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Historical landslide events in Malaysia 1993-2019

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Abstract

Background: To review historical landslide events in Malaysia. The increasing number of landslide in Malaysia is closely linked to the development of new infrastructures of the economic and social progress. **Methods:** The research was a review study utilizing secondary data as the primary source from National Slope Master Plan 2009-2023 and some additional study by the researchers. This study thoroughly examined landslide in Malaysia and found many landslide occurred in the area of Selangor due to increased development. There are several historical landslide events in Malaysia that have been extensively reviewed from the year 1993 to the year 2019. **Findings:** This disaster has resulted in substantial numbers of casualties, destruction of properties losses and direct and indirect economic implications. The summary of this study found that the number of landslides and injuries were reported to increase between 1993 and 2019. Some major landslide also occurred along the main highway without fatalities but serious traffic congestion occurred. **Novelty of the study:** This paper focus on clarify the historical events that had an impact on the physical and socio-economic conditions in Malaysia. In summary, this study has highlighted the summary of major landslide events in Selangor and Kuala Lumpur, and generally, this tragedy occurred causes of slope instability and human error. **Recommendations:** It is suggested to further restrict any development on a high land area to limit environmental impact. In addition, awareness and knowledge about on the dangers of landslides should be communicated to the public during the planning and management process. Susceptibility analyses may also provide important input during overall design, analisis and planning of development in hilly terrain.

Keywords: Landslide; historical; Malayasia; hazard

1 Introduction

Malaysia is located in the tropical climate of South East Asia and characterized by heavy rain almost all year round particularly from October to February. Malaysia has

experienced multiple natural disasters, such as landslides, mudslides and floods due to heavy rainfall, especially in these few months. Landslides are frequent in the region, particularly during this monsoon season due to high rainfall up to 700 mm per month. Landslide is frequently caused by heavy rainfall in Malaysia particularly during the summer monsoon, during the Southwest Monsoon season from end of May to September and during the North-Eastern monsoon from November to March⁽¹⁾. Landslides resulted in environmental and socio-economic damage such as loss of life, harm to properties and facilities, the social strain on families, land boundary conflicts and land degradation. Malaysia has seen quite a few major landslides and casualties. The collapse of the Highland Towers in 1993 has been an eye-opener on the need for proper policies for public and decision-makers, technical organizations, help staff for emergency services and remedial steps for landslide and prevention action⁽²⁾. With an average of 100 cases per year (estimation of reported and unreported cases) and over 600 deaths recorded since 1961, people have also been warned and told to expect for the worst⁽³⁾.

In Malaysia, the increase in landslide events are closely linked to the development of new infrastructures such as highways, road network, dams and the demand for housing in the housing sector has been increasing so that it has to build in the high terrain⁽³⁾. Landslides affecting the residential areas are frequently recorded in Bukit Antarabangsa because the residential estate was developed in the hills and indirectly leads to high-risk landslides. In addition, landslides on the highway were occurred in Malaysia, where involving the North-South Expressway at Gua Tempurung. Hill development was a significant trigger for landslide events in Malaysia involving highlands. It is often the result of technical flaws that are part of human activities like insufficiency in design, failing in construction or wretched maintenance⁽⁴⁾.

Slope failures continue to be popular from year after year in Malaysia⁽⁵⁾. Rainfall-induced slope failures occur as a shallow slope collapse, with slip surfaces oriented parallel to the slope surface, especially in areas of Hulu Kelang where the residual soil profile has been formed over the bedrock interface⁽⁶⁾. One of Malaysia's sectoral report⁽⁷⁾ documented 49 landslides out of which 88% effect on human-made slopes. Approximately all the landslide events at Malaysia that occurred in the hilly areas are caused by the slope cutting involving developmental activities. As a consequence, a combination of poor design and construction error, geological features or poor maintenance also play a significant contribution to the common occurrence of landslides⁽⁸⁾.

Malaysia has experienced many natural disasters, mostly due to heavy precipitation. Landslides during the monsoon season have been frequent due to high rainfall. Although typically landslides in Malaysia rarely exceed 500 meter in length or width, the rate of loss due to landslide disasters is rather high and worrying⁽⁹⁻¹¹⁾. Other than a rainfall-related landslide, hurricanes, seismic events, shifts in climate, disruptions and slope profile adjustments, or variations of these causes, are also possible reasons for landslide induced events. In addition to human and rainfall factors as mentioned above, the other main contributing factors to trigger landslides are geological features and ground conditions (area hydrology and morphology)⁽¹²⁾. High temperatures and humidity result in chemical processes that degrade the rock and create very dense soils, often reaching a thickness of up to 100 meters from the surface⁽¹³⁾. Although dense, these residual soils are easily disturbed and prone to slide especially when deposited or folded at an angle.

