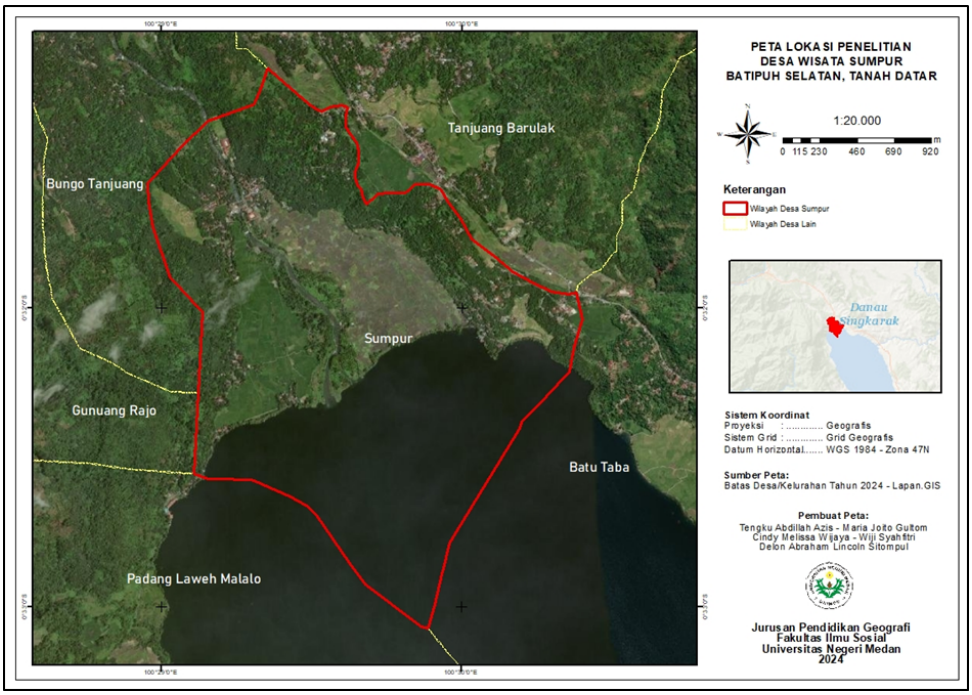

Figure 1. Land Use Map of Sumpur Village, 2025

Distribution and Characteristics of Land Use

Based on the results of spatial data processing, land use in Sumpur Village in 2025 covers a total area of 305.65 hectares. The most dominant type of land use is sapodilla plantations, occupying 149.35 hectares (48.89% of the total area). This indicates that

sapodilla is a leading commodity that significantly influences the village's spatial structure and economy. The second largest land use is rice fields, covering 103.48 hectares (33.86%), demonstrating that rice farming remains the main livelihood of the local community.

Other types of land use include coconut plantations (19.46 ha), residential areas (20.53 ha), and natural features such as rivers (6.28 ha) and open land (2.99 ha). The relatively small percentage of residential land compared to the total area reflects the predominance of productive land use in the region.

Tabel 1. Land Use Area of Sumpur Village in 2025

Number	Land Use Type	Area (ha)
1.	Rice Fields	103,48
2.	Open Land	2,99
3.	River	6,28
4.	Coconut Plantation	19,46
5.	Other Vegetation	1,57
6.	Sapodilla Plantation	149,35
7.	Other Plantations	0,53
8.	Mixed Plantations	1,47
9.	Residential Area	20,53
	TOTAL	305,65

Distribution of Village Facilities

The distribution of facilities in Sumpur Village reflects a relatively even spatial distribution across several strategic points within the village. The identified facilities fall into two main categories: (1) natural features such as rice fields, rivers, and the lake, and (2) public infrastructure including schools, mosques, the *wali nagari* office, health centers, and cultural tourism sites.

