

Physical environment and domestic waste management practices in a suburban settlement of Kuching, Sarawak

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Received: 4 June 2026; Accepted: 9 August 2026; Published: 26 August 2026

Abstract

Domestic waste management continues to pose significant environmental and public health challenges in suburban areas of developing regions, including Sarawak, Malaysia. While previous studies have largely focused on policy interventions, institutional capacity and community awareness, limited attention has been given to how the physical environment shapes everyday household waste management practices. Guided by Social Practice Theory, this study examines how the physical characteristics of the suburban environment shape domestic waste management practices in Kampung Sungai Midin, Kuching Sarawak. A qualitative research approach was employed, involving in-depth interviews, field observations and document analysis with community members, local leaders and local authority representatives. The findings indicate that perceived settlement patterns, accessibility, housing density, availability of waste management infrastructure and proximity to waste collection facilities as important conditions shaping household waste disposal behaviors. The study further reveals that physical and spatial constraints can hinder the adoption of proper waste management practices despite the presence of residents' awareness of environmental issues. From a Social Practice Theory perspective, these findings demonstrate how the material and spatial conditions of the community interact with everyday waste management practices, influencing how residents perform and sustain particular behaviors. The findings underscore the importance of integrating physical planning, environmental design and community-based governance into development of effective and sustainable waste management systems. By highlighting the role of material and spatial conditions in everyday waste practices, this study contributes to the growing discourse on sustainable waste management and urban development in suburban communities.

Keywords: Domestic waste, Physical environment, suburban settlement, Sustainable waste management

Introduction

Rapid urbanization in Malaysia has accelerated the expansion of suburban and peri-urban areas, particularly in regions surrounding major urban centres such as Kuching, Sarawak. This growth

has been driven largely by rural–urban migration and increasing demand for residential development, resulting in the emergence of settlements characterized by mixed land use, semi-planned spatial arrangements and transitional socio-economic conditions (Md Murad & Chamhuri, 2007; Mukhlis et al., 2025; Zambrao-Moserrate et al., 2020). While suburban expansion contributes to economic growth and improved accessibility, it also generates significant environmental challenges, particularly in relation to domestic waste management.

The proliferation of informal and semi-formal settlements has intensified environmental pressures within urban fringe areas, where waste management infrastructure and service provision often lag behind population growth (Mukhlis et al., 2025). Previous studies have shown that inadequate waste collection services, limited disposal facilities and insecure land tenure frequently contribute to improper waste disposal practices, including illegal dumping and indiscriminate littering (Grangxabe et al., 2023). These environmental issues are particularly evident in suburban settlements where rapid development outpaces the provision of essential public services.

Although urban centres generally benefit from more structured waste management systems, suburban and peri-urban communities often experience disparities in service accessibility and infrastructural support (Artiola, 2019). Existing research on waste management in Malaysia has predominantly focused on policy interventions, technological innovations and public awareness programmes (Moh & Abd Manaf, 2017; Razali et al., 2019). Comparatively less attention has been devoted to understanding how the physical characteristics of settlements including spatial layout, road accessibility, housing density and the availability of waste disposal infrastructure influence household waste management behavior. Consequently, the relationship between the built environment and everyday waste practices remains insufficiently understood, particularly within suburban contexts.

From a socio-spatial perspective, domestic waste management is not solely a technical or administrative concern but also a practice shaped by the interaction between residents and their surrounding physical environment (Ayeleru et al., 2020). The spatial organization of settlements can either facilitate or constrain residents' ability to dispose of waste appropriately, thereby influencing environmental outcomes at the community level (Prihandari & Wahyuni, 2023; Siwar & Murad, 2001). Understanding these interactions is crucial for developing place-based waste management strategies that are responsive to local environmental conditions and community needs.

Within this context, this study examines how the physical characteristics of the suburban environment shape domestic waste management practices in Kampung Sungai Midin, Kuching, Sarawak. Using a qualitative approach, the study explores residents' lived experiences and perceptions of waste management within their local environments. By highlighting the role of spatial and physical conditions in shaping waste-related behavior, the research contributes to the growing body of literature on environmental governance, sustainable urban development and community-based waste management in rapidly urbanizing regions.

Literature review

Domestic waste management in Malaysia and Sarawak

Domestic waste management has become an increasingly important environmental issue in Malaysia due to rapid urbanization, population growth and changing consumption patterns. Rising

household incomes and urban lifestyles have contributed to higher levels of waste generation, placing significant pressure on existing waste management systems (Moh & Abd Manaf, 2017; Razali et al., 2019). Although Malaysia has introduced various policies and strategic plans, including the National Strategic Plan for Solid Waste Management and the National Waste Reduction Master Plan, the effectiveness of waste management remains uneven across regions, particularly between urban and suburban areas.