Globally, landslides cause approximately 1,000 deaths per year and property damage of about US 4 billion⁽⁵⁾. Moreover, from 1973 to 2007, the overall economic loss due to landslides in Malaysia was calculated at about US\$ 1 billion⁽¹⁴⁾. The event of many incidents of landslides caused by overdevelopment, most of which have fatal consequences, is evidence of harmful environmental exploitation⁽¹⁵⁻¹⁷⁾. A total death due to landslide from 1993 until 2011 is more than 600⁽¹⁸⁾. These include the collapse of the Highland Towers luxury condominium in 1993, which claimed 49 lives; the Genting Highland landslide tragedy in July 1995 which killed 20 people and wounded 23 others; the 60 landslides in Penang in September 1995; in August 1996 in Pos Dipang, Perak which claimed 44 people; May 2011 in Hulu Langat which claimed 15 children and a caretaker of the orphanage which caused by heavy rains and recently in October 2017 in Tanjung Bungah, Penang Island which claimed 11 construction workers of slope hill project. Pulau Pinang is an area frequently affected by landslides, it is one of the locations that often causes loss, death and loss of property⁽¹⁹⁾.

In Malaysia, trees are logged for economic benefit. The unsustainable opening or growth of forests has triggered environmental issues, such as soil erosion, landslides and floods. A deforestation is an act of logging, mining or the clearance of urban areas. This behaviour triggers changes in climate, vegetation and animal ecology. The deforestation of the highlands for construction activities such as roads and housing often leads to landslides. Deforestation was an important process for any construction at the hilly area that made this area more vulnerable to landslides⁽²⁰⁾. Typically landslide in Malaysia has occurred at hilly area due to ecosystem changes in an environment. It applies to the felling of trees intended for development activities⁽²¹⁾. Due to extreme construction in hills, landslide events are triggered by the process of cutting slope and removing soil from the hill. Hence, the loss of roots and the strengthening they provide will significantly increase the risk of a slope failure⁽²²⁾.

The consequences of the landslide tragedy have led to environmental and socio-economic damages, destruction of property and infrastructure, social pressure on communities, conflicts on the land borders and degradation of the land. This paper was focused on landslide tragedy in order to understand the occurrence of landslides in and around Malaysia. The purpose of

this paper was to clarify the historical events that had an impact on the physical and socio-economic conditions in Malaysia. Therefore, this study also suggests a solution to this phenomenon that governments and state authorities can deal with.

2 Methodology

Malaysia located at latitude 2° N to 7° N and longitude 99.5° E to 120° E in Southeast Asia. This country is divided into two major parts, namely Peninsula Malaysia and Borneo Island, covering a total area of 330,200 km². This study is used secondary data from the National Slope Disaster Planning and Management, press and a research paper on the landslide disaster in Malaysia. Thus this study focused on landslide tragedy occurred in the year 1993 to 2019. The year selected in this study is due to the terrible landslide that caused 48 deaths and one building collapsed during 1993 and this tragedy known as a highland tower. The construction of houses in the hills area and heavy rain triggers landslides tragedy. Figure 1 shows the location of the study area.