Educational facilities are well-represented, ranging from early childhood education (PAUD) to higher secondary education at Madrasah Aliyah (MAN 4 Sumpur), indicating that Sumpur Village has strong access to education from foundational to upper levels. Health facilities such as the auxiliary health center (*Puskesmas Pembantu*), and religious facilities like Baiturrahman Mosque and the Grand Mosque of Sumpur, reflect a vibrant and well-established religious social structure. Security facilities such as neighborhood watch posts (*Pos Kamling*) and economic infrastructure such as a *Pertashop* (small-scale fuel station) are also present in the facility distribution.

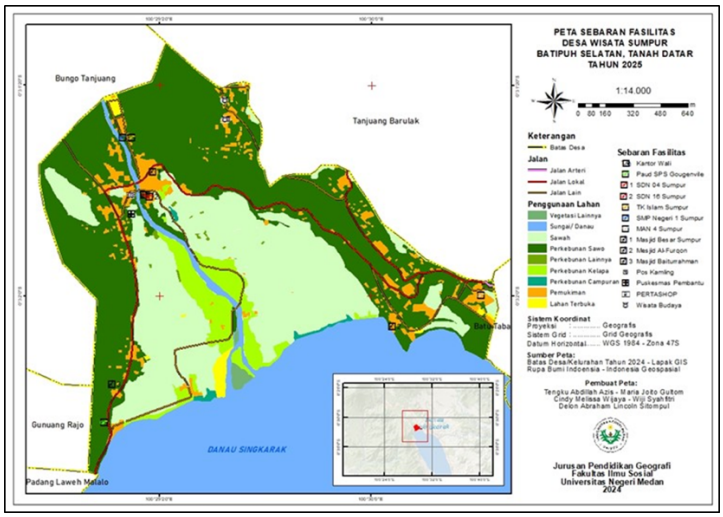

Figure 2. Map of Facility Distribution in Sumpur Village

Tabel 2. Coordinates of Facility Distribution in Sumpur Village

Number	Information	X	Y
1	River	100,493408	-0,535
2	Rice Field	100,487473	-0,536
3	Sapodilla Plantation	100,486546	-0,537
4	Rice Field	100,487340	-0,540
5	Lake	100,487397	-0,540
6	River	100,493288	-0,535
7	Wali Nagari Office	100,488107	-0,528
8	Cultural Tourism Site	100,492297	-0,523
9	Cultural Tourism Site	100,492338	-0,523
10	Cultural Tourism Site	100,492480	-0,524
11	Cultural Tourism Site	100,492382	-0,524
12	Cultural Tourism Site	100,492320	-0,524
13	PAUD SPS Gougenvile ***(Early Childhood Education)***	100,486000	-0,540
14	Baiturrahman Mosque	100,486425	-0,538
15	Auxiliary Health Center (PUSTU)	100,487429	-0,529
16	PERTASHOP ***(Mini Fuel Station)***	100,487398	-0,528
17	Security Post (Pos Kamling)	100,487500	-0,528
18	Main Bridge	100,487755	-0,528
19	SDN 04 Sumpur (Elementary School)	100,488208	-0,528
20	Islamic Kindergarten Sumpur (TK Islam Sumpur)	100,487440	-0,525
21	SMP Negeri 1 Sumpur (Junior High School)	100,486955	-0,525
22	SDN 16 Sumpur (Elementary School)	100,488356	-0,528
23	Al-Furqon Mosque	100,501097	-0,535
24	MAN 4 Sumpur (Islamic Senior High School)	100,505744	-0,533
25	Grand Mosque of Sumpur	100,488542	-0,527

Discussion of Tourism Village Attractions

Sapodilla Plantations

The sapodilla plantations hold significant economic, cultural, and historical value. According to local traditional leaders, the sapodilla tree was introduced from Manila by Minangkabau migrants, and during the Dutch colonial era, villagers were required to plant sapodilla trees in their home gardens. This policy has since evolved into a tradition, resulting in a distinctive cultural landscape.

