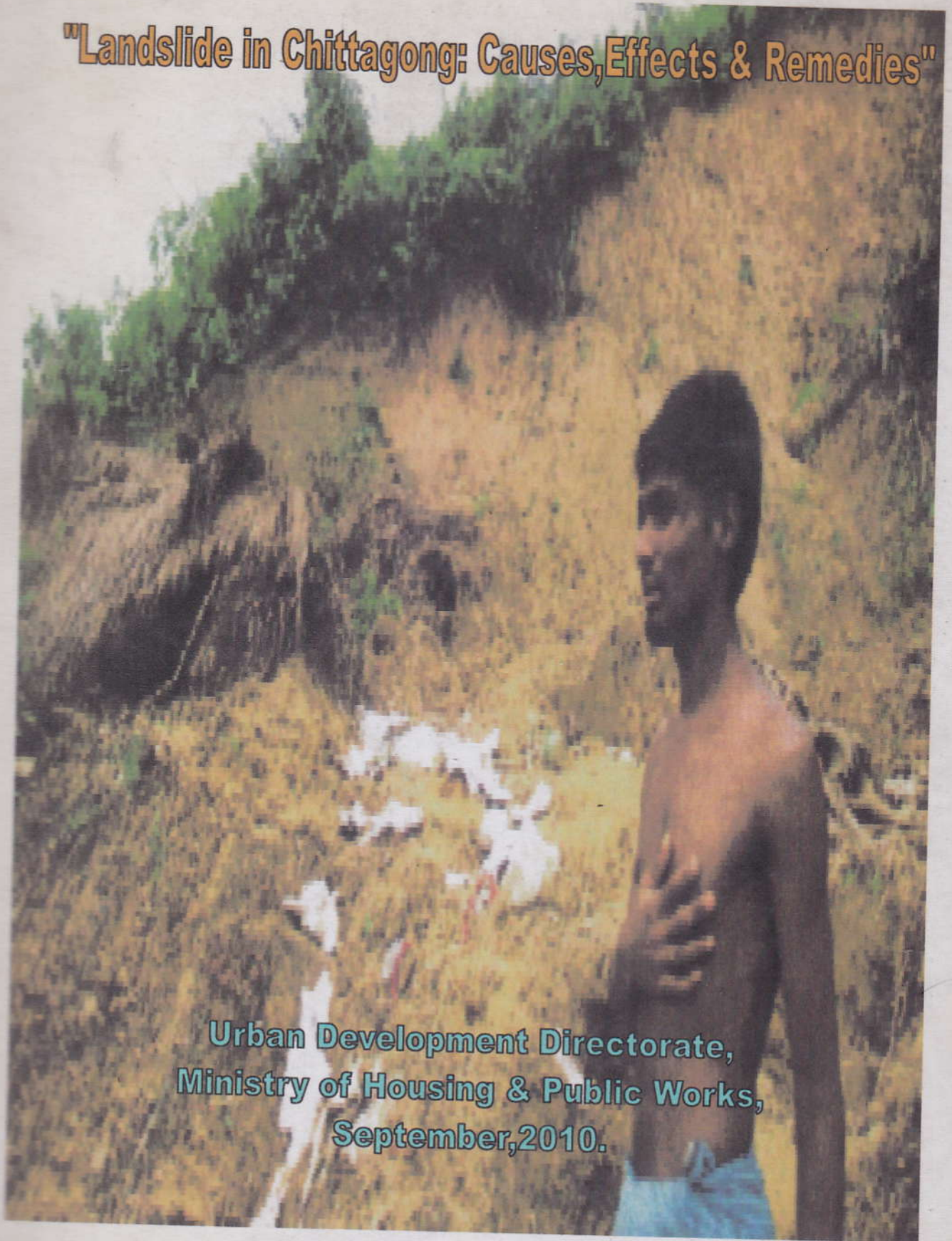


"Landslide in Chittagong: Causes, Effects & Remedies"



Urban Development Directorate,
Ministry of Housing & Public Works,
September, 2010.



Foreword

Landslide incidents affected not only in Bangladesh but also all over the world. Recently landslide incidents increase at an alarming rate in the South-Eastern region of Bangladesh, especially in Chittagong. Now, it is a national concern of the Government. In such a time, the research work entitled “Landslide in Chittagong: Causes, Effects and Counteractions” done by Md. Jahangir Ali, Senior Geographer of Urban Development Directorate (UDD) is very praiseworthy.

This treatise stimulates thinking and has come at an appropriate time. I am sure, this treatise besides influencing policy planning, will also be found highly useful and instructive by national and local Government administrators, planners, teachers, students, and researchers in the relevant Department/Organization and those who generally interested in the problems of landslide in Chittagong. I also believe that the suggestions prescribed in this treatise would be very helpful to decrease landslide incidents in Bangladesh.

I hope, UDD will continue research activities on much- required national issues in future.

20.06.2011

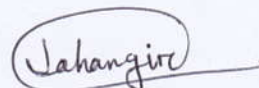
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Acknowledgement

A well being job needs co-operation of others. It is also fact for this present research work. This is because, I had to take help and co-operation from personnel and institutions/departments. First of all, I wish to give thanks to all my unit members, who have helped me cordially and sincerely in every step of this work, like tabulation of survey data, collection of various data from different departments/institutions, composing and checking. Secondly, I want to give thanks to Mr. Tarik Mainul Islam Superintending Engineer and Mr. Om Prokash Nandi Executive Engineer of National Housing Authority (NHA) Chittagong for their cordial co-operation and giving necessary information during my field visit in Chittagong. In the same line, I would like to offer thanks to Mr. Monowar Islam, the Director General (DG) of Department of Environment (DOE), Mr. Ahmed Mainuddin, Executive Engineer, Mohammad Zahir Ahemed, Town planner, Mr. Shahinul Haq Khan, Architect of Chittagong Development Authority (CDA) and Mr. Rezaul Karim, Chief Architect and Planner of Chittagong City Corporation (CCC) for their valuable opinion. I remember with great respect to Professor D. Md. Shahidul Islam, Associate Professor D. Maksudur Rahman, Dept. of Geography and Environment, University of Dhaka and Mrs. Taz Sultana Lecturer, Dept. of Geography and Environmental Studies (Chittagong University) for their valuable advice and guideline. Finally, I would like to give thanks to Mr. A.Z.M. Tajul Islam, Director of Urban Development Directorate (UDD) and to D. K.Z. Hossain Taufique, Deputy Director (Research & Coordination) of Urban Development Directorate (UDD) for their proper guideline and instruction.



09. 01. 2011

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1. Introduction:

Landslide is one kind of geological phenomenon. There are mainly two greater districts (Chittagong & Chittagong Hill Tracts) in Bangladesh, which are almost covered by hills. Landslides are occurring frequently in these regions in recent years. As a result, a great loss of lives and properties are being happened with this incident. Hundreds of hills exist here. So, the landforms of Chittagong differ from rest of the Country. Due to special topography of Chittagong, the density of population, type of settlement, economic activities and other development activities it is quite different from other parts of the country. In course of time, everything is changing in Chittagong. Due to change in natural features, some dangerous incidents like landslide is occurring every year, which is increasing at an alarming rate in recent years. In 2007, in such a landslide, about 128 people died, which is a great concern to the whole nation. There is a great impact on man, environment and on the socio-economic conditions of the people living at the concern area. This is why, a research work is needed to find out the causes of landslide, its impact on man and environment and to make some proposals to the concerning authority, so that, any kind of loss could be kept at a minimum level in future years.

2. Literature Review:

Mrs. Taz Sultana, Lecturer of Geography and Environmental Studies of Chittagong University referred in her Research work entitled "Landslide at Chittagong University Campus (2009)" about the causes of landslides are (i) Hill cutting (ii) Deforestation (iii) Slope instability and (iv) sediment flow.

Golam Mahbub Sarwar, executive Director of Committed to Earth Care (CEC) Bangladesh in his "Landslide Tragedy of Bangladesh" referred both natural and human beings are responsible for landslides in Chittagong. He added that human being use hills in improper ways and disturb slope instability. As a result, when monsoon faces torrential rain without rest for several days it causes landslides.

B. Doza in his, "Chittagong tragedy, landslide & protection of Environment" landslide tragedy occurred in Chittagong due to unlawfully flattening of the hills by the people who cares little for the law, people and environment.

The information Bulletin of Bangladesh Red Cross and Red Crescent Societies (Bulletin no.01/2007), published in 14 June 2007, referred that heavy rainfall resulted in a landslide in Chittagong district in Bangladesh on Monday, 11 June 2007, Killing 124 people so far and destroying houses, roads and embankments, as well as disrupting electricity, gas lines and communication facilities.

According to the Bangladesh weather Office, rainfall measured on 11 June (until 9 pm) was 408 mm, the heaviest rain in 25 years. A number of areas were underwater, as a result of incessant rainfall over the four days prior to the date of reporting. On 11 June it was reported that 41 words (Consisting of 1.5 million people) were waterlogged.

Dr. Md. Shahidul Islam, Professor of Geography and Environment Department (Dhaka University) explained. "The only reason for Monday's mud slides in the Cantonment area is cutting hills in discriminately. We were warning about this risk for decades, and this event has proved our fears." (Source : The Daily Star : 13 June, 2007).

