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THE ROLE OF RIVER ESTUARIES IN SHAPING TRADITIONAL MALAY KAMPONG IN JOHOR STATE, MALAYSIA: A DESCRIPTIVE ANALYSIS

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Abstract

Malay traditional settlements, known as 'kampung' (kampongs or villages), have been established for centuries, primarily in rural areas near river estuaries, riverbanks, and coastlines. These locations were historically significant for early Malay communities, serving as centres for trade, ports, forts, and administration due to their advantageous transportation links and reliable access to food and clean water. Johor State, Malaysia, features 14 major rivers connecting to the Melaka Straits, Tebrau Straits, and the South China Sea, all of which have played a vital role in the development and history of Malay kampongs in Johor. This study explores the role and significance of river estuaries in shaping traditional Malay kampongs in Johor. The objective is to analyze the historical and contemporary settlement patterns, particularly the establishment of the Old Johor Kingdom along Sungai Johor in the 15th century and the subsequent expansion along the West Coast in the late 18th century. Presently, Johor hosts 1,610 units of traditional kampongs, mostly located near riverbanks and agricultural zones, with a preference for riverfront and seashore locations. Using a descriptive methodology, this study categorizes traditional Malay kampongs into two main types: coastal settlements/ fisherman villages/ water villages (kampung nelayan/ kampung air) and hinterland settlements (kampung darat or kampung parit). The research employs aerial photographs from Google Earth to analyze the layout and arrangement of houses in these kampongs, considering both natural factors (geography, topography, environment) and non-natural factors (technology, socio-cultural influences). The findings highlight the significant contributions of river estuaries to the spatial organization and development of Malay traditional kampongs, emphasizing the intricate relationship between natural landscapes and human settlements. This study also discusses the potential of the Spatial Characteristics of Rural Malaysia System (S-CHARMs), as it provides a comprehensive geographic information system (GIS) database and spatial analysis tools that can significantly enhance the understanding and planning of these settlements. S-CHARMs offer detailed spatial information about village locations, infrastructure, and public facilities, which is crucial for analyzing the historical and contemporary settlement patterns of traditional Malay kampongs in Johor.

Keywords: River Estuaries, Malay Kampung, Settlement Patterns, Johor, S-CHARMs

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INTRODUCTION

The term ‘traditional villages’ encompasses a diverse array of communities, each with its unique customs and practices, yet bound together by a shared reliance on the natural resources provided by river estuaries. In Malaysia, traditional villages are known as ‘*kampung*’ or ‘kampongs.’ J. Widodo (2012) defines ‘*kampung*’ in the Malay language as a settlement situated near a riverbank that serves as a landing point. Physically, kampongs refer to settlements located along riverbanks, near landing points (jetties), extending to settlements further uphill from the waterfront. Kampongs are predominantly inhabited by Malay communities and have developed organically over time, often without professional intervention or a development blueprint. As such, they are considered a type of vernacular settlement. These villages are deeply rooted in Malay culture and heritage, embodying a unique way of life that has been passed down through generations. In Malay traditional villages, houses are typically built on stilts, with roofs made from *atap* (palm leaves) or zinc sheets. The layout of the village is often organic and reflects the close-knit community spirit. One of the defining features of traditional villages in Malaysia is the sense of communal living. Residents often share resources and responsibilities, fostering a strong sense of unity and cooperation. Community events and celebrations are common, providing opportunities for villagers to come together and strengthen social bonds. Traditional Malay villages in Malaysia are also characterized by their close connection to nature. The surrounding environment often plays a central role in village life, with activities such as fishing, farming, and gathering wild fruits and herbs being integral to the local economy and culture. On the other hand, ‘traditional kampung’ denotes a settlement area inherited by the Malay community across generations, characterized by Malay architecture, environmental features, and a courtyard layout following the Malay village concept. Many villages are located near rivers, forests, or agricultural land, providing residents with access to natural resources for food, water, and livelihoods. One of the most critical geographical influences on these settlements is the river estuary system and its surrounding basin. For example, the Johor River Basin, covering approximately 2,286 km² (Department of Irrigation and Drainage, 2022), flows from the central eastern highlands of Johor to the South China Sea. As a Category 1 river basin (entirely located within one state), it supports a dense network of tributaries, wetlands, and lowland floodplains that have historically provided fertile land and water connectivity essential for early Malay settlement. The definition of a river basin—as adopted from the EU Water Framework Directive (2000) and translated into the Malaysian context—refers to the total land area drained by surface water through a river system, ending in an estuary or delta. According to national records, Malaysia comprises 2,986 river basins, with 189 identified as major basins. Johor itself contains several such

