



# Understanding Flood Vulnerability Issues in Hulu Langat Residential Zone: A Study of Taman Sri Nanding, Hulu Langat, Malaysia

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**Abstract:** Flooding is responsible for a large majority of losses in Malaysia. It can be any of the following losses and consequences: human, economic, material, or environmental. This study aimed to understand and interpret flood vulnerability issues of residential zones in Taman Sri Nanding, Hulu Langat, Malaysia. No research has been carried out to date to understand the flood vulnerability issues in residential zones of Taman Sri Nanding. Therefore, flood vulnerability issues need addressing and analyzing, as most households in Taman Sri Nanding are vulnerable to flood hazards. A qualitative approach is adopted for this study to obtain comprehensive and reliable information by analyzing local perspectives with open-ended questionnaires. The findings have revealed that residential zones necessitate implementing effective flood mitigation strategies. However, the local authority still needs to take additional steps to provide safer living conditions for Taman Sri Nanding residents during and after the floods. Furthermore, the low-income residents of Taman Sri Nanding, who are most at risk from flooding, should be carefully considered. Hence, it is significant to consider the perspectives of local authorities to further this research.

**Keywords:** Vulnerability, residential zones, flooding, Hulu Langat, Malaysia

## 1. Introduction

Due to rapid urban development and climatic changes, flood hazards are becoming more frequent and severe in major South East Asian metropolitan areas, endangering people's lives and property. Increased rainfall is directly related to temperature rise and global warming, [1],[2] which affects the occurrence as well as the severity of floods and droughts [3], [4], [5]. Studies explicitly conducted in Malaysia have demonstrated that unrestrained human activity in rivers, forest destruction, and extreme weather events due to climate change is accountable for a rise in the country's flood incidents [6]. Since 2001, there have been 143 floods annually, more than 90% of which have been flash floods [7]. Such frequent floods pose a severe risk to Malaysian citizens' property and personal safety, severely damaging the nation's infrastructure [8]. In Malaysia, major floods hit in 1996, recording damage of RM300 million (\$72 million); in 2006, documenting damage of RM1.55 billion (\$376 million); also in 2014, with an estimated property and infrastructure loss of RM2.9 billion (\$704 million) [9]. Currently, Malaysia's Department of Irrigation and Drainage (DID) is in charge of developing, managing and putting flood mitigation measures into practice [10]. The key elements for the DID flood mitigation policy and strategy are structural strategies (building embankments and dams to regulate the flow of flood). Additionally, non-structural strategies are (flood risk evaluation and mapping, flood forecasting, land use planning, and warning systems for mitigating flood impacts), including preparedness equipment and flood disaster relief [11].

Nonetheless, Romali's [12] study highlighted the importance of balancing structural and non-structural strategies of flood to create an effective long-term flood risk management plan. In Malaysia, the Department of Irrigation and

Drainage reported in 2003, flooding affected 29 000 km<sup>2</sup>, or 9% of the country's overall land area on average, as well as over 4.82 million people (22 percent of the populace). The losses each year were estimated at RM 915 million [13]. Besides, according to the ASEAN Coordinating Centre for Humanitarian Assistance on Disaster Management in March 2019, of all the ASEAN Member States, Malaysia has the highest percentage of its population (67%) that is vulnerable to flooding (between July 2012 and January 2019) [14]. In the new millennium, the Malaysian government significantly financed non-structural measures and community involvement as part of an integrated flood management strategy [13]. As for non-structural measures, the government also financed warning systems and flood detection, campaigns on awareness, and recommendations for flood-proof buildings having basements [15],[16]. Although the Malaysian government has formally adopted a comprehensive strategy for reducing the risk of flooding, several researchers have criticized its implementation from the preparation to the rescue phase [17]. Flood vulnerability exposes people and properties to loss and damage by flooding [18]. Crack, in this context, refers to both the harm done to the physically vulnerable elements and the amount of material needed to bring back the damaged part to its pre-damage state [14].

