

Studies on socio-economic condition of the people living in landslide prone area of Chittagong city, Bangladesh

Md. Tanjil Mia*, Nahid Sultana and Alak Paul

Department of Geography and Environmental Studies, University of Chittagong, Chittagong-4331, Bangladesh

*Corresponding email: tanjil2009.bd@gmail.com

Abstract: *The hilly area of Chittagong city is becoming vulnerable to landslide that causes casualties every year during monsoon. Applying questionnaire survey with 120 respondents, and secondary information, the study was carried out in two landslide prone sites located in Batali hill and Motijhrna area of Chittagong city to understand about general features of the hilly areas, and the socio-economic condition of the people living in those areas. Landslide is becoming awful day by day due to unplanned establishment of settlement, hill cutting, and devegetation and deforestation. The major causes of hill cutting were house contraction (93%) and road construction (63%). People living the landslide prone area tended to be poor who are characterized by vulnerable young (30%) and old age (18%) population, illiteracy (49%), day laborer based occupation (27%), low income (57%), earthen housing infrastructure (41%) and migratory (93%) in nature. These sorts of socio-economic characteristics made the people vulnerable to landslide in the hilly area of Chittagong. Responding to this condition, government and non-government organizations should take proper initiative to protect the hilly area, and to resettle the people in the safe zone creating their livelihood opportunities.*

Keywords: *Hill cutting, socio-economic condition, landslide, vulnerability, Chittagong, Bangladesh.*

I. Introduction

Landslide is a common phenomenon in Bangladesh. Every year many people are died due to landslide in the hilly region especially in Chittagong. The term 'landslide' includes all varieties of mass movements of hill slopes and can be defined as the downward and outward movement of slope forming materials composed of rocks, soils, artificial fills or combination of all these materials along surfaces of separation by falling, sliding and flowing, either slowly or quickly from one place to another. Landslide can be initiated by storms, earthquakes, fires, erosion, volcanic eruptions and by human modification of the land. However, rapid urbanization and human development activities such as, building and road construction through deforestation and excavation of hill slopes have increased landslide in densely populated cities located in mountainous areas (Galli and Guzzetti, 2007; Schuster and Highland, 2007). In fact, low-income people in the cities of poor countries often occupy government or privately owned lands both legally and illegally and informal settlements along unstable hill slopes without following any existing building codes, standards or regulations (Boulle et al., 1997; Payne 2001; Nathan, 2005).

Physiographically, a considerable proportion (18%) of small Bangladesh is hilly and tract area although majority is floodplain (Islam and Uddin, 2001). According to geological time scale, hilly area of Bangladesh developed in tertiary age. The bedrock and soil structure of these hills are not stable, for this reason these areas are highly prone to landslide. Chittagong city has already been recognized as one of the most vulnerable city to landslide. The city dwellers of Chittagong experienced a terrible landslide. Different studies shows that more than 500,000 impoverished people are living in informal settlements on the risky foothills of Chittagong city (Islam, 2008; Khan, 2008). Since 1997, landslide caused the death of nearly 235 people in various informal settlements within Chittagong city and adjacent small urban areas (Technical Report, 2008).

Chittagong hills are degrading by different anthropogenic stresses such as, hill cutting for construction, sand and clay mining, establishment of settlement in foothills, deforestation etc. In the hilly areas, people living are facing the vulnerability of landslide almost every year. Although there are some initiatives of awareness building taken however, landslide causes casualties every year during monsoon. Considering the above facts, the present study was carried out to understand about general features of the hilly areas, and the socio-economic condition of the people living in the landslide prone hilly area of Chittagong city.

II. Materials And Methods

2.1. Location of the study area

Chittagong city is situated within 22°-14' and 22°24'30'' N Latitude and between 91°46' and 91°53' E Longitude and on the right bank of the river Karnaphuli. It is considered highly vulnerable areas where there are some human lives lost every year.