basins, of which the Johor River is among the most extensive and historically important. The basin has long facilitated socio-economic activities such as paddy farming, fisheries, and river transport, and continues to play a role in spatial planning and environmental conservation. These river basins, especially in lowland coastal zones, have influenced not only the physical structure of kampongs but also their spatial logic, orientation, and socio-cultural practices. Understanding this hydrological geography is key to re-evaluating how kampongs formed, evolved, and continue to adapt within the wider planning context of Johor. However, rapid urbanisation and shifting socio-economic priorities have eroded these patterns, prompting the need to re-examine the relationship between natural settings and traditional settlement forms. This paper aims to analyse how river estuaries influenced the spatial formation of traditional Malay kampongs, particularly in Johor. The study contributes to understanding the spatial logic of traditional settlements and their potential role in modern rural development frameworks.

THE PHYSICAL ATTRIBUTES OF KAMPONGS

The surrounding environment often plays a central role in village life, with activities such as fishing, farming, and gathering wild fruits and herbs being integral to the local economy and culture. On the other hand, 'traditional kampong' denotes a settlement area inherited by the Malay community across generations, characterized by Malay architecture, environmental features, and a courtyard layout following the Malay village concept. Many villages are located near rivers, forests, or agricultural land, providing residents with access to natural resources for food, water, and livelihoods. In this context, Peninsular Malaysia is surrounded by oceans, with numerous rivers flowing into the seas. There are approximately 100 rivers with around 1,800 subsidiary rivers and tributaries in Peninsular Malaysia, totaling over 38,000 km in length (Abdullah, K., 1999, in Ahmad Sanusi Hassan, 2001). Settlement patterns evolve spatially due to various factors, such as climate, resource access, and spatial position, as suggested by Trausti Valsson et al. (2013). In Malaysia, river estuaries have played a significant role in the nation's history, particularly in the formation of early kingdoms and civilizations. River estuaries play a critical role in the ecological and socio-economic fabric of traditional Malay kampongs, including those in Johor State, Malaysia. This study explores the multifaceted functions of river estuaries and their significant values to these communities, highlighting their environmental, economic, and cultural importance. In this study, these settlements are referred to as "Malay traditional kampongs" to avoid confusion. This term denotes any settlement inhabited by Malay communities in rural areas, characterized by traditional Malay houses and landscapes. Recent scholarly contributions further reinforce the significance of spatial and technological

approaches in understanding traditional Malay settlements. Fatin Farhana et al. (2020) identified three key orientation patterns—clustered, linear, and scattered—that are influenced by environmental, kinship, and socio-cultural contexts, mirroring the spatial logic observed in *kampung air* and *kampung darat* typologies. Norzailawati et al. (2019) demonstrated the value of drone-based 3D city modelling and GIS analysis in documenting traditional urban forms, particularly in Kota Bharu, where royal institutions and riverine geography shaped Malay urban morphology. This supports the present study's approach using aerial imagery and spatial overlays to assess settlement evolution. Additionally, Ishak et al. (2022) illustrated how GIS tools such as the container index and LISA (Local Indicators of Spatial Association) can be applied to evaluate the spatial equity of public facilities like mosques—key communal anchors in kampongs. These studies provide methodological and contextual justification for the use of S-CHARMs in this research, highlighting the importance of geospatial analysis in preserving and planning for the continuity of traditional Malay settlement patterns. By examining this traditional living environment, the study aims to understand the significant values and contributions of river estuaries to the spatial patterns of Malay traditional kampongs. This research provides fundamental knowledge of the spatial arrangement of kampongs in Malaysia.