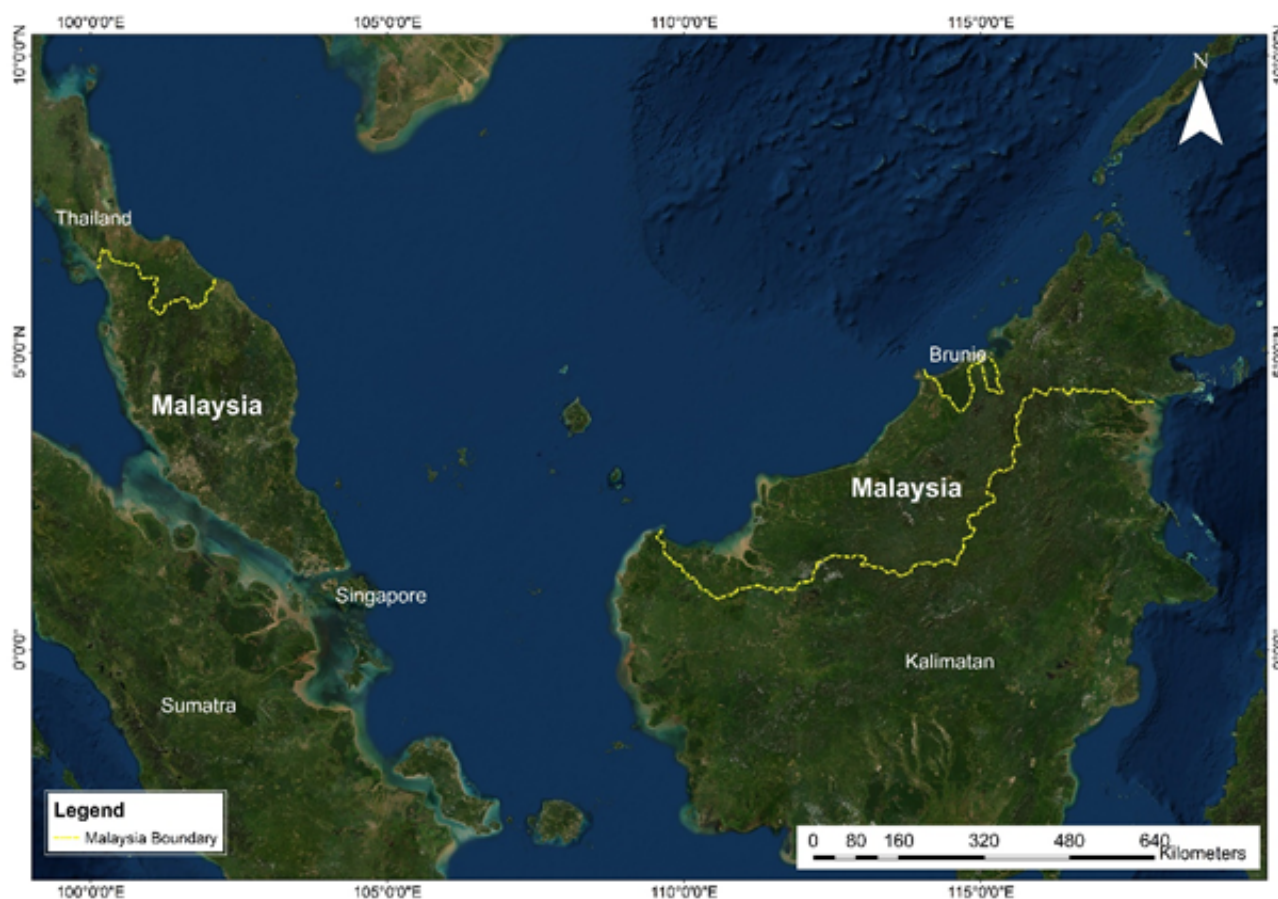


Fig 1. Map of study area

The purpose of this article is to provide information for a preliminary review of the landslide tragedy. For this study, recorded landslides events and landslide risk area are mapped and located using GIS software to view the landslide event through the map. An increase of rapid development in Selangor and Kuala Lumpur is the reason why this area is highlighted. Figure 1 shows the history of a landslide event in Peninsular Malaysia. A total of 38 landslide locations were identified in the state of Selangor and Federal Kuala Lumpur Territory. These areas have suffered much landslide damage after heavy rains⁽²³⁾. These include the tragedy in 2011 in Pekan 14, Hulu Langat, Selangor and Bukit Beruntung, Selangor in 2014. However, there are many causes able to trigger landslide occurrences, such as design errors and construction errors.

The landslide risk area plot in their position based on secondary data obtained from papers, reports, articles, relevant sources and internet sources. Landslide risk area is defined as hazardous when 30 degrees terrain elevation of more than 500 meters, which can be worse during precipitation⁽²⁴⁾. This identified landslide risk area can trigger landslides after rainfall and another factor like a gradient of hillslopes which had poor angles⁽¹³⁾. Landslide is also correlated with steep slopes, permeable rocks, groundwater, soil and human activity. The trigger is single occurrence that quickly began the landslide.

3 Results and Discussion

Generally, there had been 21,000 landslide-prone areas across the country, of which 16,000 or 76% are in Peninsular Malaysia, while around 3,000 are in Sabah and 2,000 are in Sarawak⁽²⁵⁾. The most frequent types of landslides in Malaysia are shallow slides where the slide surface is typically less than 4 m deep and occurs during or directly after heavy rainfall⁽⁹⁾. Annual rainfall in Malaysia may reach as high as 4500 mm. Coupled with year-long high average temperatures, triggers extreme chemical weathering and the development of residual soil profiles that can exceed 100 m in depth in some sites.