2.2. Selection of the study area

Landslide is a regular geologic hazard in Bangladesh, especially in Chittagong city. Especially, some areas of the city locally called Motijharna, Baizid Bostami, Kushumbag residential area, Batali Hill and Lebubagan are vulnerable to landslide. Among these areas, Batali hill and Motijharna are most densely populated and landslide prone area. For this reason, Batali hill and Motijharna have been selected for this study (Fig. 1).

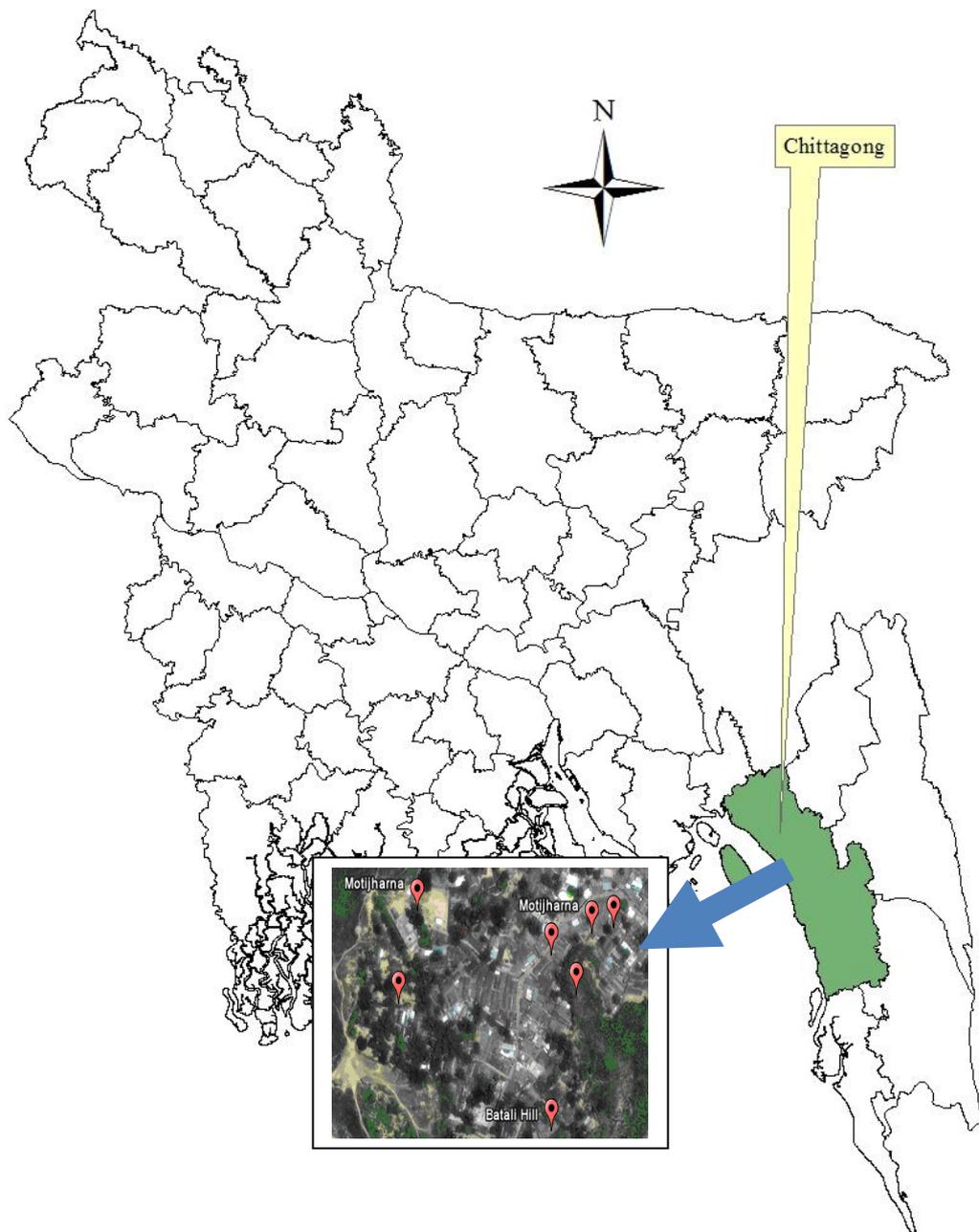


Fig. 1: Map of Bangladesh showing Chittagong district, with an embedded Google Earth image of the study area.

