LULC versus Slope Failure: An Analysis of GIS Approach

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Abstract

Highlands are important and taken seriously considered in development planning to avoid slope failure happened. Thus, GIS technique has ability to identify sensitive slopes using specific analyzes such as the analysis of space duplicity and slope analysis. This research study conducted to determined possible land used land cover in according to slope failure by using GIS approach. GIS techniques required several data for analysis, namely elevation data and contour maps, land used map data, original map data, and vegetation map data; which can be received from government department or agencies, height and topographic data maps, data from internet sources, and data from documentation includes publications. The selected area for this research study is Selangor State, which highlighted rapid development of land used for human activities. Accordingly, the first step will be entering all data into database, which involve with the physical and environment components; while the second step will be identification and preparation based on the data layers that required in the research study; and the third step are storing data into database for designed. The storage is referring to non-spatial data elements and geographical data. Results indicate the steepness parameter in determining the slope failure are 0 % to 15 % is no risk area, 15 % to 25 % are less risk area, 25 % to 40 % are moderate risk area, and more that 40 % are high risk area. GIS technique expressed three areas to have significantly high percentage to cause slope failure, namely Ulu Selangor, Gombak and Hulu Langat. As conclusion, the government and private sector should take note for not continues to suggest any development within the area for the sake of people quality life and properties.

Keyword: highlands, GIS, slope failure, steepness parameter

Introduction

Analysis hilly terrain or highlands is one of the most important and should be seriously considered in development planning to avoid slope failure happened. Usually, the developers explore the slopes of the hill as the site development primarily as a resort and residential sites. Highland area is an area that is particularly suitable as a site for housing or resort because of its advantages in terms of the landscape surrounding, which are able to attracted many residents and tourists especially from the high incomes. Hence, this may led to many investors and developers to build construction or building on high ground to gain high profits, but fail to concerned the security level.

In ensuring the slopes with potential slope failure, it is unpredictable and absolutely undetermined. Furthermore, the developer usually runs development projects in the

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slope area without doing a detailed review of the development site. Therefore the application of geographic information system should be implemented for each planning area development projects, especially in hill slope area. Therefore, the security level of development is more secure. The parties involved in development projects that without knowing the factors of causes slope failure occurred on the slopes of the hill, is a serious problem faced by third-party developers. This is because without understanding and knowing the factors and processes involved in the slopes of the hill on the slope failure, then this becomes a serious problem to the parties responsible for the project development. For example, the recruitment process of early preventive measures either during construction or after construction is completed. Typically, the problem of landslides is caused by third-party developers to carry out development on hilly terrain, which could happen due to without knowing the factors of the natural environment and processes in the slope. In additional, the developer is less emphasis on early prevention measures and the level of safety in construction sites also could cause slope failure to occur.

Hill slope failure, especially landslides will have adverse effects. For example, loss of life, destruction of homes and destruction of property becomes a major problem to the parties involved and the physical destruction of the landscape. This problem become a key issue when landslides involving humans. For example, the incident occurred in December 2008, a landslide in Selangor State which the case involving 93 victims of a landslide and buried 14 bungalows in Taman Bukit Mewah and Taman Bukit Utama in Bukit International. The landslide was reported to have claimed four lives and loss of property worth millions of ringgit,

and the people who live around Mount International of 3000 to 5000 people were ordered to evacuate immediately [1]. Therefore, this issue should be solved through analysis of the geographical information system to identify sensitive slopes using specific analyzes such as the analysis of space duplicity and slope analysis. Therefore, this research study conducted to determined possible land used land cover in according to slope failure by using GIS approach.

Methodology

GIS technique become essentially effective in determinant slope failure, which compulsory needed several data for analysis purposes like elevation data and contour maps, land used map data, original map data, and vegetation map data. These data can be received from government department or agencies, height and topographic data maps, data from internet sources, and data from documentation includes publications [2-4]. The selected area for this research study is Selangor State, which highlighted rapid development of land used for human activities. Accordingly, the first step will be entering all data into database, which involve with the physical and environment components; while the second step will be identification and preparation based on the data layers that required in the research study; and the third step are storing data into database for designed. The storage is referring to non-spatial data elements and geographical data.