The landslide statistics recorded in Malaysia actively show the dominance of inadequate engineering design. For the 49 cases slope failures, 29 cases contributed to design weakness, as shown in Table 1. In addition to faulty design, incompetence, casualness, insufficient raw input data often lead to this regular event of landslides⁽²⁵⁾. These cases are linked to the cases in Selangor, as shown in Table 1. For example, Taman Zooview (2006) case occurred at the back of a row of terrace houses located on top of the slope. In this incidence, slope stability analysis shows that the factor of safety for localized slope failure and failure can be expected to happen at any time, especially with incessant rainfall and weak drainage system⁽⁹⁾.

Furthermore, the reasons for landslides may well be related to misuse of prescriptive techniques, ineffective research of previous occurrences, design errors, and inadequate location-specific land inspection. The Malaysian government has initiated to pay more attention to the landslide phenomena. Figure 2 shows the history of a landslide event in Peninsular Malaysia.

Table 1. Reported cases of landslides in Malaysia⁽⁹⁾

Causes Of Landslides	Number of Cases	Percentage (%)
Design errors	29	60
Constructions errors	4	8
Design and Constructions errors	10	20
Geological features	3	6
Maintenance	3	6
Total	49	100

Based on Table 2, 27 landslides were reported in Selangor with a total loss of more than 85 lives from 1993 to 2019. Some fatal landslides have been recorded in Ulu Klang area after the Highland Towers disaster in 1993, followed by a landslide in Taman Hillview in 2002. Subsequently, landslides recorded in Taman Zoo View in 2006 and Taman Bukit Mewah in 2008. Thus, Ulu Klang region is very vulnerable to landslides. This area is located near the Kuala Lumpur boundary and urban growth, including the development of residential and commercial centres, has presented numerous threats to the region. The Ulu Klang region has experienced many deadly landslides triggered by rainfall. Since 1984, 28 massive landslides reported as rainfall-induced landslides. The Highland Towers collapse is among the most devastating accidents causing 48 fatalities owing to the failure of the tower following many days of rainfall in 1993^(26,27). However, investigations reveal the collapse is linked to folding and shearing of rail piles that were triggered by the motion of the earth. Retrogressive landslides behind Block 1 of the towers was crucial for the growth of soil failures. The critical factor is not only insufficient drainage but also the ineffective construction on the hill. Generally, in Malaysia, the high-risk areas with a history of landslides include Ulu Klang, Selangor which claimed many casualties and losses.

Table 2. The landslide record in Malaysia between 1993 and 2019^(28–30)

No.	Year	Location	Consequences
1	1993	Highland Tower, Ulu Klang, Selangor	48 deaths and 2 Injuries. 1 building collapsed
2	1993	Pinggiran Bukit Segar, Kuala Lumpur	One family evacuate their house
3	1993	Pantai Remis, Perak	No record
4	1994	Taman Puchong Perdana, Puchong, Selangor	10 families evacuated
5	1995	Taman Keramat Permai, Ampang, Selangor	No damage record