2.3. Data collection

This research investigation was carried based on primary and secondary data during the period from January to April, 2012. For primary data collection, a semi-structured questionnaire was designed. The questionnaire was developed on the basis of objectives to evaluate the landslide vulnerability and recommend for reducing the risk of landslide vulnerability in Chittagong city. After pilot survey, the questionnaire was then modified and rearranged according to the experience gathered. The final questionnaire was then developed in a logical sequence so that the respondents could answer chronologically. A simple random sampling method was followed to find 60 respondents from Batali hill, and 60 from Motijharna area totaling 120 respondents. Out of

total respondents (N=120) 73% were male and 27% were female. Both males and females working with various non-farm activities in the city were sampled for questionnaire survey. The respondents were interviewed in their houses, work places, shops and tea stalls. Moreover, relevant secondary information regarding landslide vulnerability in Chittagong city has been gathered from local authority particularly from the Department of Disaster Management. A number of papers, journals, books, thesis and other recent publications were also reviewed.

2.4. Data processing and analysis

The collected quantitative data were checked and then entered into the spreadsheet in MS Excel. Using statistical software SPSS (Statistical Package for Social Science, version 16.0), descriptive statistics including mean, frequency and percentage were analyzed from the collected data according to the objectives. The results are presented mostly in graphs along with tabular forms.

III. Results And Discussion

3.1 General features of landslide area

The hilly areas of Chittagong city have some common features which made the people vulnerable to landslide. The common features of landslide prone area are presented below.

Nature of hill slope

Hill slope determines the degree of landslide in some cases. In the present study, hill slope divided into three categories including low steep ($> 80^\circ$), medium steep ($80-85^\circ$) and very steep ($85-90^\circ$). Most of the respondents (47%) reported low steep slope followed by 23% medium steep slope, and 13% very steep slope. in the study area (Fig. 2). According to Mahmood and Khan (2008), hill cutting in Chittagong city is occurred with slopes of 70-80 degrees. This made the hilly dwellers highly vulnerable to the landslide.

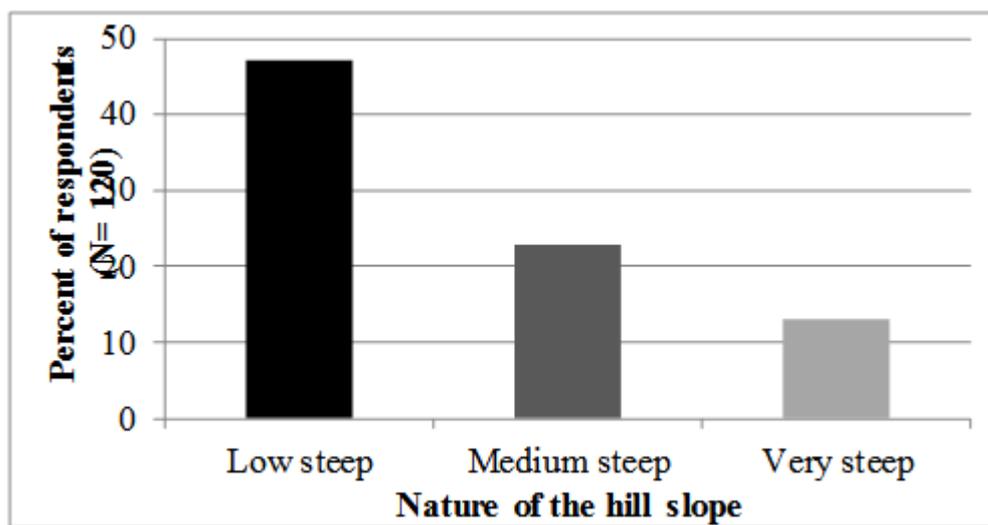


Fig. 2: Nature of hill slope in the study area as reported by the respondents (N=120).