In Sarawak, solid waste management is administered by local authorities and supported through public–private partnerships for waste collection and disposal services. While urban centres such as Kuching generally receive regular waste collection services, suburban and peripheral settlements often experience infrastructural and service limitations. These disparities contribute to variations in waste management outcomes and may encourage unsustainable disposal practices such as open dumping and open burning (Pariatamby & Bhatti, 2020). Despite improvements in waste collection systems, landfill disposal remains the dominant waste management approach in Sarawak, raising concerns regarding environmental sustainability, land availability and pollution risks. The persistence of waste-related environmental problems suggests that effective waste management extends beyond technological solutions and regulatory frameworks. Increasing attention has therefore been directed towards understanding how local environmental conditions influence household waste management behavior.

Physical environment and domestic waste management practices

Recent studies have highlighted the importance of the physical environment in shaping environmental behavior and waste management practices. Physical environmental factors refer to the spatial and material conditions that influence how individuals interact with waste management systems, including settlement layout, accessibility, housing density, infrastructure provision and proximity to waste collection facilities (Guerrero et al., 2013; Wang et al., 2020). These physical and material conditions form part of the context in which everyday practices are performed, as the availability and accessibility of material resources can enable or constrain particular ways of managing waste. Nguyen et al. (2023) stated in Vietnam that technical infrastructure can facilitate or impede residents' sustainable waste management practices, although infrastructure alone does not determine how practices are performed. This highlights the importance of examining how physical and material conditions interact in everyday waste management practices rather than treating waste disposal solely as a matter of individual behavior. The spatial configuration of settlements plays a significant role in determining the efficiency of waste collection services and residents' ability to dispose of waste appropriately. Settlement morphology and physical accessibility are particularly important in developing and transitional urban areas, where informal, peri-urban and geographical constrained settlements may develop without comprehensive infrastructure planning. For example, settlements characterized by irregular layouts, narrow roads, dispersed housing and limited vehicle access may create practical difficulties for municipal waste collection and require residents to transport waste over a longer distance to communal collection points. Evidence of informal settlements in South Africa shows that infrastructural constraints, particularly limited road access, are closely associated with ineffective waste collection while inadequate physical waste infrastructure further exacerbates waste management challenges (Maphanga et al., 2025). In riverbank and waterfront settlements, housing is often arranged according to the physical characteristics of the river and available land while access routes may be narrow, discontinuous or unsuitable for conventional waste collection vehicles. Such spatial

constraints have been reported in developing countries and rapidly urbanizing contexts, where informal or inadequately planned settlements experience difficulties in accessing urban services. A study in Palembang, Indonesia shows that informal settlements along the Musi River experienced challenges related to the uneven spatial distribution of temporary waste disposal sites and limited waste collection services (Saputra et al., 2026). The condition illustrates how the spatial organization of riverbank settlement can create differences in residents' access to waste disposal infrastructure. These conditions can shape residents' everyday practices by making some waste disposal options more convenient or feasible than others (Guerrero et al., 2013; Guo et al., 2022). Similarly, inadequate waste infrastructure, such as insufficient waste bins, limited recycling facilities and inaccessible collection points, can constrain residents' capacity to adopt environmentally responsible waste management practices (Almasi et al., 2020).

Studies conducted in peri-urban and suburban areas have demonstrated that infrastructural deficiencies are closely associated with improper waste disposal behavior. In many developing countries, rapid suburban expansion frequently outpaces the provision of public services, creating gaps in waste collection coverage and environmental management (Wilson & Velis, 2015). These conditions are particularly evident in urban fringe settlements where governance arrangements, infrastructure development and service provision often lag behind population growth. Consequently, residents may rely on informal waste disposal methods that contribute to environmental degradation and public health risks (Ferronato & Torretta, 2019; Siddiqua et al., 2022).

Beyond infrastructure availability, geographical characteristics such as terrain, distance and accessibility also shape waste management effectiveness. Settlements located in remote or difficult-to-access areas frequently experience irregular waste collection services due to logistical and transportation constraints (Ferronato & Torretta, 2019). These findings suggest that waste management behavior should be understood not only as a matter of environmental awareness or policy compliance but also as an outcome of the physical and spatial conditions within which households operate.