Continued on next page

Table 2 continued

6	1995	Kuala Lumpur – Karak Highway	20 deaths, 22 injuries and 10 car damaged
7	1996	North–South Expressway (NSE) near Gua Tempurung, Perak	No record
8	1996	Pos Dipang, Kampar, Perak	44 people were killed
9	1996	Ampang Jaya, Selangor	No record
10	1999	Puncak Athenaeum Condominium, Ampang, Selangor	Minor landslide, road access to hilly residential area affected
11	1999	Mutiara Condominium, Ampang, Selangor	No record
12	1999	North South Expressway, Kuang, Selangor	Thousands of vehicles stranded. 1 day of road closure
13	2000	Jalan Bukit Antarabangsa, Ampang, Selangor	No record
14	2001	Kampung Sungai Chinchin, Gombak, Selangor	A house partly destroyed
15	2002	Jalan Ipoh, Kuala Lumpur	Covering three-lane road leading to Rawang from Selayang.
16	2002	Taman Hillview, Ampang, Selangor	8 deaths and 5 injuries
17	2003	Taman Bukit Jaya, Ampang, Selangor	No fatalities
18	2004	Taman Melati, Gombak, Selangor	1 deaths
19	2004	Jalan Seri Penchala 1, Kuala Lumpur	24 houses evacuated
20	2006	Taman Zooview, Ampang, Selangor	4 deaths
21	2006	Taman Bukit Serdang, Seri Kembangan, Selangor	Damaged section of the road measured 50m by 25 meter
22	2006	Bukit Tunku, Kuala Lumpur	No record
23	2006	Taman Esplanad, Kuala Lumpur	2 houses damaged
24	2008	Taman Bukit Mewah, Ampang, Selangor	4 deaths
25	2008	Ulu Kelang, Selangor	4 deaths and 15 injuries
26	2008	Kuala Kubu Bharu, Batang Kali, Selangor	Two sisters were buried alive when landslide hit bungalow
27	2008	Kemensah Heights, Ampang, Selangor	No fatalities
28	2008	Bukit Ceylon, Kuala Lumpur	1 worker deaths
29	2008	Pantai Dalam, Kuala Lumpur	1 killed, 4 injured and 19 families evacuated
30	2009	Taman Cheras Awana, Cheras, Selangor	Destroyed three cars and a motorcycle, 10 families evacuated
31	2010	Ukay Perdana, Ampang, Selangor	No fatalities
32	2010	Taman Bukit Mulia, Ampang, Selangor	No fatalities
33	2011	Puncak Setiawangsa, Kuala Lumpur	88 residents of bungalows, shop houses and double-story terrace houses order to move out
34	2011	Jalan Semantan, Kuala Lumpur	6 cars were buried 5 vehicles were damaged
35	2011	Pekan Batu 14 Hulu Langat, Selangor	16 deaths
36	2011	Kampung Tengah, Puchong, Selangor	5 house affected
37	2012	Taman Desa Sentosa, Hulu Langat, Selangor	Endangered four occupants of the Perkid Welfare Home for girls.
38	2012	Taman Mulia Jaya, Ampang, Selangor	Water seeping through the sewerage system.”
39	2013	Putra Heights, Subang Jaya, Selangor	Several vehicles submerged in mud
40	2015	KM 52.4 of the Kuala Lumpur-Karak Expressway between Lentang and Bukit Tinggi, Pahang and Gombak-Bentong old roads	Lentang-Bukit Tinggi stretch of the expressway was closed to traffic
41	2016	Karak Highway	Blocked all lanes in both direction on the highway and four vehicles that were trapped in the landslide,

Continued on next page

42	2016	Bau-Puncak Borneo, Sarawak	Comprising mainly Bidayuh settlements and Padawan Ring Road critically affected
43	2017	Tanjung Bungah, Penang Island	Killed 11 construction workers
44	2018	Jalan Bukit Kukus, Georgetown, Penang Island	Killed nine construction workers
45	2019	Taman Batu Permai	No record
46	2019	Jalan Lee Woon, Ampang, Selangor	A house evacuated
47	2019	Genting Highland, Pahang	Affected a portion of the Jalan Genting-Amber Court slip road and no access to the resort

In Selangor, landslides were recorded in Bukit Antarabangsa, Ukay Heights, Taman Hillview, Dataran Ukay, Taman Melawati, Ukay Perdana, Taman Kemensah, Bukit Teratai, Bukit Permai, Taman Saga, Taman Mega and Bukit Segar⁽³⁰⁾. Some incidents are shown in Figure 2. Overall, most landslides happened in Ulu Klang area since this place has become a public place and urban sprawl as previously mentioned. With the comprehensive record of events or accidents in Selangor, especially in Ulu Klang, landslides are known to be a severe and the only natural disaster. After a series of tragedies, most residents, not only those who reside in Ulu Klang, are aware of the probability and implications of landslides occurring in this area. However, still few people in the neighbourhood have relocated to a safer spot. Only those closely associated with past landslide incidents will take appropriate steps to depart the area voluntarily, not just because of the order of the authorities.

Table 3 shows the landslides recorded in Malaysia, in Kuala Lumpur, 10 major landslides occurred between 1993 and 2019; however, the most catastrophic event happened at Puncak Setiawangsa in 2011. In this incident, 88 residents of bungalows, shops and double-story terrace houses were forced to move out due to land movement. The 60-metre high retaining wall and the rear section of the building fell. The building was subsequently destroyed to reduce the strain on the hillside^(31,32). The primary factor for this landslide is the inadequate form of slope safety used by the hill residents.

Furthermore, the shotcrete of the wall failed to block the water from penetrating the wall, and the groundwater pressure builds up and breaks through the wall, causing the landslip⁽³²⁾. As with other landslides, the possible reason of the Puncak Setiawangsa landslide was the design of inaccuracies in which a shotcrete wall was constructed on a metamorphic rock to keep the water from penetrating the soil, which is not appropriate due to a lack of metamorphic rock strength. This case has indicated that the causes of landslides in Malaysia have occurred in Puncak Setiawangsa due to design errors which is contributed as much 60% of the landslides shown in Table 1.