The South Asia Disaster Report 2007 published as entitled “ Chittagong landslide, Bangladesh, 11 June 2007” referred the causes of landslides in Chittagong area summarizing through a scientific study as follows:

- (1) Indiscriminate hill cutting is one of the major causes of landslide in Chittagong city. The Chittagong city is densely populated for accommodation people build houses on the top of the hills or on the foothills without following the existing rules and regulations. The hills were cut with steep slopes of 70-80 degrees, which fail during heavy rains due to loss of strength.
- (2) Deforestation in the hilly area further loosens the soil on the slopes.
- (3) The high rainfall is one of the major triggering factors. The average yearly rainfall of Chittagong is approximately 3000 mm. The highest rainfall occurs in the month of June and is responsible for highest number of landslides in the same month. The present landslide occurred during this type of intense rainfall in Chittagong city.

Chittagong district Commissioner Mukhlesur Rahman blamed hill cutting for disaster (Reports ABC news: 12 June 2007).

Architect Jerina Hossain said, “Cutting hills made the soil slippery and loose. As a result, it came down with the rain.” (Source : The Daily Star : 15 June, 2007).

Chowdhury, Iqbal Hossain (13 June 2007), Blamed in the same line for Chittagong disaster.- “পাহাড়ে বিতীর্ণিকা” (in Bengali); (Chutir Dine, Prothom Alo 403: 4-6)

3. Methodology:

The study was conducted through comprehensive structured interview by means of well-reformed questionnaire. The data was collected from both primary and secondary sources to strengthen the rationality of the study and for better and comprehensive analysis. The study was conducted at Kaibalyadham, Khulshi, Motijharna of Bangladesh Railway Colony, Shahid Minar area of Chittagong University, Lehubagan and Kachchaghona of Chittagong Cantonment area of Chittagong City in Bangladesh during 27 to 29 April, 2009. In this research 49 respondents were selected by random sampling procedure. Proportional percentages were calculated in terms of specific category were followed to give the research a proper logical quantitative ground.

4. Objectives of the Study:

Urban Development Directorate (UDD) has a research wing. On the other hand, landslide is one of the most concerning issues now a days in our Country. So, UDD had a great interest to carry on a research work in this Connection and

(1) Try to find out the causes of landslide.

(2) Formulate some policies so that landslides could be kept at a minimum level in future days.

5. Significance of the Study:

After massive landslides in 11 June 2007 in Chittagong, it seems that a geographical research should be done to find out the causes behind landslide incidents. This approach mostly emphasized on 'Geo-social' characters of disasters regarding weather, climate change/global warming, ecology, social change, urbanization and settlement pattern.

After every landslide incident some common talks are to be heard. Some people say that it is "Hill cutting" the only reason behind the landslide incidents. Some adds **Heavy Rainfall** and **Flash flood** of its supplementary causes.

On the other hand, there is a great impact on landslides in socio-economic aspects. Affected people have to suffer a long. In most of these cases affected people have to suffer till the end of life. The society does a very little for them. Government has to pay a lot and has a great concern about this incident, because Government cannot avoid the responsibility.

In present years, landslide incidents are being happened frequently. Heavy loss of life and wealth are being occurred. It has a great socio-economic importance. At the same time, hilly eco- system is breaking down and environmental degradation is continuing.

Now, it is a national concern to the Government and to the researchers. This is why, it can be said that the selected research work has a great social and national importance. Moreover, in this research paper some recommendations have been made as remedies/mitigating measures for future work formulation of the Government.

6. Limitations of the Study:

Dawn appears after long awaiting of the dark. The study area (Chittagong city) was far away from the work place (Dhaka). Where the topography is different and was a new experience for me. I think it is the first ever done research work in the history of Urban Development Directorate (UDD). I had to go through non co-operation situation. Although there is a rich Organogram set up for my unit (Senior Geographer), I am not provided the full-fledged unit yet. Most of the time I had to go without proper manpower. Lack of logistic support is a common phenomenon for my unit. Still I have no Printer and no Internet connection with my computer.

Not only these, I was not allowed anybody with me during my field visit in the study area (Chittagong) for collection of Socio-economic data. It is fact that, though Urban Development Directorate (UDD) has a research wing, still there is no budgetary allocation for research purpose. I had to perform my research work tackling all these obstacles.

7. Rationality of this Study:

Urban Development Directorate (UDD) preserves the right to carry on research related to urbanization and settlement. The landslide incidents, which occurred in Chittagong city and its surroundings in 2007 & 2008, are directly related to Urbanization and Urban settlement. So, it can be said that to select the present research work entitled “Landslide in **Chittagong**: Causes, Effects and Remedies” is very logical and well timed.

8. Historical Background of the Study Area:

The early history of Chittagong is not very clear. The Arabs knew the Chittagong port in the 9th century AD. A Buddhist king Gopichandra had his capital at Chittagong in tenth century. Chittagong's history becomes clear with the advent of the Muslims to the region. In 1338 Fakruddin Mubarak Shah occupied Chittagong. During the period from 1538 to 1666 the Portuguese ruled Chittagong. The Mughals conquered Chittagong in 1866. Chittagong once again came into province after the partition of Bengal, 1905. The Khilafat and non Co-Operation movements were strongly supported by the people of Chittagong. During the Second World War, the British used Chittagong as an important military base. The city played a significant role in the WAR OF LIBERATION of Bangladesh in 1971. Within a couple of years after Liberation, Chittagong became generally operational both as a city and as a port.

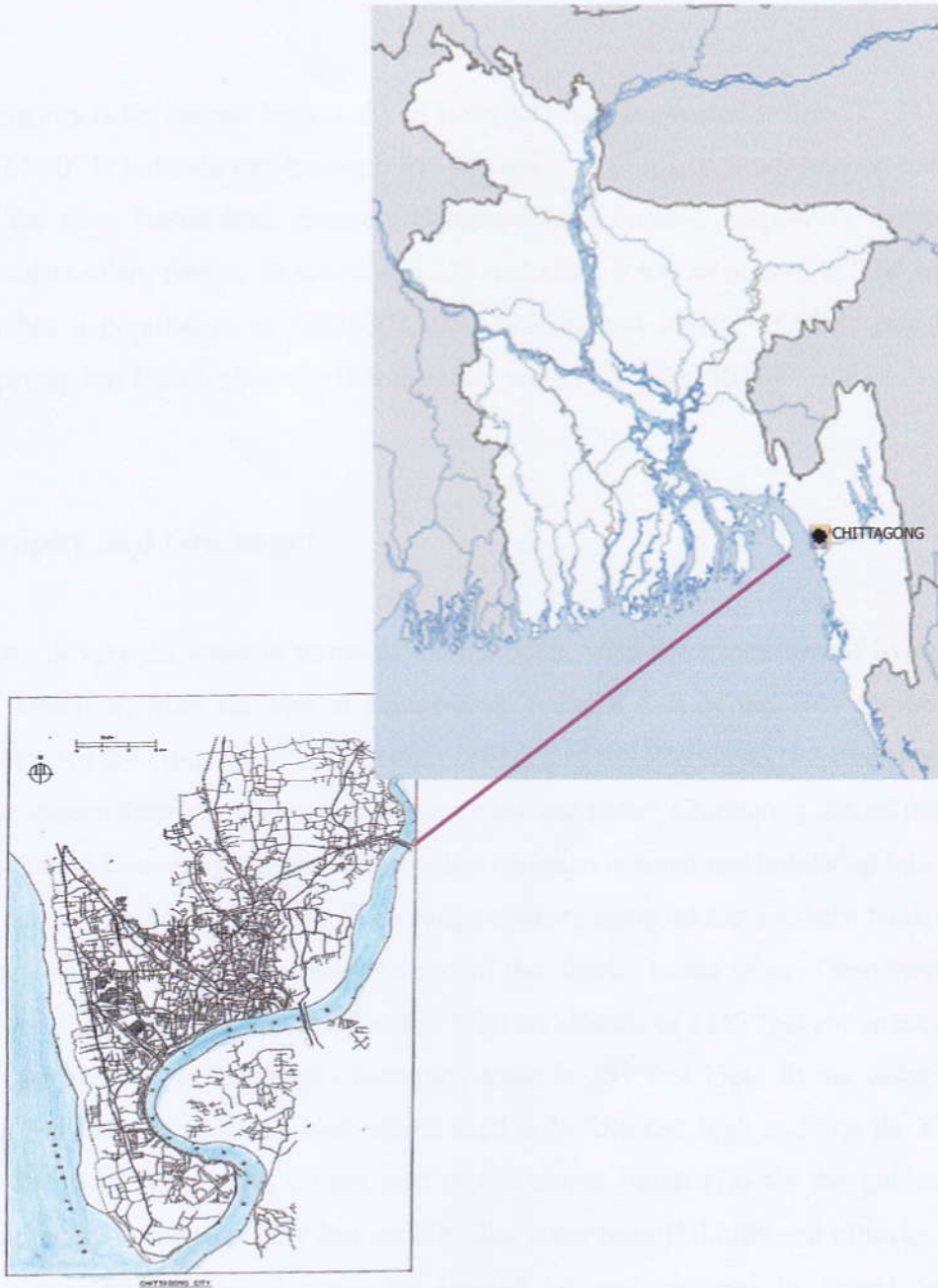
The Government of Pakistan under ordinance 51 established the Chittagong Development Authority (CDA) in 1959 as an autonomous body to cope with the expansion of the city and to help it to develop in a planned way. By 1961, the CDA drew up a "Regional plan" covering an area of 212 sq. miles and a "Master plan" covering an area of 100 sq. miles.