Results and Discussions

According to the Figure 1 indicate the land used land cover with slope sensitivity in Selangor State. Based on the GIS technique

indicate that build up area can be categorized as industrial, institutional and facilities, residential, business and services, and open space and recreational. The steepness parameter determined 0 % to 15 % is no risk area for slope failure, while 15 % to 25 % are less risk area for slope failure, 25 % to 40 % are moderate risk area for slope failure, and more that 40 % are high risk area for slope failure. Generally, the potential for slope failure risk areas are Ulu Selangor, Gombak and Ulu Langat because the area is located at high ground area. Meanwhile, the area with potential less occurrence of slope failure is Sepang Districts, Klang, Petaling, Kuala Selangor and Sabak Bernam. Continuously, majority residential area is located at Gombak and Hulu Langat with slope sensitivity is between 25 % to 40 % degree of steepness. Thus, residential area are at high risk of slope failure.

According to the steepness parameter shows the three areas have steep slopes ranging from 25% to 40% degree of steepness. Similarly, the parameters on the basis of the development of these three areas is included in the risk area of dense development in the area there, especially on the slopes of the hill slope at 15% to 25% and some development lies in the degree of 25% to 40% degree of steepness. While the parameters by cover plants also showed Ulu Selangor, Gombak and Hulu Langat is an area that suffered the loss of plant cover, especially on slopes in degrees of 15% to 25% and a fraction of 25% to 40% and above. Therefore, the analysis found that three of these areas is the most significant area or areas which are strongly affected by the three parameters compared with the other regions that have not yet solid construction area is located in the slope. Similarly, the area of plant cover it lacks in other areas, however, does not lie in the slope. Therefore, it indicates the steepness parameter is the parameter that most affects the slope failure, in addition to development parameters and vegetation cover at the same time also as a measure of the slope failure.

Figure 1: Land use land cover versus slope sensitivity in Selangor State.
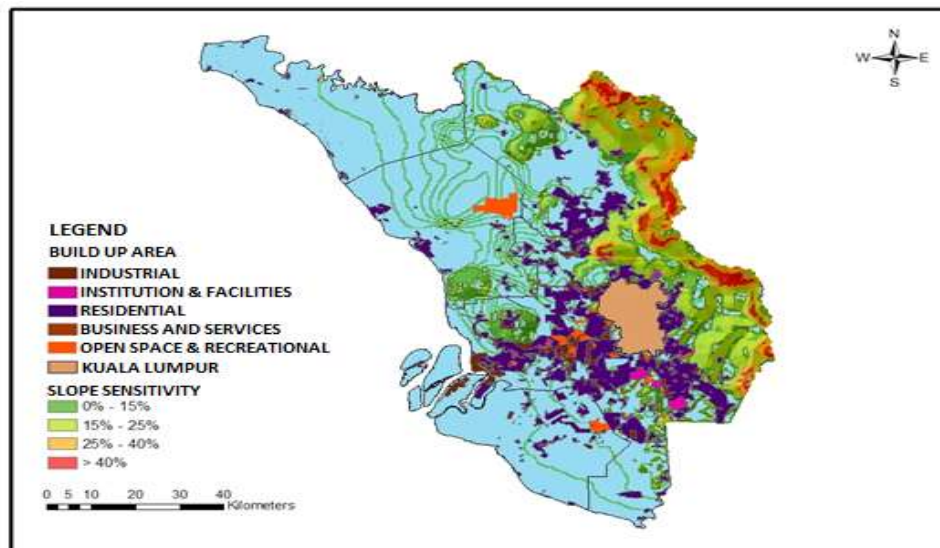
Conclusion

The steepness parameter determined 0 % to 15 % is no risk area for slope failure, while 15 % to 25 % are less risk area for slope failure, 25 % to 40 % are moderate risk area for slope failure, and more that 40 % are high risk area for slope failure. GIS technique expressed three areas to have significantly high percentage to cause slope failure, namely Ulu Selangor, Gombak and Hulu Langat. Therefore, the government and private sector should take note for not continues to suggest any development within the area for the sake of people quality life and properties.

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