Furthermore, the shotcrete of the wall failed to block the water from penetrating the wall, and the groundwater pressure builds up and breaks through the wall, causing the landslip⁽³³⁾. Kuala Lumpur Territory suffers from frequent landslides, throughout the sequence of the affected elements at threat, a significant majority of the affected elements are linked to residential infrastructure and business buildings.

The frequency of landslide cases is shown in Figure 4 and follows no specific trend but happened almost every year. The most number of landslides occurred in 2006 (4 landslides) and 2008 (6 landslides). These tend to be mostly failures triggered by localized rainfall. Associated inherent weaknesses of the rock or soil combined with human activity such as extensive condominium construction and poor drainage management contributed to the disaster. Most landslides happened in Ulu Klang nearby residential areas and very often crashing condominiums were blamed for both losses of life and economy⁽⁹⁾. In addition, hilly land areas in these locations are extremely fragile and prone to human alterations (water stream diversions, cut off vegetative cover) for development to take place.

Slope failure is complicated to be accurately predicted, and usually slope failure risk is made for planning. Table 3 shows the recorded landslide risk area in Selangor and Kuala Lumpur between 2008 and 2018. Based on Table 3, there is a 44 risk landslide area that is recorded in Selangor, Kuala Lumpur and Pahang from 2008 to 2018. Even though this landslide risk remains increasing, Selangor has not received any funds from the government for slope repair works, however, since 2012 Selangor has received fund about RM 3 billion from the federal government to repair their roads every year, including to carry out slope repair works⁽³⁰⁾.

The general geology of Kuala Lumpur and its surrounding areas in Selangor are well known. The bedrock of the Kenny Hill formation (sedimentary rock) dominates the centre of the region. On the Kenny Hill formation, it is noted that rough topography, extreme nomadic rainfall and deep tropical weather have led to the collapse of the many slopes⁽³¹⁾. Based on Table 3, the number of risk area in Kuala Lumpur is quite worrying. This is because the neighbouring regions of Kuala Lumpur have a significantly crucial role in the economic and social growth of the region. Some incidents are shown in Figure 5, which happened in Kuala Lumpur Territory. Unfortunately, these areas are also plagued by massive flooding and storms that threaten hilly slopes

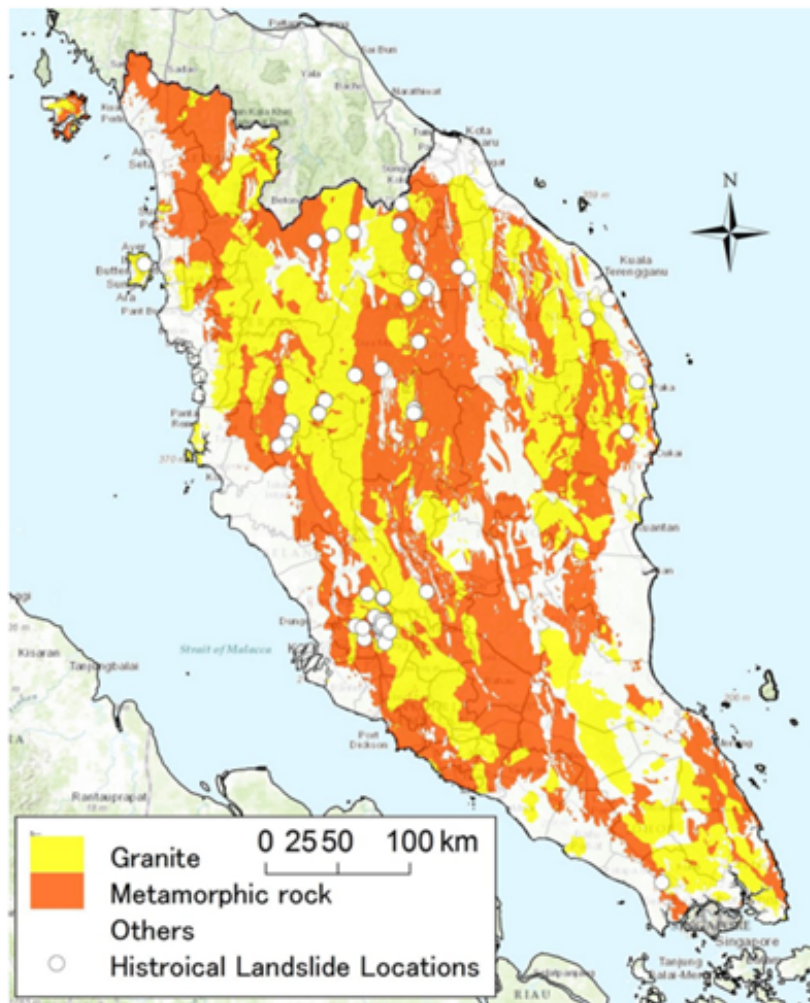


Fig 2. History of a landslide event in Peninsular Malaysia.
Sources: National Slope Master Plan 2009-2023 (2009)