Social Practice Theory

Social Practice Theory provides a useful framework for understanding domestic waste management as a routine social practice embedded within everyday life. Rather than viewing waste management primarily as an outcome of individual attitudes, intentions or environmental awareness, Social Practice Theory conceptualizes practices as emerging from the interaction of three interconnected elements: materials, competencies and meanings (Hess et al., 2018; Shove et al., 2012). Materials refer to the physical infrastructure and environmental conditions that enable or constrain practices; competencies involve the knowledge and skills required to perform particular activities; while meanings relate to values, norms, social expectations and symbolic understandings associated with the practice.

The three elements of social practice theory were used to sensitize the analysis to the different conditions surrounding domestic waste management practices with particular emphasis on the material element. This focus reflects the study's specific interest in how physical and spatial conditions shape the ways in which domestic waste management practices are performed. Within the context of domestic waste management, the physical environment constitutes a critical material element influencing residents' ability to separate, store and dispose of waste appropriately. Even where environmental awareness and positive attitudes exist, inadequate infrastructure and

unfavorable spatial conditions may limit the adoption of proper waste management practices (Erni et al., 2017; Nguyen et al., 2023). This perspective highlights the need to move beyond individualistic explanations of waste behavior or and examine the broader socio-spatial contexts in which such practices occur.

Although social practice theory recognizes the interaction between material, competencies and meaning, the study does not assume that these elements operate independently. Resident's knowledge of appropriate waste management and their environmental values may coexist with physical constraints that affect how practices are performed. Thus, a resident may understand the importance of proper waste disposal and express positive environmental attitudes while still relying on alternative disposal practices when appropriate infrastructure is inaccessible or inconvenient. This perspective allows the analysis to consider the relationship between what residents know and value and what they are materially able to do within their everyday environment. The usage of social practice theory as a framework also guided the coding and development themes of the study. During the analysis, interview and observation data were examined for material conditions such as settlement layout, road accessibility, housing density, waste collection infrastructure and the distance to disposal facilities.

Previous studies have examined waste management from policy, technological and behavioral perspectives; relatively limited attention has been given to the influence of physical environmental factors on domestic waste management practices, particularly within suburban settlements in Sarawak. Existing research has tended to focus on institutional arrangements and public awareness programmes, while the role of settlement characteristics, accessibility and waste management infrastructure remains underexplored. Addressing this gap is important because suburban communities often occupy transitional spaces between urban and rural environments, where infrastructural provision and governance arrangements differ significantly from those found in established urban centres.

Therefore, the study uses social practice theory as an analytical framework with particular emphasis on the material element, to examine how physical and spatial conditions are experienced and negotiated in domestic waste management practices in Kampung Sungai Midin, Kuching, Sarawak. By adopting a socio-spatial perspective, the study contributes to a deeper understanding of the relationship between environmental conditions and everyday waste management practices while providing insights for more context-sensitive and sustainable waste management planning.

Method and study area

This study employed a qualitative case study design to examine how physical environmental factors influence domestic waste management practices in a suburban community in Kuching, Sarawak. A case study approach is particularly suitable for investigating contemporary phenomena within their real-life contexts and for addressing research questions that focus on understanding how and why certain processes occur (Yin, 1994). The approach enables an in-depth exploration of the interactions between residents, their physical environment and waste management practices while accounting for the social and spatial complexities that shape everyday behavior.

The study was guided by two research questions: (i) How do residents manage domestic waste at the household level? and (ii) How do physical environmental factors influence domestic waste management practices? Given the exploratory nature of these questions, a qualitative approach was considered appropriate for capturing participants' experiences, perceptions and

contextual realities that may not be adequately represented through quantitative methods. The study was conducted in Kampung Sungai Midin (Fig. 1), a suburban village located on the urban fringe of Kuching, Sarawak. Established in the late 1980s through migrant settlement, the village represents a typical suburban community that has emerged as a result of rapid urban expansion in Kuching. The settlement occupies approximately 22.24 hectares and was gazetted as a Government (*Kampung*) Reserve in 2006.