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MAP: LOCATION OF CHITTAGONG CITY IN RESPECT OF BANGLADESH



Source: Geography Map Series, Dhaka.

9. Geographical Description of the Study Area:

Chittagong city is the second largest city of Bangladesh. It is situated within $22^{\circ}-14'$ and $22^{\circ}-24'-30''$ *N* Latitude and between $91^{\circ}-46'$ and $91^{\circ}-53'E$ Longitude and on the right bank of the river Karnaphuli. (Source: Banglapedia, volume-2, page-491) Chittagong Town consists of six thanas, 68 wards and 236 mahallas. It has an area of 209.66 sq. km. The city has a population of 3202000; male 54.37% and female 45.63%; population density per sq. km 15272. (Source: Banglapedia, volume-2, page-502)

Topography and Drainage:

Chittagong is very different in terms of topography, with the expansion of Sylhet and northern Dinajpur, from the rest of Bangladesh, being a part of the hilly regions that branch off from the Himalayas. This eastern offshoot of the Himalayas, turning south and southeast, passes through Assam and Tripura state and enters Chittagong across the river Feni. The range loses height as it approaches Chittagong town and breaks up into small hillocks scattered all over the town. This range appears again on the southern bank of the Karnaphuli River and extends from one end of the district to the other. Chandranath or Sitakunda is the highest peak in the district. With an altitude of 1152 feet above mean sea level Nagarkhana to the north of Chittagong town is 289 feet high. In the town itself, there is a peak known as Batali Hill, which used to be 280 feet high and was the highest point in the town. There was a light post at the top of Batali Hill for the guidance of vessels far away in the sea. This famous hill, like other beautiful hills and hillocks in the city of Chittagong, is being gradually leveled up and reduced in height for the construction of houses.



Source: Urban Development Directorate (UDD), Dhaka.

Chittagong district possesses no natural lakes. As a result, several artificial lakes and ponds or dighis, as they are popularly known, are found all over the district. A large number of dighis, big and small, were dug during the Muslim period. The most popular reason given for the presence of such a large number of ponds is that during the Muslim period it was felt necessary to provide ponds for the use of the womenfolk of the town. Therefore, almost every well-to-do house had a pond or a dighi. Among the big ponds in Chittagong city mention may be made of Laldighi, Kamal Daha's dighi, Ashar Khan's dighi and Belowa dighi. Many of these dighis have been filled up. Laldighi is still an important place. A boundary wall has protected the entire dighi. Most of the large public meetings in Chittagong are held in the field next to Laldighi. This field is known as the Laldighi Maidan. The Assam Bengal Railway dug two artificial lakes (in 1920 and 1924) near the Pahartali Railway station. These lakes served as reservoirs to supply water to the Railway. Foy's lake was dug in 1924 and was named after the Railway engineer Foy. Both the lakes are places of attraction because of their beautiful location.

Nature has favored Chittagong City, like the entire district with many natural springs. The sources of most of these springs are to be found in the hill ranges. The water from these springs is used for irrigation purposes as well as to supply drinking water. In the city there are a number of springs, which are bounded by concrete walls by the Municipal authorities and supply drinking water.

Soil & Soil condition:

The soil in this area has classified into seven categories according to the 1964-66 Forestal Survey. The most important ones are clay loam, sandy loam and silty clays. The most extensive is silty clay loam, which covers 67 percent of the total area. Almost all the soils have low fertility. All the non-alluvial soils and some of the alluvial soils show coarse textured surface material and the water holding capacity of most of the extensive soils is very low. Grass and Scrub occupying this hilly land.

Source: (Chowdhury, Quamrul Islam, "Chittagong Hill Tracts-State of Environment")

Fauna:

The fauna mainly includes monkey, fox, jungle, cat, fishing cat, wild boar, land turtle, king cobra, reticulated python, rat snake and other non-poisonous snakes together with large number of species of lizards and amphibians like frog and toad and tree frogs. The bird life of the Chittagong Hill Tracts is wonderfully rich. More than 60 families of birds are found.

Economic Activities:

Main occupations-Agriculture 18.71% fishing 1.16% agricultural laborer 12.3%, wage laborer 3.54%, industry 1.72%, commerce 16.58% transport 4.52%, construction 1.43%, service 24.09% and others 16.12%.

Source: Banglapedia, volume-2, page-501.

Urbanization in Chittagong:

In 1947 the area of the town of Chittagong was only four and half square miles and was centered around the low and small hillocks which were found scattered all over the city. Dampara, Nasirabad, Katalganj, Kapashgola and Solok bahar bound the town on the north, the Karnaphuli on the south, Chaktai null as on the east and Madarbari. Pathantuli and Dewanhat on the west. Originally, the town was confined within this limit. With rapid industrialization and development the town soon grew into a city outstripping the old Municipality area. The city extended southwest up to patenga where the Chittagong international airport is now located. Its expansion to the west incorporated the villages of Halishahar, Askarabad and Agrabad. The government acquired the land at these villages to construct up to Faujdarhat and the Chittagong cantonment area and in the northeast up to Kalurghat.

Total urban area of Chittagong zila has expanded from 1120.33sq.km. in 1991 to 1254.89 sq.km. in 2001. The Statistical Metropolitan Area increased from 964.66 sq.km. in 1991 to 1034.95 sq. km. in 2001. In 1991 there was only Paurashava in Chittagong Zila against six Paurashavas in 2001.

Chittagong City Corporation is constituted with 11 thanas of the zila namely Bakalia, Bayjid Bostami, Chandgaon, and Chittagong port, Double Mooring, Halishohar, Khulshi, Kotwali, Pahartali, Panchlaish and Patenga. In addition to City Corporation Statistical Metropolitan Area includes the entire areas of Hathazari Upazila, Sitakunda Upazila and Karnafuli Thana. Other Urban Area means the urban area adjoining to City Corporation and Paurashavas.

Table –A: Population Growth Rate, 1951-2001

Year	Growth rate (Annul percentage)
2001	2.24
1991	1.72
1981	2.45
1974	3.68
1961	1.66
1951	0.74

Source: Population Census- 2001, Zila Series, Zila: Chittagong (page 13)

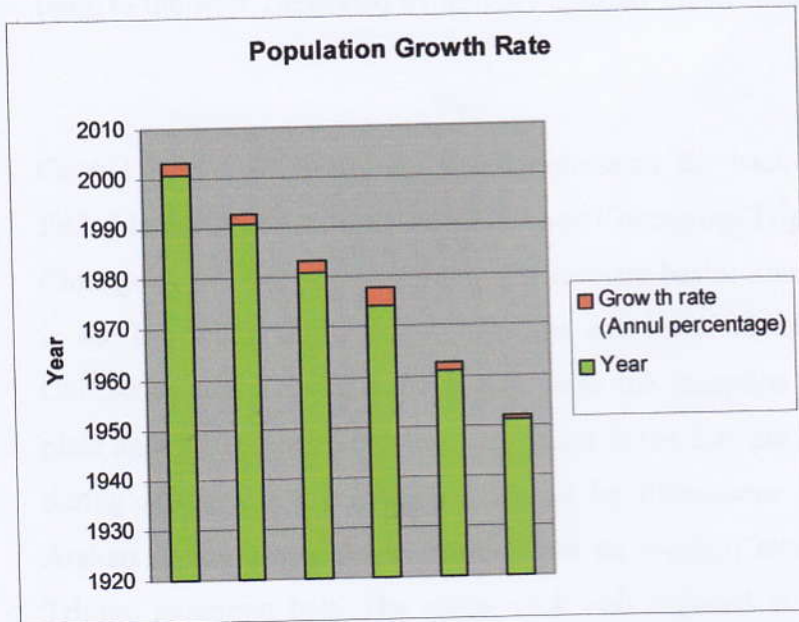


Fig-1: Population Growth Rate

10. Geological Description of the Study Area:

The geological formation of Chittagong named as Sitakunda Structure. It is one of the westernmost structures of Chittagong and Chittagong hill tracts.

The Chittagong hill tracts are originated as a result of the collision between India and Asia. After the break up of Gondwanaland, Indo-Australian plate Combined moved southeasterly of about 1750 km at a drift rate of 6 cm/yr. Later India broke a part from Australia and started to drift north northeasterly. That is the time when the history began for the Chittagong Hill Tracts. Gradually, India moved in a more northerly direction at about 2,500 km at a rate of 5 cm/year before it first collided with Eurasian plate during Eocene. Since then, Indian plate moved 1,000 km. more in a north westerly direction at a rate of 3 cm/year until the complete closure of TETHYS. Plate motion resumed or accelerated in a slightly different direction in early Oligocene time with India converging

towards Asia in a more northeasterly direction. The oceanic crust started subducting beneath the Burmese Sub-plate thus creating a back arc basin to the east and a fore-arc basin to the west, Separated by initially uplifted Yuma suture zone.