Establishment of settlement

According to the survey, the majority (90%) of the respondents reported that some influential person (powerful people called *Matobbar* locally) who established the settlement especially built house legally and illegally in the study area (Fig. 3). The migrated people rent this house in landslide prone area due to low living cost. This further creates completion among the migratory people to be settled in the landslide prone area.

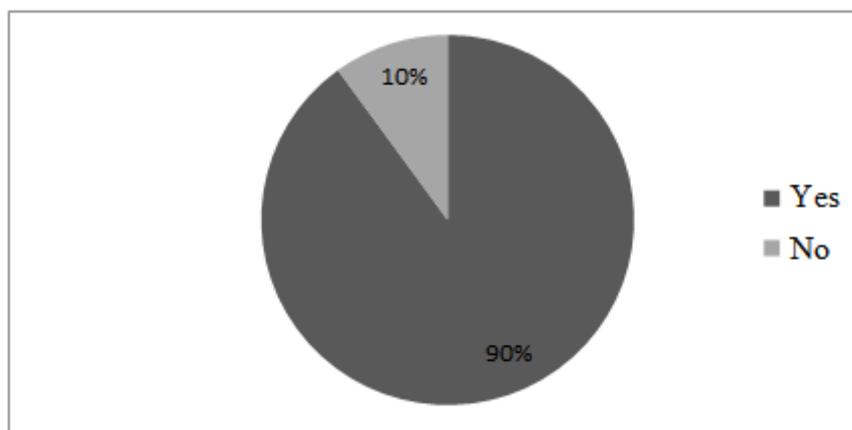


Fig. 3: Establishment of settlement as reported by the respondents (N=120).

Hill Cutting

Hill cutting is a common scenario in the hilly area of Chittagong because majority of the settlement developed through hill cutting in the landslide prone study sites. The majority (93%) of the respondents reported that hill cutting was occurred due to house construction. About 60% of the respondents reported road construction as one of the important causes of hill cutting (Table 1). Earlier study reported that the unplanned hill cutting was occurred due to road construction, sand collection and administrative infrastructure development (Sultana, 2013).

Table 1: Causes of hill cutting in the study area

Characteristics	Number of respondents (N=120)	Percent of total respondents (N=120)
House construction	112	93
Road construction	72	60
Sand collection	16	13

Devegetation and deforestation

In the hilly area devegetation and deforestation means cutting small plants and forest wood trees, respectively. In the study area, devegetation and deforestation was reported by 75% and 63% of the respondents, respectively (Table 2). Vegetation coverage is a prominent feature for hilly areas and the coverage was enriched before few decades ago in the study area. Vegetation protects the soil and makes slope stable which reduce the risk of landslide. Large trees provided strong structures in the earth that anchor the soil and protect it from any erosion (Sultana, 2013). The devegetation and deforestation is increasing day to day due to various human interventions. A number of hills were found with no vegetation coverage in the study area.

Table 2: The features of devegetation and deforestation in the study area

Characteristics	Number of respondents (N=120)	Percent of total respondents (N=120)
Devegetation	90	75
Deforestation	75	63

3.2 Socio-economic condition

Age group

Age is an important factor of the respondents which helps to understand the research purpose to a greater extent. According to survey, the major proportion (52%) of the respondents was under middle age group (31-45 years). A considerable proportion of the respondents (30%) was under young age (15-30) and the remaining was under old age (18%) group (Fig. 4). According to HDRC (2009), about 33% of the household heads belonged to the age group of 45-59 years in the hilly region of Chittagong. This indicates that collectively a large proportion of the young and old age population living in the hilly area are much vulnerable to any natural disaster like landslide due to their physical weakness compared to young age population.