KAMPONGS TYPOLOGIES

Based on the Dasar Perancangan Fizikal Desa Negara 2030 (National Rural Physical Planning Policy 2030), eight main categories of kampongs exist in Malaysia (PLANMalaysia, 2018), including *Kampung Traditional* (Traditional Village) – A classic rural Malay settlement pattern. These are the most common rural Malay settlements, characterized by organic growth patterns with houses typically built in clusters or linear formations along roads or riverbanks. They feature traditional Malay architecture, including stilted wooden houses with raised floors for ventilation and flood protection. Traditional villages are often self-sufficient, relying on agriculture, small-scale trade, and fishing. Second, *Kampung Nelayan* (Fisherman Village). These villages are predominantly located along coastal areas or river estuaries, where fishing serves as the primary economic activity. The houses are often built on stilts along the shoreline. These villages frequently feature jetties, fish markets, and processing areas for drying and storing fish. Third, *Kampung Tersusun* (Well-Planned Village) – Unlike organically grown traditional villages, this village is a planned settlement introduced by the government to provide structured housing layouts with better infrastructure. These settlements are designed with grid-like arrangements, modern amenities, and proper access roads, ensuring improved living conditions while preserving rural lifestyles. Fourth, *Kampung Atas Air* (Water Village).

These settlements, often found in coastal or estuarine regions, consist of houses built entirely above water on wooden stilts. Connected by wooden walkways, these villages have a distinctive landscape and are highly dependent on fishing and water-based trade. Fifth, *Kampung Orang Asli* or *Orang Asal* (Indigenous Village). These settlements are home to Malaysia's indigenous (Orang Asli) communities, who traditionally live in forested and riverine environments. Their houses, made from natural materials like bamboo and rattan, reflect their deep connection to the environment. Many of these villages are semi-nomadic or have adapted to government resettlement programs. Six, *Petempatan Tanah Rancangan FELDA/ FELCRA/ RISDA* (Planned Land Settlement). These structured agricultural settlements were introduced through land development schemes by FELDA, FELCRA, and RISDA to support Malaysia's agricultural sector. Designed primarily for large-scale plantations such as rubber and palm oil, these settlements consist of uniform housing, well-planned roads, and community facilities. Seventh, *Kampung Baru Cina* (Chinese New Villages) – Established during British colonial rule, these villages were originally fortified settlements created to control Chinese communities during the Malayan Emergency (1948–1960). Over time, they evolved into permanent settlements with economic activities centred around agriculture, small industries, and retail and eight *Petempatan Estet* (Estate Settlement) – Primarily found in plantation areas, these settlements were historically built to house workers in rubber, palm oil, and tea estates. Unlike traditional Malay villages, estate settlements often feature barrack-style housing and dormitories, reflecting their function as labour accommodations. According to PLANMalaysia (2018), 12,259 units (81.3%) of traditional kampongs are distributed across Peninsular Malaysia and Labuan, forming a significant part of the national rural landscape. These kampongs play a crucial role in preserving Malaysia's cultural heritage, supporting rural economies, and ensuring sustainable development through strategic planning and conservation efforts.

RIVER ESTUARY AND EARLY SETTLEMENT

In the early settlement of the Malay community, traditional Malay villages were intricately connected to the river. Moorhead (1965) described the river as the primary means of communication and transportation to the interior regions. Additionally, the river served as an ideal location for settlement due to its strategic positioning and accessibility. Historically, river estuaries offered safety for fishermen and traders from harsh weather conditions. According to Abdullah Sani Ahmad in Chen Voon Fee (1998), rivers were the only means of transportation into hinterland areas due to dense rainforests and the lack of efficient road systems. It was only in the early 20th century that the British colonial administration introduced infrastructure such as railways and roads to