Central Burma or Irrawaddy Basin represents the back-arc basin and Arakan Yuma folded belt and its western extension up to Chittagong-Tripura hills a part of which is the Chittagong hill tracts, representing the fore-arc basin. The thick SEDIMENTS deposited in the Irrawaddy Basin during Miocene and lower Pleistocene time is exposed in the Chittagong and Tripura hills. Hence, with the inception of convergence of the Indian plate and the Tertiary Sediments deposited in the fore arc basin. The region was uplifted during Miocene Orogeny and followed by Pleistocene Orogeny to form the present Arakan Yuma Mega Anticlinorium and its western extension covering Chittagong Tripura mountain belt. The oldest rock unit exposed is the Bhuban Formation of the Surma Group of Miocene age. No exposed rock older than the Miocene Bhuban Formation is known yet.

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Geological Formation:

There are two prospective geological structures underneath Chittagong. One is the Dupi Tila Formation which consists of yellow-brown to brown, fine to medium grained pebbly and cross bedded Sandstone with subordinate Claystone and siltstone the surface of this structure consists of pebble beds coarse to fine grained sandstone and shale of grey colour. The other is the Sitakunda structure, which is the westernmost structure of Chittagong. The Sitakunda fold is an elongated, asymmetrical, box type doubly plunging anticline. The axis of the fold is running in NNW-SSE direction, parallel to the general trend of regional strike. The Sitakunda Structure contains a thick sedimentary sequence of Sandstone, Shale and Siltstone.

11. The Concept of Landslide:

A landslide or mudslide or hill slide is a geological phenomenon which includes a wide range of ground movement, such as rock falls, deep failure of slopes and shallow debris flows, which can occur in offshore, coastal and onshore environments. All though the action of gravity is the primary driving force for a landslide to occur, there are other contributing factors affecting the original slope stability, Typically, pre-conditional factors build up specific sub-surface conditions that make the area/slope prone to failure, whereas the actual Landslide often requires a trigger before being released.

12. The History of Landslide incidents in Chittagong City:

The historical background of landslide incidents in Chittagong City and its surrounding areas is very alarming. Statistics shows that in 2000, there happened two landslides in Chittagong city in two times, which killed 13 people. But there happened no landslide in 2001. From 2002 to 2004 there happened single landslide in every year and killed 3, 1 and 5 people respectively. On the contrary, in 2005, it happened four several landslides in Chittagong city which caused death of 8 people. In 2007, the most massive landslides took place at seven points in Chittagong City and killed 130 people, which is the highest in landslide incident history of Bangladesh. After this huge damage 11 people were died by landslide just next year (2008) in Chittagong City.

Table – B: Statistics of Landslide incidents in Chittagong City.

No.	Year	Frequency	Damages
1	2000	2	13
2	2002	1	3
3	2003	1	1
4	2004	1	5
5	2005	4	8
6	2007	1	130
7	2008	1	11

Source: Geological Survey of Bangladesh, 2010.

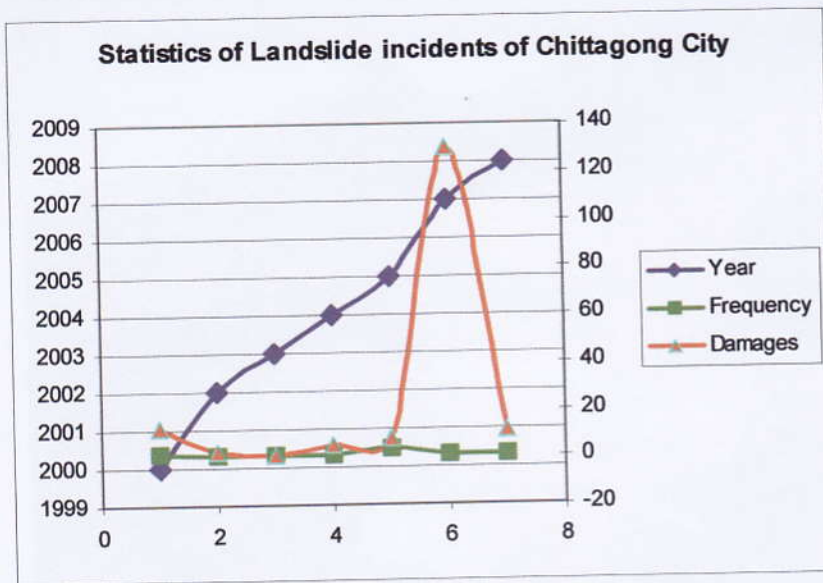


Fig-9: Statistics of Landslide incidents in Chittagong City.

13. Landslide in Chittagong (2007 & 2008):

Chittagong the Southeastern Divisional city of Bangladesh is the most vulnerable for landslide. On 11 June 2007, at the very early morning the city of Chittagong experienced a deadly landslide with massive casualties. Motijharna, Power colony, Kushumbag, Dhaper parh, Shaheed Minar area of Chittagong University, Lebubagan and Kachchaghona of Chittagong Cantonment area were badly affected by landslide. More than 130 people dead including women and children adding 213 wounded. Extremely heavy rainfall counting as long as 267 mm in 24 hours was observed on the day causing water logging within the city area, submerging ground floors of about 500 buildings of city's commercial area Agrabad landslide and Flash Flood bound to homeless a total of about 5072 families and affected another 1.5 million people in Chittagong region. Army, police, fire fighter, NGO activists and other volunteers drove rescue operation. Rescuing the affected people was under challenge because of bad weather, especially heavy rainfall and flooding with an additional of adequate rescue equipments. Rescue operation was observed very slow because of lack of technical knowledge, poor co-ordination and absence of landslide contingency plan professional rescue coordination was not in place.

Picture (A): Immediate After Landslide Incident in Chittagong on 11 June 2007



(1)



(2)



(3)

Source: International News of Bangladesh (INB), Dhaka.

Picture(B): Resque Operartin Activites on 13 June 2007 in Chittagong Landslide



(1)



(2)



(3)

After One year of this devastating event on 18 August 2008 another landslide took place at the very early in the morning killing 11 people of Chittagong city. It vanished two whole families of Hussein Colony near Motijharna area of Lalkhan Bazar. The devastating event completely bulldozed 13 cottages in a sudden moment. The night was full of torrential rain having a record of 142 mm in 24 hours of the 18th August. (according to local weather department record, Hayat, 2008). Hossain Colony was built on an abundant property of Chittagong Water Supply and Sewerage Authority (WASA). At the same time, City's Bakulia, Bahoddarhat and Chandgaon were waterlogged because of heavy rainfall.

Table-C: Monthly Rainfall in Chittagong (in Millimeter)

Month	Rainfall (mm)	
	Year	
	2007	2008
January	005	063
February	000	030
March	057	006
April	128	004
May	271	244
June	917	707
July	816	859
August	516	759
September	523	255
October	450	175
November	207	000
December	000	000
Total	3845	3092

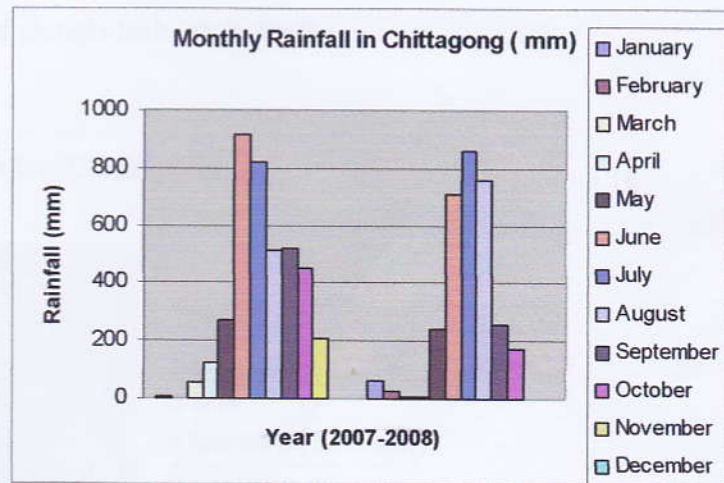


Fig-2: Monthly Rainfall in Chittagong (mm)

Source: - Statistical year book of Bangladesh, 2007-2008

Table-D: Yearly Total Rainfall in Chittagong

Year	Rainfall (in Millimeter)
2002	1789
2003	2769
2004	2819
2005	2283
2006	2443
2007	3845
2008	3092

Source: - Statistical year book of Bangladesh 2002-2008

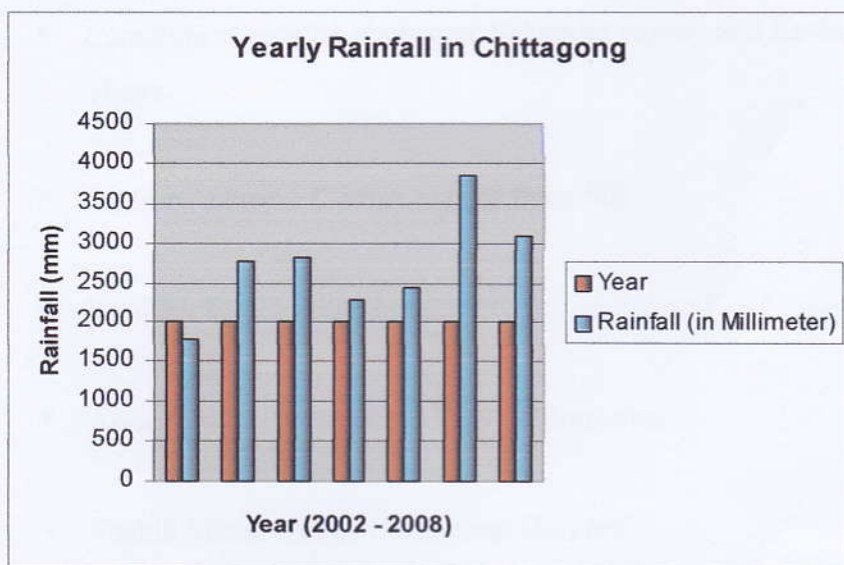


Fig-3: Yearly Rainfall in Chittagong

Landslide has its own Geological and human implications. On the other hand, due to lack of employment opportunities, housing facilities and rapid Urbanization people's vulnerability further deteriorate to a grater extent. There are some land grabbers who are always active in the hilly region. Therefore, landslide is a recurrent phenomenon in Chittagong region of now a days. Few measures such as evacuation and rehabilitation,

CHITTAGONG CITY
MAP OF THE AFFECTED AREAS

which has been taken, are not adequate and permanent solutions for reducing landslide rather in Chittagong region the problem remains as a regular phenomenon. River erosion and flood are also consequence of hilly settlement. This paper is an attempt to find out the possible causes of landslide and to formulate counteraction policies to minimize landslide events.