According to studies conducted specifically in Malaysia, the number of deaths caused by flood incidents has declined; nevertheless, there is a rise in both the quantity and cost of losses to physical property [20],[21]. A precise evaluation of such vulnerabilities requires the development of practical flood risk management strategies [22]. Vulnerability assessment studies focusing on different scales [19] and dimensions [18] have demonstrated the ability to predict socioeconomic damage and risk caused by floods. The flood vulnerability assessment took place in several developed nations, but Malaysia needs more understanding of its vulnerability to natural disasters. Although Malaysia's flood-prone areas are well known, there still needs to be adequate measurements to determine how severely the areas will be affected [23].

Recent flooding in eight states of Malaysia in December 2021 displaced over 40,000 people and took away 50 lives. The Malaysian Department of Statistics estimated that overall flood damages recorded approximately RM6.1 billion (USD1.46 billion). This figure uses approximate calculations for public belongings and infrastructure, dwelling units, transportation, commercial premises (mainly for facilities), manufacturing, and agriculture. Among all districts, one of the worst-hit ones identified was Taman Sri Nanding, Hulu Langat [24]. Understanding and conducting research regarding flood vulnerability issues still need to be completed, which inspired this study at Taman Sri Nanding to close this gap by concentrating on households in communities at risk of flooding. This paper exclusively focuses on identifying flood vulnerability issues in Taman Sri Nanding, Hulu Langat, Malaysia. Flood vulnerability issues in Taman Sri Nanding, Hulu Langat, require a solution, as receiving government relief after a flood does not resolve the concern [25]. It is then followed by highlighting and understanding the flood vulnerability issues from the perspectives of the local Imam in Hulu Langat, as the institution of the Masjid usually acts as the primary shelter during flood disasters [26],[27]. A qualitative approach is adopted to acquire detailed and reliable information by considering local perspectives with open-ended questionnaires. The results showed that additional practical actions are required to be taken by the authority during flood occurrences. The data was gathered solely from locals' firsthand experiences of flood occurrences. A comprehensive discussion on the current flood vulnerability issue follows.

At last, the paper concludes with recommendations to further this research. This approach can help disaster risk management professionals and the appropriate authorities implement the most suitable site-specific adaptation and mitigation strategies. Furthermore, the achievement will undoubtedly inspire experts from Malaysia and other developing countries.

## 2. Flood Vulnerability Issues in Malaysia

Employment, health, income, and education are the factors when determining the level and magnitude of vulnerability and resilience to catastrophic events [28]. Vulnerability, adaptive capability, and resilience interconnect in natural disaster incidents [29]. A low-vulnerability community has the probability of high resilience. The poor are more vulnerable to hazards than the wealthy [30]. The poor are vulnerable because they lack chances and access to solid structures, and their understanding and resources of the disasters are inadequate. Furthermore, apart from the poor people, lower-income groups are also most vulnerable to floods [28].

Houses built near riverbanks and low-lying areas, mismanagement of flood transit centers, inappropriate and impractical flood evacuation plans, an absence of prompt and precise flood information, and community members' failure to prepare for flooding have increased people's vulnerability to the flood event. The participants, aged 26 to 45, were worried about housing placement in vulnerable areas that could flood quickly, such as low-lying areas near riverbanks and swamps. In the meantime, the older generation, those between the ages of 56 and 65, are particularly vulnerable because they decline to stay at the transit center, their homes are typically made of wood, and they are frequently close to the beach, making evacuation challenging. In terms of income, flooding has rendered participants vulnerable and insecure, with monthly incomes ranging between RM1000 and RM3000. However, they refused to relocate to the transit center, citing the increased risk of burglary at their homes [28].