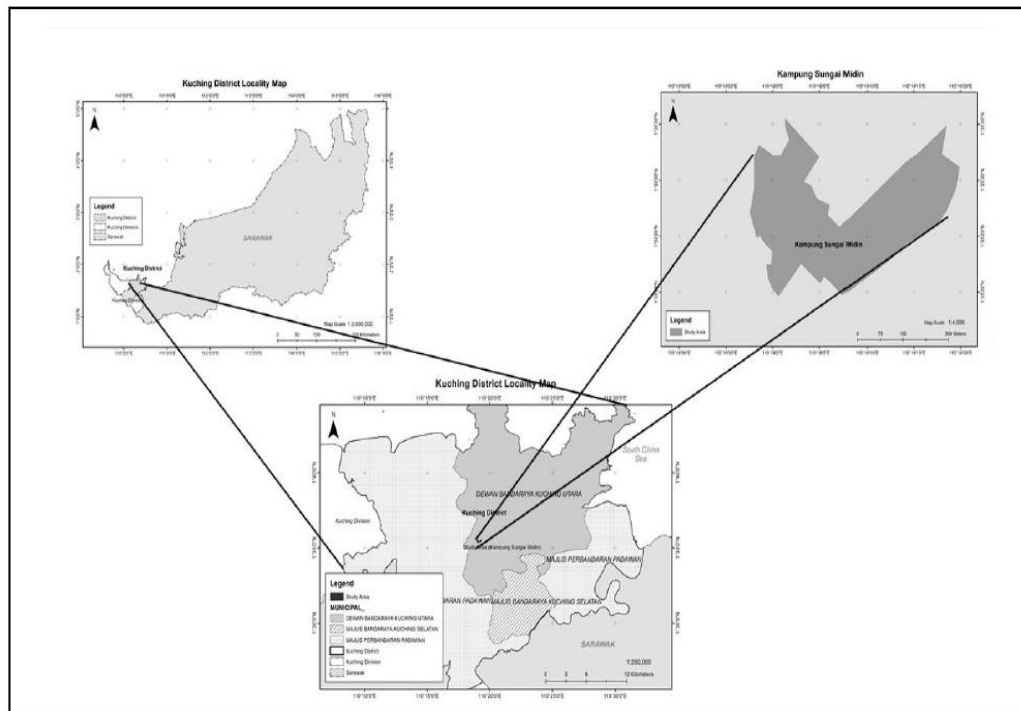


Figure 1. Study area

Kampung Sungai Midin was selected as the case study area because its physical and socio-spatial characteristics provide a suitable context for examining domestic waste management practices. The village exhibits features commonly associated with suburban settlements, including semi-planned housing development, varying levels of infrastructure provision and transitional governance arrangements between rural and urban administrative systems. Although residents have access to basic infrastructure such as paved roads, electricity supply, water facilities and community amenities, variations in housing layout, road accessibility and waste collection access continue to influence environmental management practices. These characteristics make the village an appropriate setting for exploring the relationship between physical environmental conditions and household waste management behavior.

Data collection and data analysis

Data collection was conducted between October 2022 and January 2023 in Kampung Sungai Midin, Kuching Sarawak, using three qualitative methods: semi-structured interviews, field observations and document analysis. The use of multiple methods facilitated data triangulation and

enhanced the credibility of the findings (Mohd Tobi, 2017; Zhang & Wildemuth, 2009). Semi-structured interviews were conducted with 25 participants selected through purposive sampling. The participants consisted of 20 household residents, three community leaders and two officers from the local authority responsible for waste management services in the study area. The sample of 25 participants was considered adequate for the qualitative design because data collection continued until no substantially new themes emerged from subsequent interviews. Saturation was assessed progressively during the interview process by comparing emerging codes and themes across participants.

Household participants were selected based on their length of residence, housing location, proximity to communal bins and direct involvement and experience in household waste management to ensure the sample captured different experiences of the physical and spatial conditions of the settlement. Participants were included based on their direct experience with domestic waste management in Kampung Sungai Midin, Kuching, Sarawak. Household residents provided information on everyday waste management practices and their experiences with waste collection facilities, while community leaders provided information on community-level waste management issues and local practices. Local authority officers were included to provide institutional perspective on waste collection services, infrastructure and service provision in the study area. The inclusion of these participant groups allowed the findings to be examined from household, community and institutional perspectives.

The interview questions focused on household waste management practices, experiences with waste collection services, perceptions of environmental and spatial conditions and the ways in which physical conditions affected or constrained everyday waste management practices. Interviews were conducted in local Malay Sarawak language, lasted between 45 and 90 minutes and was conducted either at participants' homes or at community facilities within the village.

Field observations were carried out throughout the data collection period to document the physical characteristics of the settlement. Particular attention was given to housing arrangements, road conditions, accessibility of waste collection points, availability of waste storage facilities and evidence of waste disposal practices such as illegal dumping, open burning and waste accumulation. Observation notes and photographs were recorded systematically to support the interpretation of interview findings.