14. Landslide Affected Areas in Chittagong:

In June 2007, landslide happened at main 7 points surrounding Chittagong Metropolitan City. These are:

- * Cantonment area's Leubagan, Sekandor colony and Kachchaguna of Hathazatri Thana.
- * Railway's Power Colony area of Pahartali.
- * Khulshir Dhebar parh area.
- * Armed Police Battalion (APBN) Colony area.
- * Shahid Minar area of Chittagong University.
- * Motijharna area of Lalkhan Bazar.

(Source: The Daily Ittefaq, 12 June 2007.)

CHITTAGONG CITY MAP OF THE AFFECTED AREA

SEKANDAR COLONY
KACHCHA GHONA
LEBUBAGAN

APBN COLONY

KHULSHI
RAILWAY POWER COLONY
MOTIJHARNA

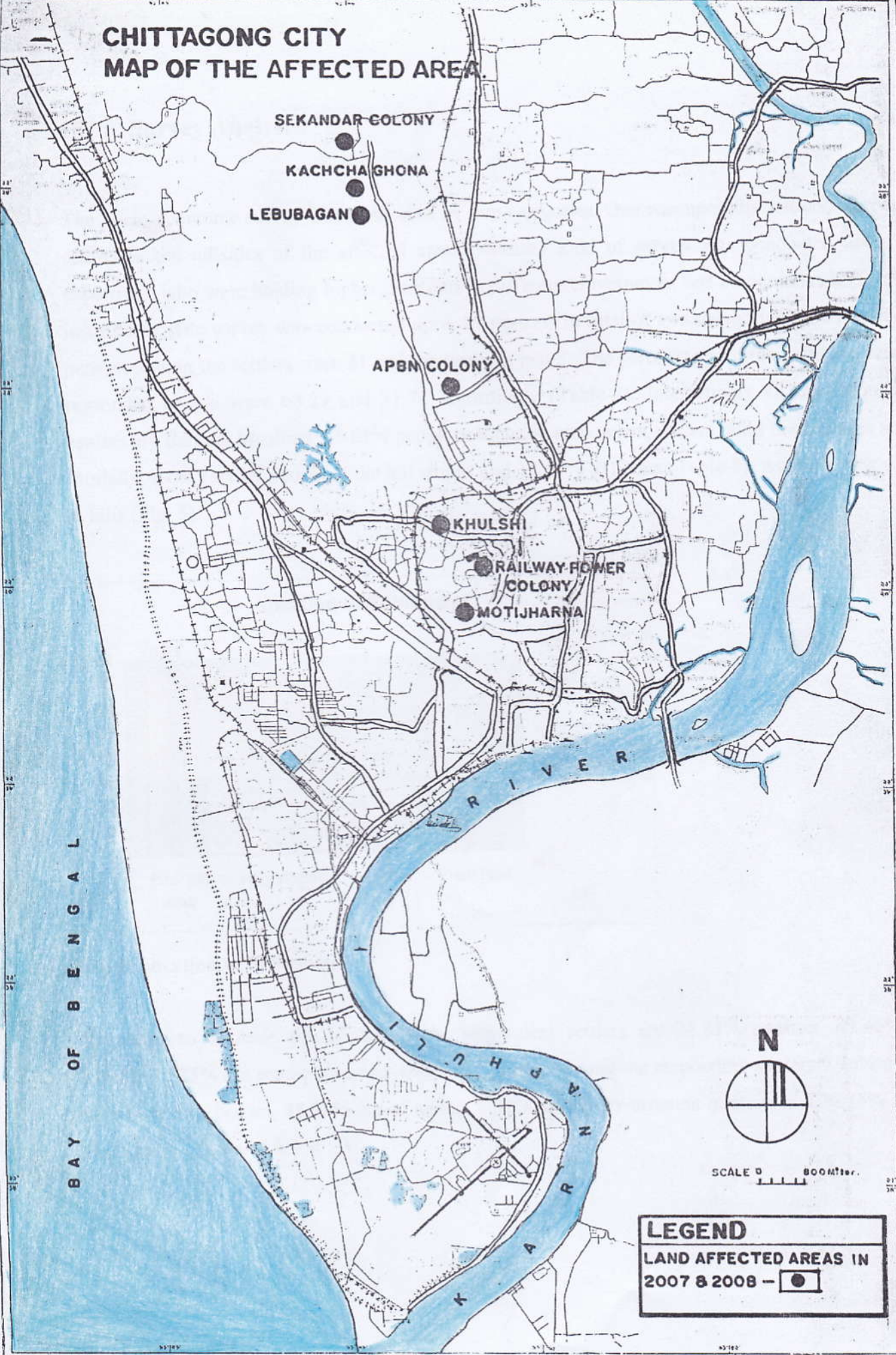
BAY OF BENGAL

KHULNA RIVER



SCALE 0 800 Meters

LEGEND
LAND AFFECTED AREAS IN
2007 & 2008 - [Symbol: a square with a solid black circle inside]



15. Survey Analysis:

The Socio-economic survey was conducted by two categories. One was upon the settlers, who were settled in the hillsides of the affected areas. Another kind of survey was conducted upon the expertise's who were holding higher positions in different Government and autonomous bodies and institutions. The survey was conducted upon 49 persons in total of two categories. The responded persons among the settlers were 41 and the rest was just 8. The percentages of the male and female responded people were 68.29 and 31.71 accordingly (Table-1). Interestingly all the respondent settlers are Bengali Muslims. 75.61% people among the respondent settlers build their houses at the foothills, 9.76% settler people at the hill slopes and 14.63% in plains (Table-8), which is very close to hills (Fig: 5).

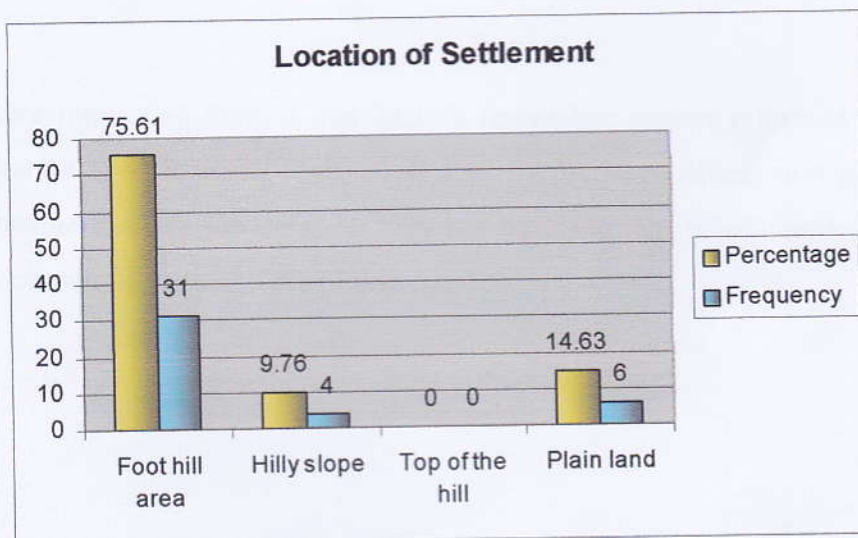


Fig-5: Location of Settlement

According to Table-9: the houses of the respondent settlers are 26.83% squatter, 41.46% are kancha, 26.83% are semi-pucca and 4.88% are pucca. Among the respondent settlers 9.76% people have their own houses, 48.78% are of rented, 7.32% are of Government quarters and 34.15% are in khash lands (Table-11& Fig: 7).