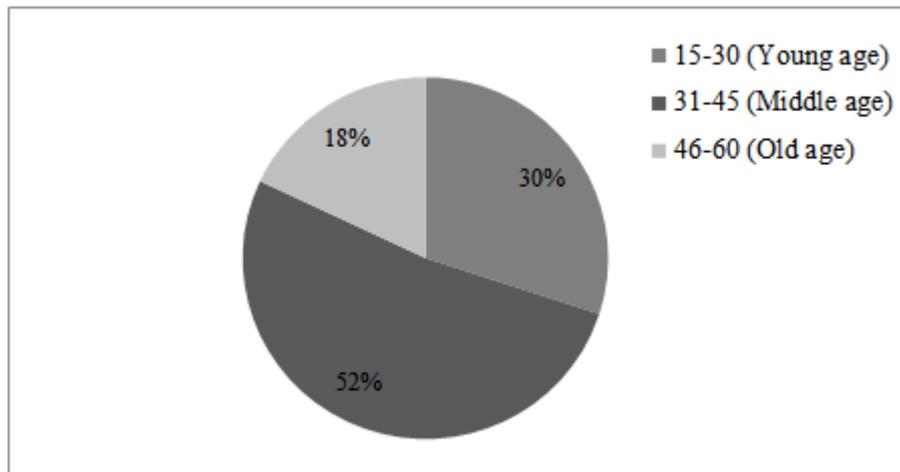


Fig. 4: Age group distribution of respondents in the study area (N=120).

Educational qualification of the respondents

The majority of the respondents were illiterate in the landslide prone study area (49%). About 27% of the respondents had primary level of education, 20% secondary level, 4% higher secondary level (Fig. 5). The schools and other facilities are not good at all in Motijharna and Batali hill areas (Ahmed et al., 2014). As a result, most of the people were illiterate and very low academic qualification. This indicates that the people living in the hilly area had very poor capacity to learn about the causes and consequences of natural disaster due to their illiteracy.

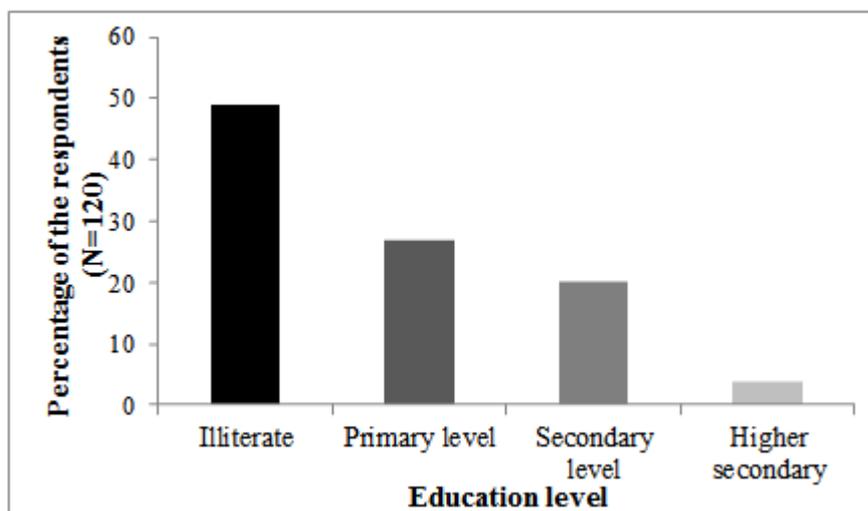


Fig. 5: Education status of the respondents in the landslide prone study area (N=120).

Occupation of the respondents

The income level of respondents of the study was not sufficient for better survival. According to the present study, the majority (27%) of the respondents engaged in day laborer activity in and around the city. About 22% of the respondents engaged in petty job (e.g. garments worker, security guard, peon, etc.), 21% small business, 17% housewife, and 13% CNG driver (Table 3). According to Ahmed et al., (2014), males mainly performed grocery shops, tailoring shops, tea stalls, and saloons by the side of main road and female mostly worked in the garments and houses of higher income people in the Motijharna and Batali hill areas in Chittagong city. Poor people living with their petty non-farm livelihoods activities made them firmly settled in the vulnerable hilly area.

Table 3: Occupation of the respondents in the landslide prone study area (N=120)

Occupation	Number of respondents (N=120)	Percent of total respondents (N=120)
Day laborer	32	27
Petty job (e.g. garments worker, security guard, peon, etc.)	27	22
Business	25	21
Housewife	20	17
Driver	16	13

Monthly income of the respondents

Monthly income of the people is one of the important reasons for living in the city area. The majority (57%) of the respondents living in landslide prone area had monthly income of BDT. 3,000-6,000. The remaining 19% had BDT. 6,000-9000, 13% had > BDT 9,000, 11% had <BDT.3000 (Fig. 6). This suggests that the population clustered in the hilly area is of poor income section of the urban community. Earlier study shows that the hilly areas in Chittagong are mainly the residence of the lower income people, and most of them are migrated from different regions of Bangladesh (Ahmed et al., 2014).