connect mining areas to the west coast of the peninsula for economic benefit. Before colonization, river transportation was the most effective way for local people to connect upstream (*hulu*) and downstream (*hilir*) settlements or river estuaries (*kuala*). Siti Norlizaiha Harun & Azira Ibrahim (2011) also noted that most traditional settlements were located along river flows with swampy topography, encouraging settlers to engage in rice cultivation and fisheries as major socio-economic activities. Traditional societies adapted their economic activities to the existing topography, influencing the design of traditional houses to accommodate ground-level dampness, tropical climate, and flooding (Siti Norlizaiha Harun & Azira Ibrahim, 2011). Since the 18th century, the role of rivers in national development has transformed from providing basic functions to multiple purposes. Many urban areas, such as Melaka, Kuala Terengganu, Kelantan, Kuantan, and Kuala Kangsar, are concentrated around river estuaries, drawn by the attractive water features of seashores and riverfronts (Azlina Md. Yassin, 2010). In Johor, settlements like Muar, Batu Pahat, Johor Bahru, Kota Tinggi, and Mersing developed from river estuaries and extended along rivers. Some settlements, such as Segamat and Kluang, exist inland but remain connected to rivers. Residents in the hinterland (*hulu*) areas could travel to the sea (*hilir*) by small boat (*sampan*) through the river, emphasizing the importance of river accessibility rather than direct frontage. Initially, these areas started as fishing settlements but gradually evolved into important trading ports or administrative centres due to their strategic locations. According to Azlina Md. Yassin (2010), the function of rivers for human life and transportation has diminished due to rapid urbanization, industrialization, and intensive agricultural activities. The differences between inland villages (*kampung darat*) and water villages (*kampung air*) are significant in understanding the spatial patterns and cultural adaptations of Malay traditional settlements. Inland settlements are typically situated further away from direct river access and rely on irrigation and road networks for connectivity. Water villages, on the other hand, maintain direct interaction with waterways, adapting their housing and livelihoods to the dynamic river environment.

THE KAMPONG FORMS AND SETTLEMENT PATTERNS

A review of existing literature reveals the historical and contemporary significance of river estuaries in shaping Malay traditional kampongs. Previous studies have highlighted the ecological functions of estuaries as nurseries for marine life and natural barriers against coastal erosion. Additionally, scholars have explored the economic importance of estuaries for fishing and agriculture, as well as the cultural significance of these water bodies in Malay folklore and traditions. For example, Ahmad Sanusi Hassan and Ku Azhar Ku Hassan (2001) categorize kampongs in Malaysia into three types: 1) *kampung darat* (inland

settlements), 2) *kampung air* (water village), and 3) *kampung gabungan* (mixed settlements). This classification is based on the settlement's growth patterns towards either the hinterland or river areas. The *kampung gabungan* combines characteristics of both inland and water settlements, making it more challenging to identify distinctly. The *kampung darat* and *kampung air* settlements are influenced by river estuary topography and riverbanks. Houses built near riversides often use high stilts, unlike those in hinterland areas. Settlements near or over water, where the river estuary is deep, support large fishing boats anchoring near landing points or jetties (Ahmad Sanusi Hassan and Ku Azhar Ku Hassan, 2001). Malay carpentry innovations and building technologies also shaped early Malay traditional kampong patterns (Siti Norlizaiha Harun & Azira Ibrahim, 2011). The *kampung air* features strong jetties or wooden platforms supporting houses above water levels. These houses, known locally as "*rumah tiang seribu*" (a thousand stilt houses), stand on hundreds of stilts planted in the river. Each house is connected by small wooden pathways, creating dense housing patterns due to the limited land size at river estuaries. Houses are built closely together, maximizing the use of available space. In contrast, *kampung darat* typically has larger land parcels. Often, a single land parcel contains multiple houses owned by family members, such as siblings. Groups of related families might settle near each other, fostering a concentrated settlement pattern influenced by strong kinship ties. These houses have no physical boundaries separating them, leading to organic and free-form arrangements. This layout creates communal spaces between houses, enhancing social interactions and community bonding. According to Siti Norlizaiha Harun & Azira Ibrahim (2011), the spatial structure of Malay traditional kampongs organically follows the river form. The *kampung darat* and *kampung air* settlements are influenced by river topography, either paralleling the riverbank or concentrating near river estuaries. The *kampung darat* settlements extend inland, while *kampung air* settlements remain close to or over water. This natural alignment with river forms dictates the organic and adaptive nature of traditional Malay settlements, reflecting both environmental and socio-cultural influences. The strategic location of Malay traditional kampongs has significantly influenced their development. The general layout and arrangement of houses in both *kampung darat* and *kampung air* depend on natural factors (geography, topography, natural environment) and non-natural factors, including construction technologies and socio-cultural influences. Natural factors like water levels encourage settlers to build houses on high stilts to avoid flooding. To ensure harmonious relationships between humans, nature, and spirits, the choice of location for settlement built-up areas is carefully considered. J. Widodo (2012) noted that the location of houses is usually selected based on traditional beliefs, aesthetic views, and high accessibility to jetties or natural resources. Consequently, settlers often prefer to build houses facing the

river or seashore. The village was mainly a fisher, hunter and gatherer of forest produce. The Malay settlements concentrated along the coastal and estuarine fishing villages, followed by wet paddy growing, including the establishment of the fruit orchard (A. A. Rahman, 2018).