Sumpur Village is recognized as the primary sapodilla production center in Tanah Datar Regency, contributing around 30% of the total sapodilla output in West Sumatra Province. Thus, sapodilla farming not only serves as a source of income but also forms part of the village's cultural identity and supports the development of locally based agro-tourism.

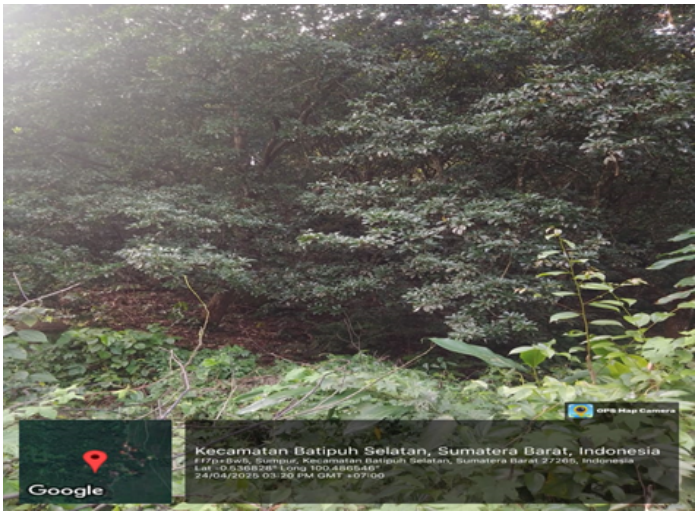

Figure 3. Sapodilla Plantation as a Leading Commodity

River

The rivers in Sumpur Village are part of the Lake Singkarak hydrological system and play a crucial role in supporting agriculture, fisheries, and the provision of clean water. They also serve as locations for traditional fishing activities, which are among the village's local tourism attractions. In addition, the rivers function as natural irrigation channels for increasing the productivity of rice fields and sapodilla orchards.

Figure 4. River as a Site for Traditional Fish Catching

Rice Fields

Sumpur's rice fields are characterized by broad and interconnected expanses, which enable efficient agricultural services such as the 57-hectare free plowing program. Agricultural innovations like the jajar legowo planting system and salibu method have been adopted to boost rice yields. Beyond their role in food production, the rice fields enhance the scenic value and support the village's agrotourism potential.

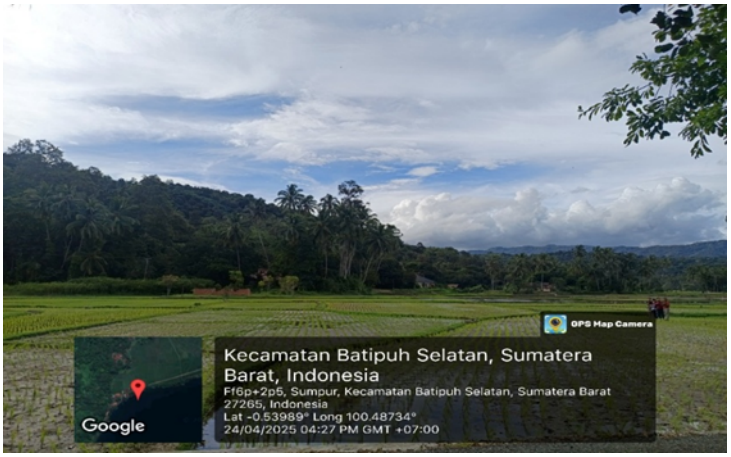

Figure 5. Rice Field Landscape in Sumpur Village

Rumah Gadang Homestays

Sumpur Village has 68 Rumah Gadang (traditional Minangkabau houses), three of which have been developed into CHSE-certified (Cleanliness, Health, Safety, and Environmental Sustainability) cultural tourism homestays. The unique and philosophical architecture of these houses—still used as residences—offers tourists an authentic cultural experience, allowing them to engage in Minangkabau daily life.