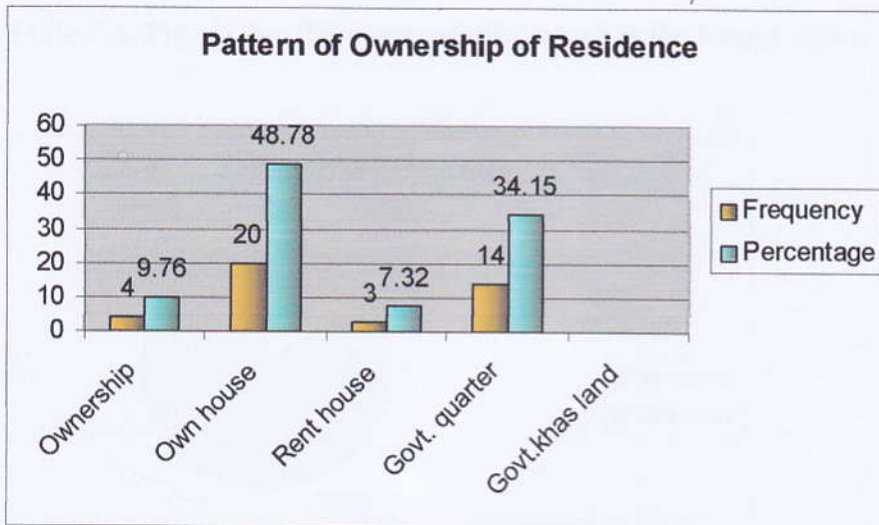


Fig-7: Pattern of Ownership of Residence

One interesting thing is that 24.39% respondent settlers informed that the proper authority doesn't permit their houses (Table-10 & Fig: 6). By occupation, among the respondent settlers 21.95% people are day laborers, 36.57% are businessmen, 9.76% settlers are service holders and other occupational are 31.72% (Table-5).

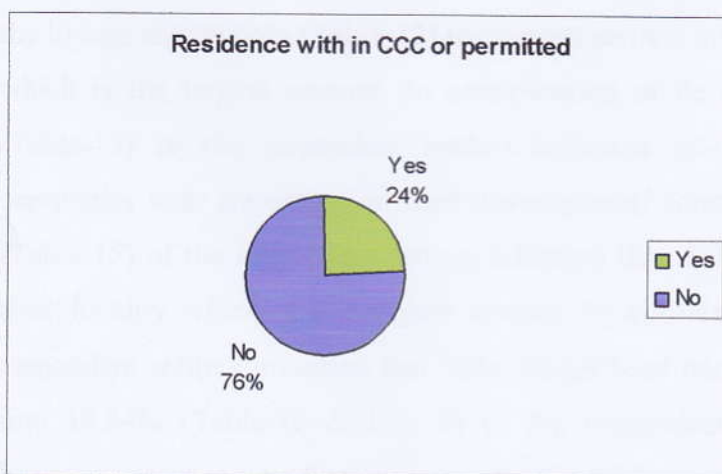


Fig-6: Residence with in CCC or Permitted

According to residential condition 23.33% settlers live there permanently and 76.67% settlers (Table-6 & Fig: 4) live there temporarily, which is the largest figure.

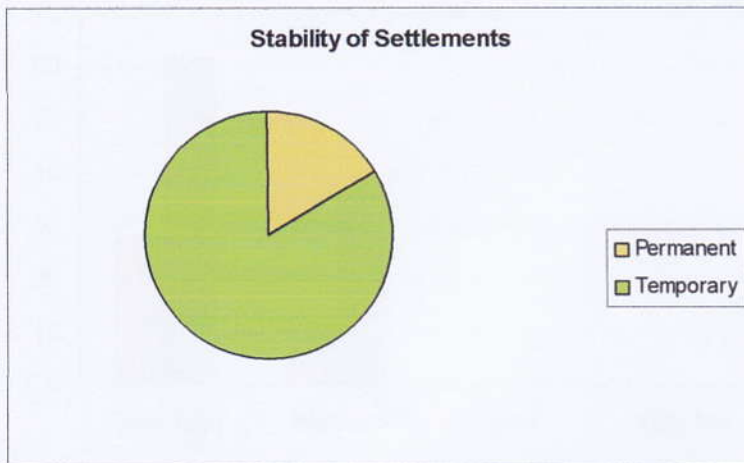


Fig-4: Stability of Settlements

According to income generating 7.32% of the respondent settlers informed that 7.32% settlers earn 3000 to 4000 Tk. per month which is the lowest, 24.39% settlers earn 4000-5000 Tk. Per month, 68.29% settlers earn more than 5000 Tk. (Table-14) per month which is the highest. In consideration of civic facility 28.71% of the respondent settlers informed that civic facility is enough, 7.75% settlers informed that it is medium, 2.88% settlers informed that it is less which is the lowest and 60.66% (Table-12) respondent settlers informed that they don't get any civic facility, which is the largest amount. In consideration of developer/construction activities only 16.66% (Table-15) of the respondent settlers informed that there are some developer/ construction companies who are caring on their development/ construction works. On the other hand 83.34% (Table-15) of the respondent settlers informed that there is no development/construction works in their locality which is the largest amount. In consideration of tidal surge/flood 61.66% of the respondent settlers informed that Tidal Surge/flood occurs too much in their locality, in the same line 38.34% (Table-16 & Fig: 8) of the respondent settlers informed that Tidal surge/flood happens/occurs at a medium amount which is the lowest.

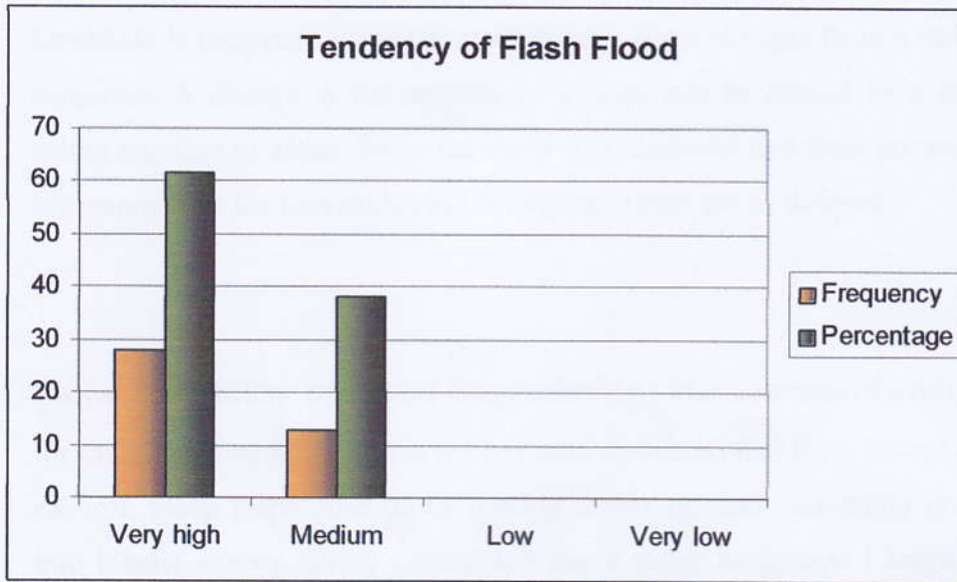


Fig-8: Tendency of flash flood/flood

In consideration of deforestation only 3.34% (Table-17) of the respondent settlers informed that there is a little sign of deforestation or tree cutting. On the other hand 96.66% (Table-17) of the respondent settlers informed that there is no activity of deforestation or tree cutting in their locality. In consideration of hill cutting only 20% of the respondent settlers informed that hills are cut sometimes somewhere. On the other hand 80% (Table-18) respondent settlers informed that hills are not cut in their locality. In searching the root cause of landslide in 2007 & 2008, 70.73% of the respondent settlers answered that it was a natural disaster due to continuous heavy rainfall with thunderstorms, which was the highest opinion. On the other hand, only 2.44% of the respondent settlers expressed that both natural cause and men's activities were responsible for the occurred landslide and 17.07% of the respondent settlers expressed that neither natural cause nor misdeed of men is responsible for land slide in 2007 & 2008 (Table-19).

Interestingly, 60% (Table-24) of the experts expressed that the landslides, which were occurred in 2007 & 2008, caused by only men's misdeed like hill cutting. On the other hand 40% of the respondent experts expressed that it was happened due to both men's misdeed and natural cause.

✓ 16. Causes of Landslide in Chittagong:

Landslide is happened when the stability of a slope changes from a stable to an unstable condition. A change in the stability of a slope can be caused by a number of factors, acting together or alone. From the study it is observed that there are some causes, which are responsible for Landslides in Chittagong. These are as follows:

Slope Instability by Land Degradation: The steepness of a hill is the main factor for the movement of materials (soil or mud or debris) that flow down towards the foot of the hill. Steep slope push down quickly debris or mud converting gravitational energy into kinetic energy. Every natural hill has a stable surface and keeps a balance of it's components. But sometimes it losses its balance by man's inhuman activities. Landslides of Chittagong in 2007 and 2008 are the two authentic examples for such misdeeds. For rapid urbanization, increasing of house rent and land value to supply soils in brick kiln industries and for the purpose of construction roads, new buildings or culverts soils are extracted haphazardly and unplanned way in Chittagong city area. A study (Quddusi, 2007) referred that more than 100 hills have been raised in last 30 years in Chittagong region. Another study (Islam, 2008) referred that hills of Chittagong region are cut slopping 70° or more angle. This inhuman and relentless activities resulted landslide in Chittagong in the previous years.

Deforestation: It is another important cause for landslides in Chittagong region. Hills are first deforested for soil extraction imposing the land surface of the hill increasing its vulnerability to erosion. This is because, soils of open hill surface absorb rainwater quickly which dissolve soils nutrient loosing its compaction. Slope instability and loose wet or muddy soil, which absorbs rainwater, cannot hold extra weight results downward soil movement as landslide.

Heavy Rainfall with Earthquake: It is keenly observed that a heavy rainfall within a shorter period of time always led to a large scale of landslide in Chittagong area. Landslides of Chittagong in 2007 and 2008 are two instances of it. Chittagong Meteorological Department declared that, before the landslide incident of 2007 in Chittagong the total rainfall recorded 267 mm in a day. Such a huge amount of rainfall in such a shorter duration of time adding earthquake triggered landslide in Chittagong hilly region. This is because hilly uncovered topsoil is compounds, dissolved and loss the strength of compaction and finally occurs landslide in unstable hills.