Document analysis was also undertaken to provide institutional and policy context for the study. Relevant documents included local authority reports, village development records, waste management guidelines, planning documents and reports related to waste collection services in Kuching. These documents provided supplementary information regarding waste management policies, service provision and infrastructure development within the study area. All interviews were audio-recorded with participants' consent and subsequently transcribed verbatim. The interview transcripts, observation notes and documentary materials were analyzed using thematic analysis following the framework proposed by Braun and Clarke (2006). The analysis involved six stages: data familiarization, initial coding, theme generation, theme review, theme definition and report writing. Data coding was conducted manually to facilitate data organization and retrieval. Initial codes were generated from recurring patterns identified in participants' narratives and field observations. Similar codes were subsequently grouped into broader themes related to physical environmental factors and domestic waste management practices. Examples of emerging themes included accessibility to waste collection services, settlement layout, infrastructure availability and community responses to environmental constraints.

To strengthen the trustworthiness of the findings, methodological triangulation was employed by comparing evidence obtained from interviews, observations and documents. Member checking was conducted with selected participants to verify the accuracy of interpretations, while peer debriefing with fellow researchers was undertaken to minimize researcher bias. These procedures enhanced the credibility, dependability and confirmability of the study.

Results and discussion

Household domestic waste management practices

The findings examined how households in Kampung Sungai Midin, Kuching, manage their domestic waste in everyday lives. The interview and field observation data revealed several practices including temporary storage of household, disposal through communal collection points, limited waste segregation and in some cases, the disposal of waste through burning or directly into the river. These practices were closely associated with the availability of waste management facilities, the distance to communal collection points and the physical characteristics of the settlement.

Most households stored their domestic waste temporarily before transporting it to the communal waste collection points located at the main road. However, individual wheeled waste bins were not provided to households. Instead, residents used containers available at their homes, including paint buckets, purchased bins and plastic bags to store waste before disposal. One resident explained:

“We were not provided with the wheeled waste bins. We have to provide our own bins to store the waste before taking it to the communal bin. Usually, we take the waste to the communal bin every morning.” (Resident 5, male, 45 years)

Another resident described the situation as follows:

“We really do not have wheeled waste bins. We only use paint buckets or bins that we purchase ourselves to store the waste. Besides, the garbage truck cannot enter the village because of the narrow road. That is why communal bins are provided, making it easier for the garbage truck to collect waste.” (Community leader, male, 56 years)

Burning was also identified as one of the household waste disposal practices observed in the study area. The use of burning as an alternative disposal method further demonstrates that households employed different disposal practices depending on the type and quantity of waste and the accessibility of formal waste collection facilities. Long-term residents recalled that burning was mainly practiced for dry leaves and small amounts of plastic food packaging. Residents reported burning waste accumulated from cleaning their household surroundings rather than transporting it to the communal collection point. As one resident explained:

“I burn dry leaves and sometimes food packaging in front of my house. When I clean the yard, I burn the waste I collect so that I do not have to take the waste to the communal bin.” (Resident 11 male, 59 years)

This finding shows that burning was used as a convenient alternative to communal waste disposal, particularly for waste generated from routine yard cleaning and small quantities of household waste.

Physical environment as a determinant of domestic waste management practices

The findings indicate that the physical environment plays a significant role in shaping domestic waste management practices in Kampung Sungai Midin. Interviews and field observations revealed that residents' waste disposal behaviors were influenced not only by individual attitudes and environmental awareness but also by the spatial and infrastructural conditions of the settlement. Three interrelated physical environmental factors emerged as particularly influential: (i) settlement layout and housing characteristics, (ii) accessibility and availability of waste management infrastructure, and (iii) proximity to the river.

These findings support the argument that environmental behavior is embedded within everyday interactions between individuals and their surrounding physical environment. While awareness of environmental issues was generally present among respondents, physical constraints often limited their ability to practice proper waste management. Consequently, domestic waste management behavior was shaped by a combination of environmental conditions, convenience and accessibility rather than environmental awareness alone.