METHODOLOGIES

This study employs a qualitative, descriptive research approach using triangulated methods that collectively uncover the historical, spatial, and socio-cultural dimensions of kampong settlements in Johor. 1) Archival Research: Primary and secondary historical sources, including colonial maps, government reports, and historical texts, were reviewed to trace the emergence and evolution of kampong settlements along Johor's rivers. This stage offered insight into the socio-political and environmental context behind kampong establishment. 2) Field Surveys: Direct field visits were conducted in selected kampongs to observe architectural styles, spatial arrangements, and community interactions. Interviews with elderly residents and local leaders provided qualitative narratives about the historical dependency on river systems. These ground observations enhanced the authenticity of archival interpretation and offered local perspectives on spatial organisation. 3) Spatial Analysis using GIS and Google Earth: Satellite imagery from Google Earth was used to identify settlement patterns and their physical proximity to river estuaries. The Spatial Characteristics of Rural Malaysia System (S-CHARMs), a GIS-based planning tool by PLANMalaysia, was referred to map and analyse the distribution, accessibility, and infrastructure of kampongs with riverine systems. This geospatial assessment provided quantitative validation for historical and observational data. The integration of these methods allowed a triangulated view of kampong evolution and its contemporary spatial relevance. The study also acknowledges its limitations, including the regional focus on Johor, which may not generalise across all Malaysian kampongs, and the availability of up-to-date spatial data for certain kampong sites.

FINDINGS

PLANMalaysia (2018) reported that in Johor, there are 1,610 kampongs identified as 'traditional villages', representing 13.1% of the total 1,958 kampong units found in the state. Nationally, these kampongs make up 12.9% of traditional villages. Of the Johor total, 1,119 units (57.1%) are located in urban areas, while 839 units are situated in rural zones.

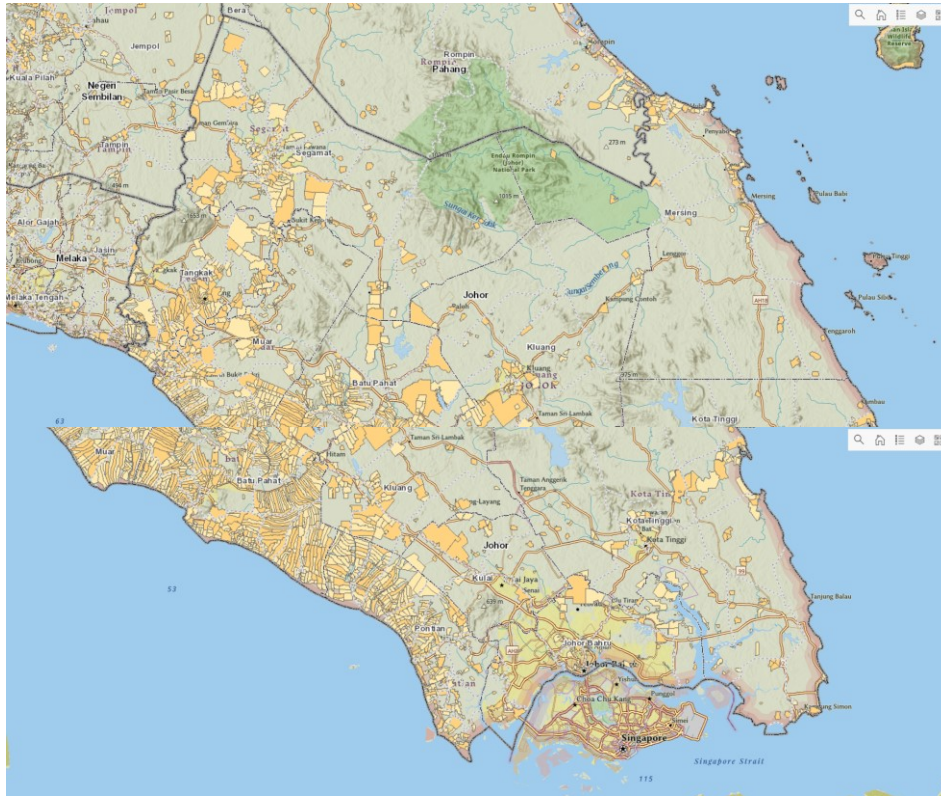


Figure 1: Distribution of traditional Malay kampungs across Johor State, highlighting settlement clusters along river estuaries and inland parit systems. Generated by using S-CHARMS

Source: PLANMalaysia (2025).