Figure 6. Rumah Gadang Homestay

Nearest Neighbor Analysis

The Nearest Neighbor Analysis (NNA) was used to evaluate the settlement distribution pattern in Sumpur Village. The analysis results indicate a clustered settlement pattern, with a Nearest Neighbor Ratio of 0.329755, a z-score of -28.470036, and a p-value of 0.000000. These values show that the distribution is not random, but rather concentrated in certain areas—likely influenced by topography, access to facilities, and social bonds.

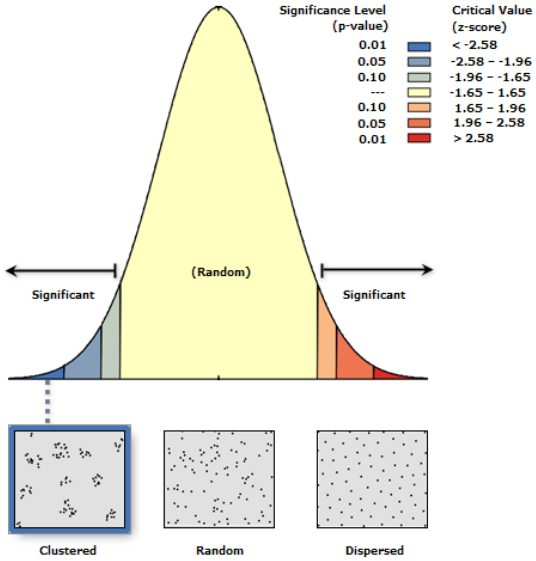

Figure 7. Nearest Neighbor Analysis Results using ArcGIS

Parameter	Value
Observed Mean Distance	16,0363 meter
Expected Mean Distance	48,6310 meter
Nearest Neighbor Ratio	0,329755
z-score	-28,470036
p-value	0,000000

Nearest Neighbor Summary Explanation:

Observed Mean Distance: 16.0363 meters

Expected Mean Distance: 48.6310 meters

Nearest Neighbor Ratio: 0.329755

z-score: -28.470036

p-value: 0.000000

1. Observed Mean Distance: 16.0363 meters Represents the actual average distance between the closest neighboring settlements in the field.
2. Expected Mean Distance: 48.6310 meters This is the expected average distance if settlements were randomly distributed across the study area.
3. Nearest Neighbor Ratio: 0.329755 Calculated as the ratio between observed and expected distances. A value < 1 indicates a clustered pattern. A ratio of 0.329 indicates very strong clustering.
4. z-score: -28.470036 A highly negative z-score signifies that the pattern is significantly different from random and is statistically very clustered.
5. p-value: 0.000000 A p-value near zero indicates that the likelihood of this pattern occurring by chance is less than 1%, thus the hypothesis of a random distribution can be rejected.

Based on the results of the analysis, it can be concluded that the distribution of settlements in the study area tends to be highly clustered. This is indicated by a Nearest Neighbor Ratio that is well below 1, a strongly negative z-score, and a very small p-value. These values imply that settlements are not evenly or randomly distributed but are concentrated in specific locations, likely influenced by geographical, economic, or social factors.

CONCLUSION

The research findings show that the Kampuang Minang Tourism Village in Nagari Sumpur has agrarian characteristics, with productive land dominated by sapodilla orchards and rice fields. Minangkabau cultural values are reflected in the presence of Rumah Gadang, the makan bajamba tradition, and ongoing cultural tourism activities maintained by the local community.

The spatial layout reveals a well-distributed network of facilities that support the community's social life, education, and economy. Spatial analysis results especially through Nearest Neighbor Analysis confirm that settlements in the study area follow a highly clustered distribution pattern, which is a critical consideration for future spatial and sustainable village development planning.

Overall, the integration of culture, agriculture, and spatial planning positions Sumpur Village as a model of a tourism village based on local wisdom that can be further developed through spatial and participatory approaches.

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