Settlement layout and housing characteristics

The physical layout of Kampung Sungai Midin was found to significantly influence household waste management practices. The village consists of a semi-planned settlement pattern characterized by narrow roads, irregular housing arrangements and riverbank dwellings which create challenges for waste collection and environmental maintenance. Field observations revealed that several houses located along the river were constructed on stilts to accommodate tidal fluctuations and periodic flooding. Domestic waste was frequently observed beneath houses and along riverbanks including plastic waste, food packaging and other household refuse. Interview findings further indicated that residents' ability to maintain cleanliness around their homes was influenced by these physical conditions. Residents living along the riverbank described how waste could accumulate beneath their houses following rainfall, tidal movements and flooding. One resident explained:

“My neighbor often throws waste into the river behind our house, The waste then gets carried by the current and ends up behind my house. Whenever it rains, I have to clean up the waste because I do not want it to pile up in my house. I worry that every time it rains, the waste will be carried towards my house”. (Resident 4, female, 52 years)

Other participant similarly describes the difficulty of maintaining cleanliness:

“The bin is quite far from my house. If I only have a small amount of kitchen waste, sometimes it is easier to throw it somewhere nearby than carry it all the way to the communal bin.” (Resident 10, Male, 28 years)

These accounts suggested that housing location and environmental conditions influenced their willingness and ability to maintain cleanliness around their homes. Respondents explained

that waste frequently accumulated beneath houses due to tidal movements and flooding events, while some waste originated from neighboring areas and became trapped around house structures. Consequently, cleaning efforts were often perceived as temporary because waste would reappear after heavy rainfall or changes in river conditions. The findings suggest that the spatial characteristics of the settlement create environmental conditions that both facilitate and constrain waste management practices. In particular, riverbank housing and limited accessibility increase residents' exposure to waste accumulation while simultaneously reducing opportunities for effective waste removal.

Accessibility and availability of waste management infrastructure

The availability and accessibility of waste management infrastructure emerged as another important factor influencing household waste management practice. Due to narrow roads and irregular settlement patterns, waste collection vehicles are unable to access many residential areas within Kampung Sungai Midin. As a result, residents depend on communal waste bins provided by the Kuching North City Hall (DBKU) at designated collection points located along the main road. Although most respondents acknowledged that the provision of communal bins had improved waste management within the village and reduced indiscriminate waste disposal, accessibility remained a concern for households located further from the collection points. One resident described the difficulty of transporting household waste to the communal bin:

“It is easier to throw the waste into the river. I do not have to take it to the communal bin. Besides, my house is closer to the river. The bin is quite far away. I only throw food waste into the river.” (Resident 12, female, 42 years)

The lack of individual household bins further contributed to this problem. Residents reported using temporary storage containers, including plastic bags, paint buckets and reused containers before transporting their waste to the communal collection points. As two participants explained:

“We were not provided with wheeled waste bins. We have to provide our own bins to store the waste before taking it to the communal bin. We take the waste to the communal bin every morning.” (Resident 15, Male, 48 years)

“We really do not have wheeled waste bins. We only use paint buckets that we purchase ourselves to store the waste. Besides, the garbage truck cannot enter the village because the roads are narrow. That is why communal bins are provided. It is easier for the villagers to bring their waste to the communal bins, making it easier for the garbage truck to collect the waste.” (Resident 16, female, 55 years)

The interviews also revealed concerns regarding overflowing communal bins. Some respondents reported that residents from neighboring settlements also used the collection points resulting in bins reaching capacity before scheduled collection. One participant stated:

“The communal bins provided are also used by people from outside the village. This caused the bins to fill up quickly and residents were forced to place their waste outside the communal bins. This can lead to unpleasant odors and pollution problems.” (Community leader, male, 56 years)

The local authority was also aware of the misuse of the communal collection points by individuals from outside the village. One representative explained:

“We have been informed about the issue and several measures have been taken to address it. For example, the collection point has been provided with a roof to prevent the waste from getting wet when it rains.” (Local Authority Officer, female, 47 years)

This finding also indicates that the issue of improper use and overloading of the communal collection points was recognized not only by residents but also by the local authority. The communal collection system enabled regular waste collection services and provided residents with a designated location for waste disposal. Nevertheless, accessibility to these facilities remained a significant challenge for some households. Respondents living further from the communal bins reported difficulties transporting household waste, particularly small quantities of daily kitchen waste. Several residents indicated that the distance to disposal facilities discouraged regular use and encouraged alternative disposal practices that were perceived as more convenient. The problem was further compounded by the absence of individual household waste bins, forcing residents to rely on temporary storage containers such as plastic bags, paint buckets and reused containers. Observations also revealed that communal bins frequently reached capacity before scheduled collection times. According to respondents, individuals from neighboring settlements often used the facilities, resulting in overflowing waste and the accumulation of refuse around collection points. This situation contributed to unpleasant odors, visual pollution and concerns regarding public health. Another important finding was the absence of waste segregation practices at the household level. Most respondents disposed of mixed household waste directly into communal bins, including recyclable materials such as plastics, paper and metal containers. Participants mentioned that:

“I do not separate the waste before taking it to the communal bin. There are no separate bins provided and the lack of storage space makes it difficult for us to separate the waste. It is better to take everything directly to the communal bin.” (Resident 17, female, 47 years)

“How are we supposed to separate the waste when we do not even have the facilities for it? There is a recycling facility but it is quite far. (Resident 3, male, 42 years)

Interview data suggested that residents perceived waste separation as impractical due to limited storage space and the lack of dedicated recycling facilities. These findings indicate that infrastructure availability influences not only waste disposal behavior but also the adoption of waste reduction and recycling practices. Overall, the findings demonstrate that accessibility and infrastructure provision are critical determinants of sustainable waste management behavior. Although residents generally expressed positive attitudes towards proper waste disposal, infrastructural limitations constrained their ability to engage in more environmentally responsible practices.

River proximity and waste disposal behavior

The river emerged as one of the most influential physical environmental features shaping domestic waste management practices in Kampung Sungai Midin. Many households are located directly adjacent to the river, making it an integral part of residents' daily lives and interactions with the

surrounding environment. Interviews with community leaders and long-term residents revealed that prior to the provision of communal waste bins, some households routinely disposed of domestic waste into the river. This practice was associated with the perception that river currents would carry waste away from residential areas. A long-term resident recalled:

“Before the communal bins were provided, many residents used to throw their waste into the river. For those living near the river, the waste was simply disposed of directly into the river.” (Community leader, female, 52 years)

Although respondents acknowledged that such practices have declined following improvements in waste collection services, occasional disposal of household waste into the river continues to occur. Field observations indicated that food waste and other biodegradable materials were the most common forms of waste discarded into the river. Respondents explained that disposing of small quantities of kitchen waste directly into the river was often perceived as more convenient than transporting waste to communal disposal facilities located further away. For some households situated along the riverbank, the river effectively functioned as an informal waste disposal outlet. This practice was associated with the perception that river currents would transport waste away from residential areas. Although the provision of communal bins has reduced this practice, interviews indicated that some residents living close to the river continued to perceive the river as a more convenient disposal option particularly for small quantities of food waste. One resident explained:

“It is easier to throw the waste into the river. I do not have to take it to the communal bin. Besides, my house is closer to the river. The communal bin is quite far. I only throw food waste into the river.” (Resident 19, female, 43 years)

Similarly, another resident stated:

“If it is food waste, such as fish scraps, I will throw it directly into the river because it is closer. Besides, the amount of waste is small.” (Resident 17, female, 47 years)

The findings further revealed that tidal fluctuations and seasonal flooding contribute to the accumulation of waste along riverbanks and beneath houses. Waste transported by river currents from upstream locations often becomes trapped around house pillars and vegetation, creating additional environmental management challenges for residents. As a result, community efforts to maintain environmental cleanliness are frequently undermined by factors beyond their direct control. Although most respondents demonstrated awareness of the environmental consequences of river pollution, observations suggest that awareness alone is insufficient to eliminate improper waste disposal practices. Convenience, accessibility and long-established habits continue to influence behavior (Tramoy et al., 2022). Furthermore, several respondents expressed frustration towards neighbors who continued to dispose of waste into the river, indicating differing levels of environmental responsibility within the community. These findings highlight the complex relationship between physical environmental conditions and waste management practices. The river simultaneously functions as an environmental resource, a source of waste accumulation and, for some residents, an alternative disposal pathway. Consequently, effective waste management interventions in riverine suburban communities must address not only environmental awareness but also the physical and spatial conditions that shape everyday waste disposal practices.

Discussion

The findings of this study demonstrate that domestic waste management practices in suburban Kuching are strongly shaped by physical environmental conditions. Although residents generally demonstrate awareness of appropriate waste management practices, their ability to translate this awareness into consistent action is constrained by spatial, infrastructural and environmental limitations. This reinforces broader arguments in environmental behavior literature that individual actions are not solely determined by knowledge or attitudes, but are significantly mediated by material conditions and the spatial organization of everyday life (Agamuthu et al., 2007; Hamidi Ismail et al., 2011; Li et al., 2021).

From a socio-spatial perspective, the results highlight that domestic waste management in suburban areas is embedded within uneven infrastructural landscapes. Semi-planned settlement patterns, limited road accessibility and inconsistent service coverage collectively shape how residents engage with waste disposal practices. In such contexts, environmental practice becomes a pragmatic response to physical constraints rather than a purely voluntary or awareness-driven choice. This finding is consistent with studies suggesting that sustainability practices in developing and transitional urban areas are heavily influenced by the availability and accessibility of environmental infrastructure (Omollo, 2019).