Distribution of traditional Malay kampungs across Johor State, highlighting settlement clusters along river estuaries and inland parit systems (Figure 1). Studied along the Johor River (East Johor) shows an early riverbank settlement pattern of Johor. Historical analysis traces kampong establishment in Johor to as early as the 15th century, beginning with the Old Johor Kingdom founded by Sultan Alauddin Riayat Syah II in 1528. Johor River in Kota Tinggi served as the nucleus for these early settlements, where administrative centers and royal forts were strategically positioned along the riverbanks. Multiple settlements were developed along the river to facilitate trade and defence, including notable sites like Panchor, Pekan Tua, Sayong Pinang, Seluyut, Batu Sawar, and Pasir Raja (Figure 2):

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Figure 2: Several early settlements along the riverbank of the Johor River, Kota Tinggi
Source: Asyaari Muhammad (2012).

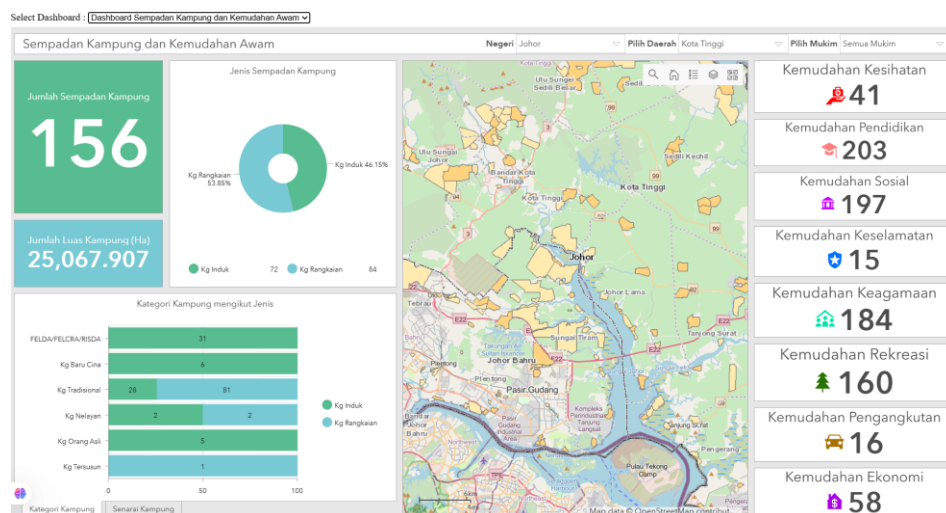


Figure 3: Distribution of traditional kampongs along the riverbank of the Johor River.
Data generated using S-CHARMs portal.
Source: PLANMalaysia (2025).

It visualises the strategic positioning of settlements along Sungai Johor, reinforcing the idea that river estuaries shaped the location and significance of early Malay kampongs in Johor. Such maps align well with archival insights, such as from Kassim Thukiman and Asyaari Muhammad studies. To evade external

threats, including attacks from the Portuguese (1535–1587) and Aceh (1564–1623), the royal administration frequently relocated, establishing settlements such as Kampung Johor Lama (1500s), Kampung Panchor (1699), Kampung Makam (1700s), and Kampung Lukut (1890s). Archaeological studies (Muhamad, 2020) validate the historical presence of these administrative and trading kampongs along the Johor River corridor.