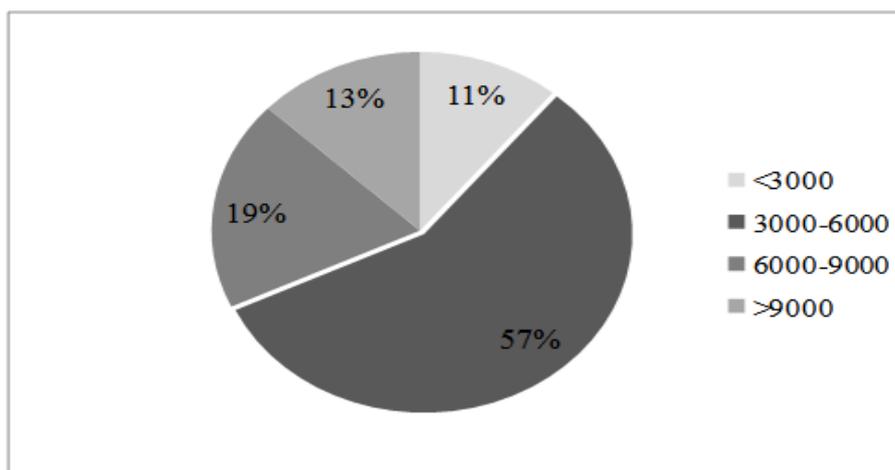


Fig. 6: Income level of the respondents in the study area (N=120).

Housing pattern of the respondents

Houses of the community were of four main types: a) earthen, b) tin-shed, c) half-building, and d) building. Through the survey, it was found that maximum (41%) houses were earthen. About 10% was building, 29% half-building and 20% tin-shed (Fig. 7). According to Ahmed et al. (2014) most of the houses are of semi built type. Houses are of small sized, single or multiple storied. Corrugated tin is used as roofing material. Some houses are made of tin, local material like bamboo and brick. These types of poor housing structures further aggravate the vulnerability of landslide to the poor people in the hilly area Chittagong city.

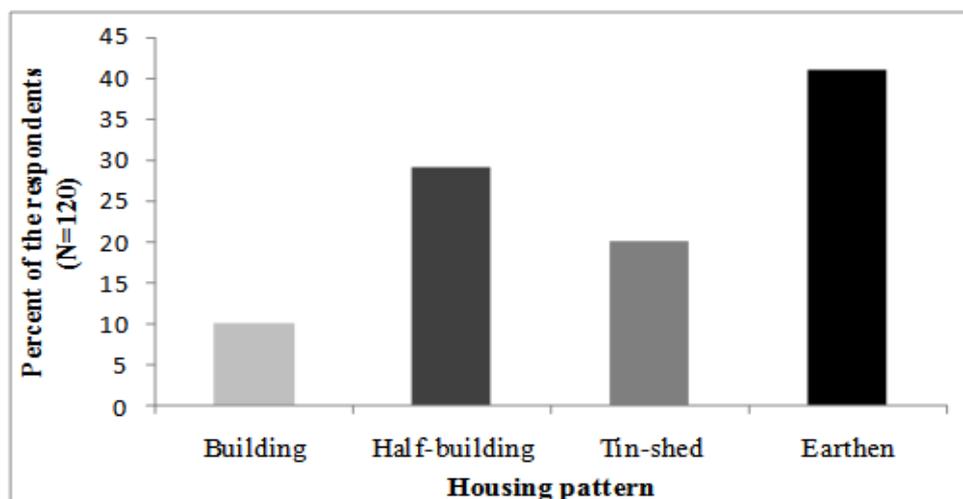


Fig. 7: Housing pattern of the respondents in the landslide prone study area (N=120).