Rapid Urbanization, Housing problem and Unplanned Settlement:

Lack of employment opportunity in rural areas, on the other hand industrialization, business or other income generating opportunities in urban areas people emigrate Chittagong city from nearby districts. Sometimes river eroded or cyclone or flood affected people gathers in city to survive a little. These poor and pro-poor people live in cheaper rented houses built in close foot hills or sometimes live at hill slopes. Most of these houses are built cutting hills in unplanned ways. The people who live in such places, most of the time are targeted of landslide.

Global Warming: It is another important factor of landslide. Bangladesh has experienced effects of global warming from various aspects in recent years. Due to global warming weather factors behaving irregularities. It has been seen that, it does not rain in time. Most of the year, either rainy season comes late or sometimes comes sooner after a long dry and hot weather. Due to hot weather in day time and low temperature at night topsoil's of hills weathered (specially in deforested hills where hills are composed of clay and sand) become loose and loses it's soil compaction strength, When torrential rains last two or three days or more adding a little earth quake it occurs landslides with heavy loss of life and wealth which is a very Common picture in Chittagong and it's surrounding hilly areas of now a days.

Jhum Cultivation: It is one of the causes of landslide. Hilly people practice Jhum cultivation after deforesting and trenching soil as traditional to these areas. Thus, topsoils become loose, absorb rainwater and triggers landslide.

Increase of Population: Now a days, the flow of population has increased at an alarming rate in hilly areas for different socio-economic causes. These floating people misuse of hilly lands in different ways and increase the frequency of such disasters.

Presence of Greedy and Influential people: There are some greedy and influential people who are always active in hill cutting activities managing different authorities which finally led to landslide.

17. **Effects of Landslide:**

Effects of landslide are horrible. This is because, it happens within a few seconds. It does not give any scope of escaping from the affected area. It rushes tons of mud or soil or stone within a few seconds without alarming anybody. It always brings sorrows and sufferings from family to state level. Some of these are:

- (1) Continuous and rampant landslides cause loss of lives and properties. Most of the time it devastates the whole family with all properties or sometimes it makes at a loss of a single survivor of a family.
- (2) Sometimes it poses serious threat to other existing buildings-Government or private owned, where hill shape is changed.
- (3) Heavy loss of life and properties is always a state concern. Government has to pay a great compensation for landslide recovery. This is because, Government has to arrange food and shelter, clothing and treatment for the affected and vulnerable evacuated people. Sometimes, it needs to repair and reconstruct houses, roads and culverts.
- (4) Sometimes, houses and roads are blocked and remain disconnected from other parts of the city or country, which lingers the sufferings of affected people. Not only this, sometimes rescue or aid suppliers cannot reach to those people.
- (5) Sometimes, affected people have to take shelter in refugee camps or Government owned buildings and has to led a miserable life.
- (6) Most of the time, affected people have to change their previous occupation losing all properties in landslides.

(7) Some injured and physically disabled people survived from landslide have to led on other members of family as a burden rest of their life.

(8) Some times, trees and shrubs fell with landslide. Thus, forest resources are hampered by landslide. Finally, it causes threat to eco-system.

(9) Women and children suffer/affect the most by landslide. This is because, women are physically weak by born and like to stay at home stead. In the same line, children also stay home most of the time. This is why, these two groups suffers the most by landslide.

(10) Hill shape is changed to Shrunken where it rampant landslides. Therefore topography is changed finally.

18. Remedies:

On the basis of analysis of causes and effects of landslide in Chittagong the following mitigating measures are suggested as counteractions of this incident, which can play an important role to keep an eco-friendly hilly environment and will be able to keep disaster free in future years. These are:

(1) A strong hill preservation committee must be formed with different expertises like Geographer/Environmentalists, Geologist, Planner, Hydrologist, Climatologist, Economist, Sociologist, Administrative Judge, Political leader etc. who will look after the hills and will take necessary legal actions against the unabated hill cutters.

(2) In this connection, it is needed to be said that, existing Environmental Laws in our country must be upgraded.

(3) The body (The Hill Preservation Committee) could also play an important role in the people especially in the hilly settlers to increase awareness of unabated hill cutting and risky settlements through Seminar, Symposium, Meeting, making poster, Lifflet and through print and electronic media.

(4) All illegal settlers must be evacuated from the foothills, hill pockets and hill slopes and rehabilitate to safer places like Government khash lands. A healthy fund may be created for this purpose. The responsibility may be given to the "Hill Preservation Committee"(HPC). They will carry on the duty and prohibit people establishing any kind of settlement at vulnerable hilly areas. At the same time Security fences round the exposed hill slopes to prevent the potentiality of illegal settlement development further.

(5) Any kind of change and development activities in the hilly areas must be performed through the concern/permission of Hill Preservation Committee (HPC). It will act, as an independent body and must be entitled with supreme Authorization power. The HPC will look into the matter. It may only give permission of development work incase of national

need like National Highway or Rail Track or like national security matter development activities and not for other purposes.

(6) Deforested/Barren hills must be taken under afforestation program immediately. Trees protect hills in various ways. Roots of trees stabilize the strength of soil compaction as cementing material and reduce soil erosion. In the same line, vegetation preserves soils from erosion protecting sunrays and raindrops as an umbrella.

(7) All kinds of unplanned development activities (private or Government) must be stopped from now.

(8) Flash Flood water stagnant is a common picture in Chittagong City. This is because, the water drainage system is very poor. City's drainage system should be improved immediately to drain out city's rainwater. In this connection, canal grabbers should be removed and the flow of rainwater through canals should be ensured for the improvement of water logging situation.

(9) When landslide is occurred very often a blame game is seen within various departments/Organizations it should be stopped. At the same time it should be established a good governess with transparency and accountability. To avoid this problem retention walls can be constructed between the territories of various departments.

(10) A landslide hazard Mitigation related rescue Operation Contingency should be formed immediately and permanently at Chittagong based. The contingency may be formed both in Government and Community level with a strong co-ordination body. It should be well equipped with rescue tools and well trained. So that, they could perform instantly in case of emergency situation.

(11) It is obvious that most of the landslides have been occurred in time of continuous intense rainfall. This is why, landslide warnings should be reached to the relevant people

through different medias like print and electronic media, Mobile SMS and announce by mike/ loudspeaker. So that, vulnerable hilly people could be taken shelter to a safer place when danger would come.

(12) The people who have taken shelters in foothills, hill pockets and hill slopes are pro-poor. Most of them are either river eroded or Cyclone affected or flood affected people. They have lost their land and property. So, Government should address their shelter and poverty. They should be taken under the Social safety net programme of the Government. NGOs can play an important role in this connection. If they are assured of minimum food and shelter, it is expected that they will not go back to hilly areas farther.

(13) A landslide database is essential to be developed as early as possible through geomorphological and geophysical survey. It could be helpful to find out the most actual causes and trends of landslide through studies. Moreover, a landslide vulnerable mapping should be established through the survey and more landslide vulnerable areas should be marked as Red-Zone. For housing or any kind of development activities this Red-Zone should be marked with proper Sign Board and fencing or Retention wall, using a modern technology that is Geographic information system (GIS) and Remote Sensing (RS) which perform this important task.

(14) Last of all a Detailed Area planning (DAP) of Chittagong City should be developed by zoning according to the use of land. It should be followed by stakeholders and would be implemented strictly by a good governance system with Transparency and accountability.

19. Conclusion:

In Conclusion, it can be said that hill cutting and heavy rainfall with earthquake are main factors for landslides in Chittagong, which causes death to hundred people with a great loss of property and domestic animals. This scenario could be kept at a minimum level by strictly checking land grabbing that is hill-cutting activities by influential and resettling the risky settlers to safer places from hill areas. Experts from different organizations should establish high-powered Hill Preservation Committee (HPC) immediately and permanently. A detailed area planning with zoning of the city is very essential. In the same line, landslide database and landslide vulnerable mapping through geophysical and geological analysis of the city is essential to minimize landslides and its impacts in this region in future years. In addition, a rapid weather forecasting system to be developed with establishing a rainfall database for this region. Furthermore, a Rapid Rescue Operation Contingency should be established with modern tools and proper training that will take necessary actions in crisis period to minimize the hazard. Finally, a social and environmental awareness developing scheme should be taken through different medias like meeting, seminar, symposium, cinema, drama and different programmes by Television and Radio. Last of all, the vulnerable people of the hilly region must be brought under social safety net programme.