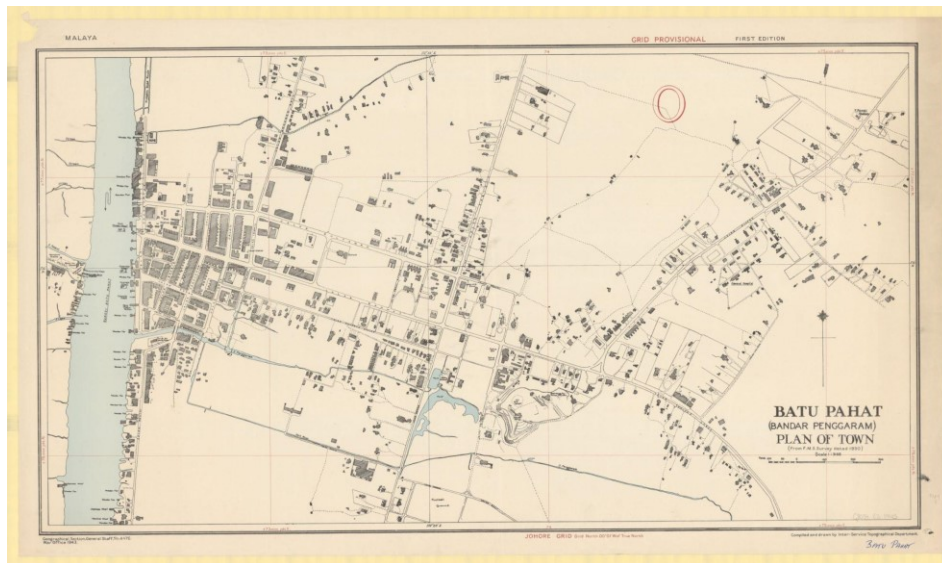


Figure 3: The Bandar Penggaram Plan in the year 1930 revealed several early settlements in Batu Pahat established along the main road, arranged in a grid pattern. The linear form was established due to the alignment of the drainage system (parit).

Source: F. M. S. Survey (1930). National Library of Australia.

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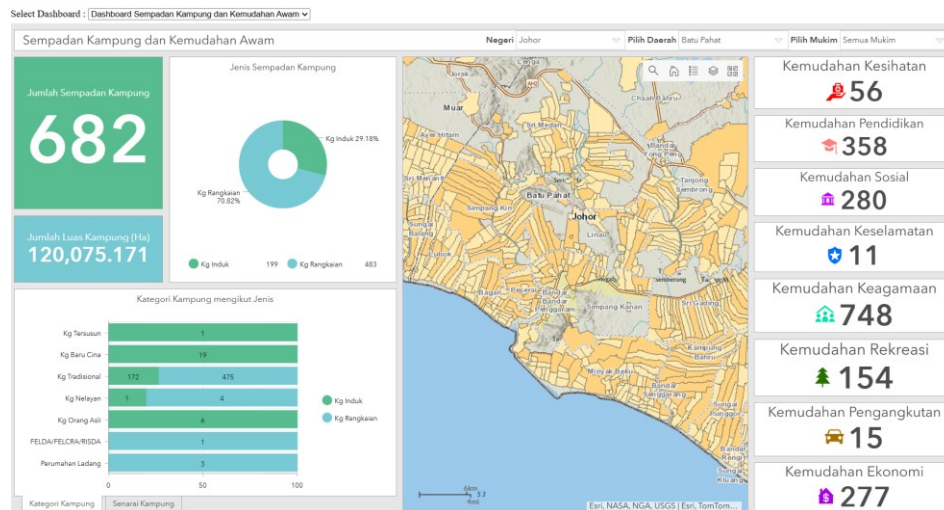


Figure 4: Distribution of traditional kampongs along the riverbank of the Batu Pahat River and the coastal. Data generated using S-CHARMs portal.

Source: PLANMalaysia (2025).

The West coast of Johor, Figure 3, demonstrates the spatial outcomes of colonial and agricultural development in Bandar Penggaram, Batu Pahat, Johor. During the late 19th to early 20th century, the expansion of agricultural settlements led to a different spatial form in the west coast regions of Johor, particularly in districts such as Muar, Batu Pahat, and Pontian. This archival map exemplifies the morphological evolution of kampongs from organic riverside clusters to more linear, grid-like layouts under colonial influence. The characteristic of *kampung darat* illustrates a typological contrast to *kampung air*.

- Visual confirmation of the drainage-based linear layout (parit system). Supports the identification of *kampung darat* and its spatial adaptation to agriculture and planning.
- The 1930 map contextualises the emergence of parit settlements during the New Modern Johor Kingdom period.
- This figure enriches the typological discussion by showcasing how settlements like Batu Pahat transitioned into formalised, infrastructure-aligned towns. It illustrates the dual narrative of natural and engineered spatial evolution.