Furthermore, several transit centers are a long distance from their homes, requiring victims to pay for shelter. Men and women approve that warnings declared just during high tides and ambiguous flood warnings have increased their vulnerability. In contrast to residents, the JKKK (village committee) is more vulnerable. The JKKK frequently ran into



However, repair efforts continue for months [37]. Directly affected were about 116,273 persons from 31,949 households [38].



**Fig. 2 - Land development plan, specifying the study zone of Hulu Langat. Source: Integrated Land Use Planning System, (i-Plan)**



**Fig. 3 - Damage caused by the 2021 flood in Hulu Langat. Source: Author**

## 2.2 Statistics Related to Flood

The end of 2021 was also one of the worst floods ever to hit our country [38]. Selangor, Terengganu, Pahang, Kelantan, Melaka, Negeri Sembilan, Kuala Lumpur, and Perak were the eight states devastated by the floods [40]. The impact of the flood at the end of 2021 and the beginning of 2022 resulted in devastating dwelling units, public assets, commercial premises, automobiles, agriculture and industrial sectors, and infrastructure in Malaysia. Overall losses by category recorded RM2 billion in terms of public property as well as infrastructure, RM1.6 billion recorded for dwellings, RM0.9 billion for the manufacturing industry, RM1.0 billion for automobiles, RM500 million for company premises, and RM500 million for the agriculture sector (RM90.6 million). Based on the research conducted by the Department of Statistics Malaysia, the most impacted state by the floods was Selangor, with damages totaling RM3.1 billion, followed by Pahang (RM593.2 million) and Melaka (RM85.2 million) [39].

## 2.3 Recent Flood Events in Taman Sri Nanding

Flood victims in Taman Sri Nanding were alerted regarding possible flood occurrences. However, they believed the flood would ultimately subside because this region had encountered floods many times before. From their experience, flood levels rarely exceed a meter. However, this time in December 2021 was different, and many people had to flee to



roofs for protection. Taman Sri Nanding has 1,000 residences, with 10 to 15 victims each on the top of the house waiting for rescue. The evacuation team needed ample time to evacuate everyone to safety because the team only had two boats to carry out the evacuation [41]. To recover from the devastating floods that shattered the region, residents of Taman Sri Nanding had to take on a sad and automated approach, with some alleging that there is a lack of support from authority. There is much too much bureaucracy when it comes to getting things done. Furthermore, the ever-changing lawmakers and government personnel cause a great deal of confusion. As a result, there is no way to accomplish things appropriately [25].



Fig. 4 - People taking shelter in *Masjid* during the flood in Sri Nanding. Source: Author

### 3. Methodology

This section is a discussion of the methodology of this research. This research intends to address and understand the flood vulnerability issues from the perception of the local imam in Taman Sri Nanding. Therefore, this section will highlight the method of data collection and uncover the evidence for putting forward the solutions to the research question posed earlier. A qualitative research methodology adaption takes place as per the above discussion. In contrast to quantitative modes of inquiry, qualitative approaches aim to understand better respondents' perceptions of vulnerability and their ability to cope with and adapt to potentially dangerous climatic incidents [43]. Hence, it has implemented the interviews facilitating open-ended questionnaires and content analysis. Regarding the ethical conditions of research, the respondents' names remain anonymous. The interview process takes place in two phases with two weeks gap in between. Findings from the first interview as analyzed first to refine the open-ended questions for the second interview. Once both interviews were complete, the results created comparisons through descriptive analysis. Finally, the interview outcomes lead to a compilation under specific sub-sections in the discussion part. The scope of the inquiry for this study was limited to feedback from residents' perspectives. At the same time, further research is recommended at the end of the study to analyze the input from the local authority on the study issue.