and present a high danger to residents. These elements can trigger the probability of the landslide to happen especially during the rainfall

Table 3. Recorded landslide risk area focused in Selangor and Kuala Lumpur Territory between 2008 and 2018^(29,32,33)

No.	Year	Location
1	2008	Pangsapuri Sri Wira, Ampang
2	2008	Taman Keramat
3	2008	Taman Cheras Utama
4	2008	Kampung Cheras Baru
5	2008	Taman Bukit Permai
6	2008	Taman Bukit Segar
7	2008	Ukay Perdana, Ampang
8	2008	Ukay Heights, Ampang
9	2008	Sering Ukay, Ampang
10	2008	Dataran Ukay, Ampang
11	2008	Jalan Memanda, Ampang Jaya
12	2008	Kampung Pasir, Kuala Lumpur

Continued on next page

Table 3 continued

13	2008	Bukit Sungai Seputih, Kuala Lumpur
14	2011	Taman Keramat Permai
15	2011	Taman Muda
16	2011	Jalan Saga 21, Taman Bukit Teratai, Ampang
17	2011	Jalan Teratai 2/7b, Taman Bukit Teratai, Ampang
18	2011	Taman Mega Jaya
19	2011	Cemerlang Heights
20	2011	Jalan Wangsa 5, Wangsa Heights
21	2011	Beverly Heights, Ampang
22	2011	Taman Sri Ukay, Ampang
23	2011	MRR2 – Villa Sri Ukay
24	2011	Bukit Utama, Petaling Jaya
25	2011	Taman Sri Watan, Ampang
26	2011	Taman Bukit Ampang, Ampang Jaya
27	2011	Taman Mulia Jaya, Ampang
28	2011	Taman Permai Jaya, Ampang
29	2011	Kampung Lembah Jaya Selatan, Ampang
30	2011	Taman Bukit Indah, Ampang Jaya
31	2011	Kampung Warisan, Ampang Jaya
32	2011	Taman Koperasi Uda, Hulu Langat
33	2011	Taman Melati, Kuala Lumpur
34	2011	Desa Melawati, Kuala Lumpur
35	2011	Wangsa Maju, Kuala Lumpur
36	2011	Setapak, Kuala Lumpur
37	2011	Setiawangsa, Kuala Lumpur
38	2011	Kolej Tengku Abdul Rahman, Kuala Lumpur
39	2011	Gombak Setia, Kuala Lumpur
40	2011	Kampung Setia Jaya, Kuala Lumpur
41	2011	Taman Melur, Ampang
42	2017	Tanjung Bungah, Georgetown, Penang Island
43	2018	Ukay Perdana, Ampang
44	2019	Genting Highlands, Pahang

Along with the details, the recent report by ExpatGo⁽³⁴⁾ confirms that a total of 1,740 slopes in Kuala Lumpur are vulnerable to landslides. Among the 1,740 hill slopes, at least 620 were classified as very high risk while the rest were high risk. Besides that, the Segambut parliamentary constituency recorded the highest number of hill slopes at 713, of which 219 are very high-risk areas and 494 high risks, followed by Lembah Pantai with 315 hill slopes, Bandar Tun Razak (183), Seputeh (132), Setiawangsa (125), Bukit Bintang (90), Kepong (70), Wangsa Maju (56), Cheras (45) and Batu (11)⁽³⁵⁾.



a



b



c



d

Fig 3. (a) Slope failures in Kuala Lumpur – Karak Highway landslide in 1995, (b) Taman Hillview in 2002, (c) Taman Zooview in 2006 and (d) Orphanage House in Pekan Batu 14, Hulu Langat in 2011