For example, this pattern can be found in Kampung Parit Sakai (1707) and Kampung Parit Pinang Seribu (1818) in Muar, Kampung Parit Bakar Darat (1864) in Batu Pahat (Figure 4), and Kampung Parit Ayer Baloi (1900s) in Pontian. Traditionally, the Malay community engaged in agricultural activities in

hinterland areas like paddy cultivation, coconut plantations, small-scale estates, and orchards, relying heavily on efficient irrigation systems. These kampongs—collectively known as *kampung parit*—are characterised by prominent drainage channels or "*parit*" that shape the spatial layout of settlements. Typically located away from the immediate coastline due to swampy or muddy terrain, these kampongs were established on flat lands between mangrove coastlines and hilly hinterlands. According to Abdullah (2011), commercial and traditional agricultural activities significantly influenced the physical and cultural features of these settlements. Archival maps such as the Bandar Penggaram Plan (1930) further illustrate this evolution, revealing a linear grid arrangement reflective of the engineered parit system and colonial urban planning practices. In sum, two main typologies of kampongs were identified 1) *Kampung Air* (Water Villages): Typically built on stilts directly over water or adjacent to riverbanks, these kampongs exhibit linear arrangements clustered around jetties and docks and; 2) *Kampung Darat* (Inland Villages): Located further from the coast, these kampongs are structured around agricultural canals (*parit*) with more expansive land parcels and dispersed family plots. S-CHARMs spatial analysis affirms these settlement patterns. It reveals that kampongs formed organically in alignment with the terrain, river networks, and land use activities such as fishing, rice cultivation, and trade.

DISCUSSION

The discussion reveals the profound influence of estuarine systems, particularly the Johor River, on the formation and evolution of traditional Malay kampongs. River estuaries served not only as natural transportation corridors and economic zones but also as foundational geographic structures around which kampong settlements organically emerged. The strategic position of kampongs along these estuaries reflects a longstanding adaptation to the natural environment, where proximity to water was essential for livelihoods, agriculture, and mobility.

Kampung located near estuaries, especially in areas such as Kota Tinggi (East of Johor), were historically part of the early administrative and cultural centers of the Johor-Riau-Lingga Sultanate. These riverine environments enabled socio-political connectivity, allowing communities to thrive through fishing, trade, and agricultural activities. In contrast, the *kampung darat* or *parit* typology such as Batu Pahat (West of Johor) area developed later in inland areas, where engineered irrigation systems—*parit*—were constructed to support plantation economies and population growth during colonial expansion. The spatial character of these settlements illustrates how environmental adaptation shaped local vernacular patterns. Modern spatial tools such as the Spatial Characteristics of Rural Malaysia System (S-CHARMs) have enhanced our ability to document and analyze these settlement patterns. S-CHARMs allows planners and

researchers to overlay historical data with current satellite imagery and village infrastructure, providing a clearer picture of the continuity and transformation of kampong landscapes over time. The spatial data reveal that many kampongs retain their original alignment with riverbanks or drainage systems, although urban expansion and road construction have altered their orientation in some areas. PLANMalaysia has developed S-CHARMs as a comprehensive GIS-based planning and analysis system tailored for rural environments. Built on the policy foundation of the National Rural Physical Planning Policy 2030 (NRPP 2030), S-CHARMs provides planners with accessible, real-time spatial information regarding village infrastructure, facilities, and demographic patterns. This integration allows for data-informed decision-making in identifying development priorities, preserving heritage areas, and improving rural service delivery. S-CHARMs also contributes to the cultural mapping of kampongs by identifying socio-cultural anchors such as mosques, balai raya (community halls), and traditional Malay houses. This data provides critical insight into how kampong life remains oriented around collective spaces that reinforce community ties. By incorporating spatial and socio-cultural dimensions, S-CHARMs helps visualise the layered character of kampongs—not only as physical settlements but as living socio-ecological systems. In sum, integrating historical geography, environmental adaptation, and contemporary spatial planning tools highlights the continued relevance of traditional Malay kampongs in rural Johor. Sustainable development efforts should prioritise preserving these historically rooted communities' spatial integrity, cultural identity, and ecological resilience.

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