A key implication of the findings is the apparent misalignment between waste governance frameworks and urban–suburban spatial realities. Existing waste management policies often assume relatively uniform service provision, however, the empirical evidence from Kampung Sungai Midin demonstrates that suburban settlements are characterized by heterogeneous physical conditions that directly affect service delivery. Irregular housing layouts, narrow access roads and riverine settlement patterns limit the efficiency of waste collection systems and create unequal access to waste disposal facilities. This disconnect between policy assumptions and ground-level spatial realities has also been identified in other developing urban contexts, where governance systems struggle to adapt to rapidly changing suburban landscapes (Grangxabe et al., 2023; Sicam, 2023).

These findings underscore the importance of integrating waste management considerations into physical and spatial planning processes. Effective domestic waste governance requires not only institutional coordination but also deliberate planning of waste infrastructure within settlement design. Strategic placement of communal bins, optimization of collection routes and provision of accessible disposal points are critical in reducing the physical burden on residents and improving compliance with sustainable waste practices. As highlighted in previous studies, improving accessibility to waste infrastructure is a key determinant of behavioral change in household waste management (Guerrero et al., 2013).

Furthermore, embedding waste governance within spatial planning frameworks can contribute to more equitable and context-sensitive environmental management. Suburban and peri-urban communities should not be treated as extensions of urban service models but rather as distinct spatial entities with specific infrastructural and environmental challenges. Recognizing these differences is essential for ensuring that sustainability policies are inclusive and responsive to local conditions (Guo, 2025). Without such integration, there is a risk that suburban communities will continue to face structural disadvantages in accessing effective waste management services.

Overall, the findings of this study emphasize the need for a more integrated approach to domestic waste management that combines behavioral, infrastructural and spatial planning

dimensions. While environmental awareness remains an important component of sustainable behavior, it is insufficient on its own to ensure effective waste management outcomes. Future policy and planning interventions should therefore prioritize the alignment of waste infrastructure with settlement morphology and accessibility conditions in order to support more sustainable and equitable waste management systems in suburban contexts.

Conclusion

This study examined the influence of physical environmental factors on domestic waste management practices in Kampung Sungai Midin, Kuching, Sarawak, a suburban settlement located on the urban fringe of Kuching, Sarawak. Using a qualitative case study approach, the research explored how residents manage household waste and how physical environmental conditions shape their waste-related behavior.

The findings demonstrate that domestic waste management practices are closely linked to the physical characteristics of the settlement. Three key factors were identified as influencing residents' behavior: settlement layout and housing characteristics, accessibility and availability of waste management infrastructure, and proximity to the river. Narrow roads, irregular housing arrangements and riverbank settlements limited access to formal waste collection services and influenced how residents disposed of household waste. Although communal waste bins provided by the local authority have improved waste management practices, challenges related to accessibility, distance and limited infrastructure continue to affect household waste disposal behavior. The river also remains an important environmental feature influencing waste management practice, as its proximity creates opportunities for both proper and improper waste disposal.

The study further demonstrates that environmental awareness alone is insufficient to promote sustainable waste management behavior. While many respondents recognized the environmental consequences of improper waste disposal, physical and spatial constraints often shaped their decisions and everyday practices. This finding supports the argument that waste management behavior should be understood not only as an individual choice but also as a product of the socio-spatial environments within which people live and interact. From a social practice perspective, the availability of infrastructure and the configuration of the built environment constitute important material conditions that enable or constrain environmentally responsible behavior.

This study contributes to the growing body of literature on domestic waste management by highlighting the importance of physical environmental factors in shaping household waste practices within suburban communities. While previous studies have largely focused on policy interventions, technological solutions and environmental awareness, the findings suggest that greater attention should be given to settlement planning, infrastructure accessibility and place-based environmental management. Effective waste management strategies require closer integration between physical planning, local governance and community participation to address the unique challenges faced by suburban and riverine settlements.

Acknowledgement

This paper forms part of a PhD research project supported under the Skim Latihan Akademik IPTA 2.0 (SLAI 2.0), funded by the Ministry of Higher Education Malaysia (MoHE) and Universiti Malaysia Sarawak (UNIMAS). The authors would like to express their sincere gratitude to MoHE and UNIMAS for their financial support. We also extend our appreciation to all respondents, Institute for Environment and Development (LESTARI), UKM and others who contributed their time, cooperation, and valuable insights to this study.

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