Locale

In the landslide prone area the majority (93%) of the respondents was migratory who came from different Upazilas or districts of Chittagong division (Table 4). The remaining proportion (7%) was found local. According to Ahmed et al. (2014), people from the surrounding regions migrated into the city areas for better income opportunities as well as attractive urban facilities because of Chittagong is the port city and the commercial capital. As a result, unplanned and haphazard urban growth of slum areas is taking place at different locations of the city which is making the city dweller vulnerable.

Table 4: Locale of the respondents in the study area (N=12)

Characteristics	Number of respondents (N=120)	Percent of total respondents (N=120)
Locally origin	8	7
Migrated from outside	112	93

IV. Conclusion

Landslide is one of the most notable natural damaging disasters in hilly environments especially in Chittagong region of Bangladesh. It is becoming awful day by day due to unplanned establishment of settlement, hill cutting and devegetation deforestation. People living the landslide prone area are characterized by vulnerable young and old age population, illiteracy, day laborer based occupation, low income, weak housing infrastructure and migratory in nature. These sorts of socio-economic characteristics made the people vulnerable to landslide in the hilly area of Chittagong. Government and non-government organizations should take proper initiative to conserve the hilly area, and to resettle the people in the safe zone creating their livelihood opportunities.

Reference

- [1] Ahmed, B., Rahman, M.S., Rahman, S., Huq, F.F. and Ara, S. 2014. Landslide Inventory Report of Chittagong Metropolitan Area, Bangladesh. BUET-Japan Institute of Disaster Prevention and Urban Safety (BUET-JIDPUS); Bangladesh University of Engineering and Technology (BUET), Dhaka-1000, Bangladesh. pp. 125.
- [2] Boulle, P.L., Vrolijk and Palm, E. 1997. Vulnerability reduction for sustainable urban development. *Journal of Contingencies and Crisis Management*, 5(3): 179-188.
- [3] Galli, M. and Guzzetti, F. 2007. Landslide vulnerability criteria: A case study from Umbria, central Italy. *Environmental management*, 40: 649-664.
- [4] HDRC (Human Development Research Centre), 2009. Socio-economic baseline survey of Chittagong hill tracts. Chittagong Hill Tracts Development Facility, Funded by European Union. pp. 307.
- [5] Isalm, M.S. 2008. Causes of landslides and mitigation, paper presented at the daily star Roundtable on Challenges of development: Hill cutting and landslide in Chittagong Bangladesh on 30 August 2008.
- [6] Islam, M.N. and Uddin, M.N. 2002. Country Paper on Hydrogeology Section in International Workshop on Arsenic Issue in Bangladesh, 14-16 January, 2002.
- [7] Khan, I.S. 2008. Hill cutting in Chittagong city corporation area. Its causes and the consequences. PhD dissertation Khulna University, Khulna Bangladesh.
- [8] Mahmood, A.B. and Khan, M.H. 2008. Landslide vulnerability of Bangladesh Hills and sustainable Management options: A case study of 2007 Landslide in Chittagong City. *Proceedings: International Seminar on Management and Mitigation of Water induced Disasters*. 21-22 April 2008, Kathmandu. pp. 112-123.
- [9] Nathan, F. 2005. Vulnerabilities to natural hazards: case study on landslide risks in La Paz. Paper presented at the World International Studies Conference (WISC) at Bilgi University, Istanbul, Turkey on 24-27 August 2005.
- [10] Payne, G. 2001. Urban land tenure policy options: Titles or rights? *Habitat International*, 25(3): 415-429.
- [11] Schuster, L.R. and Highland, L.M. 2007. Urban landslides: socioeconomic impacts and overview of mitigative strategies. *Bulletin of Engineering Geology and the Environment*, 66: 1-27.
- [12] Sultana, T. 2013. Landslide disaster in Bangladesh: A case study of Chittagong university campus. *International Journal of Research in Applied*, 1(6): 35-42.
- [13] Technical Report, 2008. Identification of landslide causes and recommendation for risk reduction. Chittagong Divisional Office. Chittagong, Bangladesh.