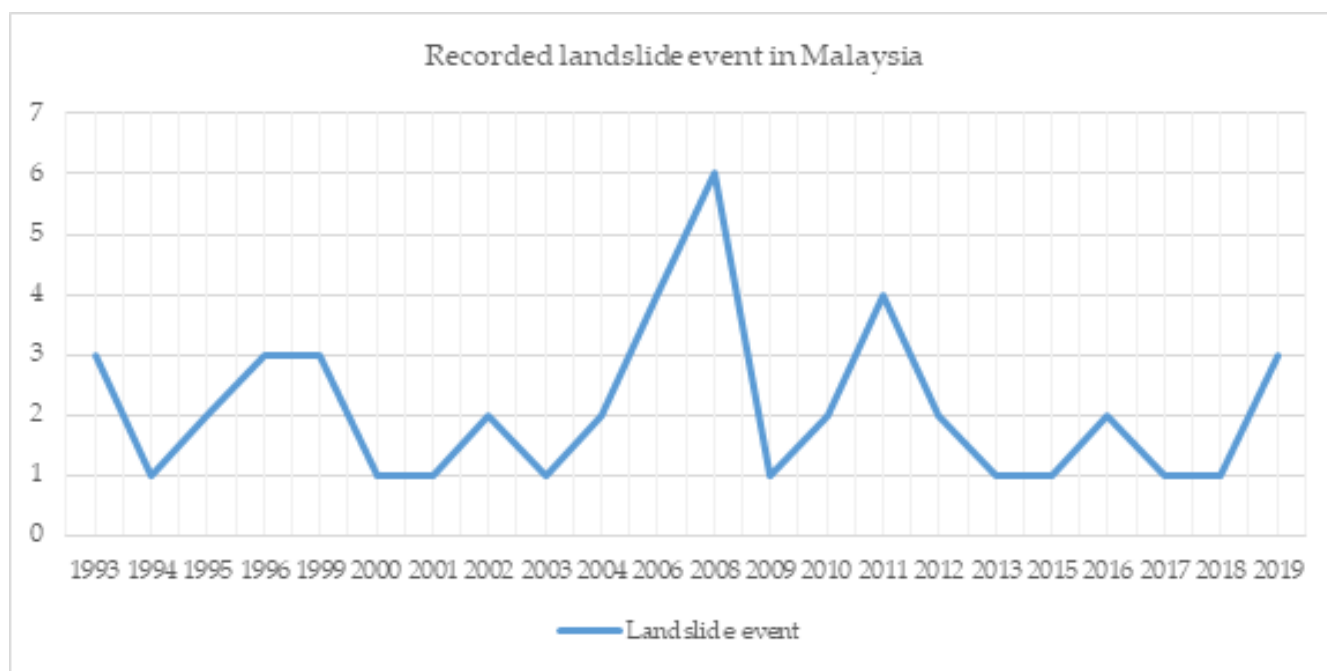


Fig 4. The landslide record in Malaysia between years 1993 to2019 (28-30)



Fig 5. (a) Slope failures in Jalan Seri Penchala 1 in 2004, (b) Puncak Setiawangsa in 2011, (c) Taman Esplanad in 2006 and (d) Jalan Semantan in 2011

4 Conclusion

In Malaysia, the causes of landslides are generally related to slope instability caused by development activities. The recorded landslides and casualties between 1993 and 2019 indicated an increase in the number of fatalities with an increase in the number of landslides. Based on the research available, it shows that development in hilly area was the main cause of landslide occurrences in Selangor and Kuala Lumpur. Most of the major landslide occurred in hilly areas, caused by the development of highway or housing area. As housing development and human activities keep growing, failures from landslides as well as other effects of soil failures increase significantly. As a result of drastic developments since the 1980s, strategic and appropriate low-lying area development have become very scarce and thus became serious challenge to meet development demands in urban Malaysia. As a consequence, the development of high land or hilly terrain has significantly increased, especially in the vicinity of densely populated areas, thus exposing communities to an increased likelihood of landslides.

The finding from the landslide historical data shows that climate was recognized as a factor landslide occurrence in Malaysia. Landslides tragedy occurred in Malaysia from June to October due to heavy rainfall during the monsoon seasons. Some suggestions to deal with and reduce landslide events in Malaysia include:

1. Integrated landslide risk, preparedness policy and framework for any development activities particularly for development involving high terrain
2. Susceptibility studies should be performed to reduce the tragedy of landslide and these findings useful for planning and decision making
3. Any development project should be appropriately designed with proper planning, construction, and maintenance to prevent landslide tragedy.
4. Conduct awareness program among agencies to highlight the risk of landslides tragedy. Awareness and knowledge about the danger of landslides should be implemented during the planning and management processes.

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