### 4. Findings and Discussions

This section presents the data in an organized form from the interview sessions. The data were analyzed qualitatively. For ease of understanding, there is a usage of specific sub-section titles. The sub-sections are arranged according to the priority as indicated by the respondents. The issues emphasized by both respondents are listed first, while the problems mentioned by individual respondents sit in a later position. From the perspective of local imams in Hulu Langat, the following findings are:

#### **4.1 Double Story House is a Safe Place as a Shelter During Flood Events**

The respondent, an imam, said he lives in a recently renovated double-story house. Therefore, he had the opportunity to help around 20 residents by providing them shelter in his place on level 2 during this crucial time. Besides that, 200 flood survivors took refuge in the Surau Al-Munir and the rest at Madrasah.

#### **4.2 Lack of Appropriate Action from Local Authority**

The imam believes more practical measures need to be implemented by the local authorities to address the flood vulnerability issues and to develop the right solutions.

The Government promised to clear and upgrade the drainage system and regular maintenance. However, actions are pending. The Local Authority did not do its job; it was just a promise. There needs to be coordination between people and the local authority.

#### **4.3 No Water and Electricity During Flood**

When the flood hit Taman Sri Nanding, there was no water or electricity for three days. It is challenging to carry out daily activities for the residents without these basic facilities.

#### **4.4 Inadequate Funds for Renovating the House**

The State Government only allocated RM 2500 for repainting the house. After the flood, for rebuilding the house, RM 5000 was provided by the Government, which was insufficient.

#### **4.5 NGOs Were Constant Support During the Flood Occurrences**

NGOs were the first to help the flood survivors; they were speedy and efficient. Mostly, Chinese Non-Muslims came forward to help them.

#### **4.6 Low-income People Are Most Vulnerable During Flood**

It is painstaking for low-income people to renovate their houses and make them double-story. To put it bluntly, it is impossible for them. That is why people who rent homes in this area only stay for a while because of the flood. They move out. However, better-income households and house owners can renovate and make their houses double-story, and low-income people with no options but to continue living here. Approximately RM25 000 is required to construct a house accommodating two stories.

Six factors in Taman Sri Nanding that determine flood vulnerability include dwelling type, actions from the local authority, availability of power and water supply, insufficient funding, support from NGOs, and income. These factors were ranked from most important to second, third, fourth, and least important on a five-point scale. The most crucial factor was the type of dwelling, followed by a need for practical actions from the local authority. In addition, the collapse and cracking of respondents' houses caused by the flood event influenced their rankings. A maximum of respondents has witnessed the destruction of their houses. Water and power disruption ranked third, insufficient funding fourth, assistance from NGOs fifth, and income as the sixth significant factor in determining flood vulnerability issues.

In Georgetown, income level, type of dwelling, health, and accessibility to resources determine flood vulnerability [44]. The dwelling type, actions from the local authority, availability of power and water supply, insufficient funding, support from NGOs, and income were evident as determinants of flood vulnerability in this study rather than income level, health, and resource accessibility. The presence of dwelling type and income are similar; however, dwelling type ranked first and income as the sixth factor to determine flood vulnerability issues in this community. These demonstrate how socioeconomic factors and the physical environment interact to shape vulnerability. It is not advisable to generalize the study of flood vulnerability results because they might not apply to other areas [44].

### **5. Conclusion**

To sum up, from the findings, this research revealed crucial information that can be utilized as input to bring some meaningful considerations for directing the Government, researchers, and architects in identifying, understanding, and analyzing the flood vulnerability issues in Taman Sri Nanding, Hulu Langat, Malaysia. As the first step, this paper considered the residents' perspective to understand the impact of recent flood events in the Taman Sri Nanding residential zone. The study's field of inquiry restricts responses from residents' views. Although the residents' perspective gives a partial picture of the whole scenario, the paper's findings endorsed the numerous reports in newspapers and media to highlight the seriousness of the situation. For a wholesome understanding, the study will focus next on the perspective of local authorities and NGOs who are the first respondent during disasters. Therefore, to provide an in-depth analysis of the flood vulnerability issues in Taman Sri Nanding as well as further carry out the research, it is recommended to interview the local authority and NGOs to acknowledge their perspectives.

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