References:

- (i) Sultana, Taz, 2009. Landslide in Chittagong University Campus.
- (ii) Sarwar, Golam Mahbub, Landslide Tragedy of Bangladesh.
- (iii) Biswash, S. 2007. What Caused Landslide Deaths in Chittagong? Weekly Holiday, 22 June 2007, Dhaka, Bangladesh.
- (iv) Islam, M.S. 2008. Challenges of Development: Hill cutting and Landslide, speech at Roundtable Discussion arranged by the Daily Star, 30 August 2008, Chittagong, Bangladesh.
- (v) Priyo News, Dhaka, Move on to evacuate 20,000 high sick people from hillsides, 2 August 2009.
- (vi) msnbc.com news services, 2007. 'Sea of mud' kills dozens in Bangladesh.
- (vii) INFORMATION BULLETIN, Bangladesh: Landslides and Floods, 14 June 2007.
- (viii) An Unacceptable Tragedy, New Age, 2 August 2009.
- (ix) Mindless Tree-felling brings on Landslides, The Daily Star, 19 June 2010.
- (x) Unheeded Warnings, New Age Extra P: 16-18, 25 June 2010.
- (xi) Islam, D. Md. Nurul, Social Problems of Bangladesh (in Bengali), January 2008.
- (xii) Elahi, K. Moudud & Rumi, Sayed Rafiqul Islam, Urban Geography: Recent Trends (in Bangla), February 2005.

- (xiii) Hasan, Murshid Al, Social Research (in Bangla), January 2005.
- (xiv) Alam, D. Khurshid, Social Research Method (in Bengali), Social Research Method.
- (xv) Banglapedia, National Encyclopedia of Bangladesh, Asiatic Society of Bangladesh, volume no-2-7.
- (xvi) Bangladesh Bureau of Statistics (BBS -2001), Population Census – 2001, Zila Series, Zila: Chittagong, GOB, Dhaka.
- (xvii) Chowdhury, Quamrul Islam, “Chittagong Hill Tracts State of Environment.”

Annexure

Socio -Economic Survey: A

Table- 1: Gender

Gender	Frequency	Percentage
Male	28	68.29
Female	13	31.71

Source: Field Survey-2009

Table -2: Age

Age Group	Frequency	Percentage
15-24	12	30.71
25-34	14	32.10
35-44	6	13.37
45-54	7	15.07
55-+	2	8.75

Source: Field Survey-2009

Table -3: Religion

Religion	Frequency	Percentage
Muslim	41	100
Sanatan	0	0
Buddhist	0	0
Christian	0	0

Source: Field Survey-2009

Table -4: Ethnicity

Nation	Frequency	Percentage
Bengali	41	100
Indigenous	0	0

Source: Field Survey-2009

Table -5: Occupation

Professions	Frequency	Percentage
Day-Labor	9	21.95
Business	15	36.57
Agriculture	0	0
Service	4	9.76
Others	13	31.72

Source: Field Survey-2009

Table-6: Stability of Settlements

Stability of Settlements	Frequency	Percentage
Permanent	7	23.33
Temporary	34	76.67

Source: Field Survey-2009

Table-7: How long had they lived here?

Longevity of living	Frequency	Percentage
1-5	2	4.88
6-10	8	19.51
11-15	12	29.27
16-20	19	46.34

Source: Field Survey-2009

Table-8: Location of Settlements

Location of Settlements	Frequency	Percentage
Hilly area	31	75.61
Hilly slope	4	9.76
Top of the hill	0	0
Plain land	6	14.63

Source: Field Survey-2009

Table- 13: Family size /number of Family Members

Number of Members	Frequency	Percentage
2-3	1	2.44
4-5	20	48.78
6-7	14	34.15
8-10	6	14.63

Source: Field Survey-2009

Table- 14: Monthly income of Family

Income range (Tk.)	Frequency	Percentage
Bellow 3000	0	0
3000-4000	3	7.32
4000-5000	10	24.39
Above 5000	28	68.29

Source: Field Survey-2009

Table -15: Activities of Developer /construction companies

Existence of activity	Frequency	Percentage
Yes	5	16.66
No	36	83.34

Source: Field Survey-2009

Table- 16: Tendency of flash flood/flood

Tendency of flash flood	Frequency	Percentage
Very high	28	61.66
Medium	13	38.34
Low	0	0
Very low	0	0

Source: Field Survey-2009.

Table -17: Massive deforestations activity in the area

Deforestations activity	Frequency	Percentage
Yes	1	3.34
No	40	96.66
Others	0	0

Source: Field Survey-2009

Table -18: Hill Cutting Activity

Hill cutting activity	Frequency	Percentage
Yes	6	20
No	35	80

Source: Field Survey-2009

Table -19: Which is the most possible causes for landslide in 2007 & 2008?

Most possible cause	Frequency	Percentage
Physical	29	70.73
Man's activity	1	2.44
Both	4	9.76
Nothing else	7	17.07

Source: Field Survey-2009.

Socio-Economic Survey: B

Table- 20: Educational Qualification

Index	Total	%
S.S.C.	0	0
H.S.C.	0	0
Honors	4	50
Masters	4	50
M.Phill/PhD.	0	0

Source: Field Survey-2009

Table -21: Consciousness about natural environmental preservation

Index	Total	%
Yes	8	100
No	0	0

Source: Field Survey-2009

Table-22: Weather Department/Organization drive any activity about preservation of natural environment

Index	Total	%
Yes	8	100
No	0	0

Source: Field Survey-2009

Table -23: Which steps have been taken your Department /Organization by this time to protect landslide?

Index	Total	%
Evacuation of settlement & rehabilitation	8	100
Mark & punish outlaws	0	0
Preventive observation	0	0
Announcement about increase of consensus	0	0

Source: Field Survey-2009

Table-24: Which cause is responsible for landslide in Chittagong in 2007 & 2008?

Index	Total	%
Physical	0	0
Man's invented	5	60
Both	3	40
Others	0	0

Source: Field Survey-2009

Table -25: Who are responsible for landslide?

Index	Total	%
Individual	5	75
Group	3	25
Business	0	0
Institute	0	0

Source: Field Survey-2009

Table -26: How is the possibility of landslide in Chittagong in future?

Index	Total	%
Very high	0	0
High	8	100
Low	0	0
Totally not happened	0	0
Don't know	0	0

Source: Field Survey-2009

Table-27: Which steps should be taken to protect landslide in future?

Index	Total	%
Immediately	0	0
Short term	0	0
Long term	4	50
Both of them	0	0
Others	4	50

Source: Field Survey-2009

গণপ্রজাতন্ত্রী বাংলাদেশ সরকার
নগর উন্নয়ন অধিদপ্তর
৮২, সৈয়দবাগিচা, ঢাকা-১০০০।
(গবেষণার কাজে ব্যবহারের জন্য)
আর্থ-সামাজিক জরিপ।
ক-অংশ

জরিপ এলাকা :
গ্রাম/মহল্লার নাম :

নমুনা নম্বর :
জরিপের তারিখ :

- ১। সাড়াৎ প্রদান কারীর নাম :
- ২। সাড়াৎকার প্রদান কারীর পরিচিতি :
- (১) নাম ----- (২) লিঙ্গ : পুরুষ/মহিলা (৩) বয়স : -----বৎসর।
- (৪) ধর্ম : ইসলাম/সনাতন/বৌদ্ধ/খ্রীষ্টান (৫) জাতি : বাঙালী/উপজাতি।
- ৩। আপনার পেশা : উঃ (১) দিনমজুর (২) ব্যবসা (৩) কৃষি (৪) চাকুরী (৫) অন্যান্য
- ৪। আপনার বসবাসের স্থায়ীত্বের ধরন কেমন ?
উঃ (১) স্থায়ী (২) অস্থায়ী
- ৫। আপনি কত বৎসর যাবৎ এ এলাকায় বসবাস করছেন?
উঃ (১) ১-৫ বৎসর (২) ৫-১০ বৎসর (৩) ১০-১৫ বৎসর (৪) ১৫ বৎসর বা তদুর্ধ্ব।
- ৬। আপনার বসত বাড়ীর অবস্থান কেমন জায়গায় ?
উঃ (১) পাহাড়ের পাদদেশে (২) পাহাড়ের ডালে (৩) পাহাড়ের চূড়ায় (৪) সমতলে।
- ৭। আপনার বসতবাড়ীর গঠন কেমন?
উঃ (১) বুপড়ি (২) কাঁচা (৩) আধাপাকা (৪) পাকা।
- ৮। আপনার বাড়ী CCCএলাকার অর্ন্তভুক্ত হলে উহা CCC কর্তৃক অনুমোদিত কিনা?
উঃ হ্যাঁ/না।
- ৯। আপনার বসতবাড়ীর মালিকানার ধরন কোনটি?
উঃ (১) নিজের বাড়ী (২) ভাড়া বাড়ী (৩) সরকারী কোয়ার্টার (৪) সরকারী খাস জমি।
- ১০। আপনার এলাকায় নাগরিক সুযোগ-সুবিধা কেমন?
উঃ (১) পর্যাপ্ত (২) মাঝারী (৩) স্বল্প (৪) মোটেও নাই।
- ১১। আপনার পরিবারের আকার/সদস্য সংখ্যা কতজন?
উঃ (১) ২-৩ জন (২) ৪-৫ জন (৩) ৬-৭ জন (৪) ৮-১০ জন।
- ১২। আপনার পরিবারের মাসিক আয় কত টাকা?
উঃ (১) ৩০০০ টাকার নিচে (২) ৩০০০-৪০০০ টাকা (৩) ৪০০০-৫০০০ টাকা (৪) ৫০০০ টাকার উর্ধ্ব।
- ১৩। আপনার এলাকায় কোন ডেভেলপার/গৃহ নির্মানকারী কোম্পানীর কার্যক্রম আছে কিনা ?
উঃ (১) হ্যাঁ (২) না।
- ১৪। আপনার এলাকায় পাহাড়ী ঢল/বন্যার প্রবণতা কেমন?
উঃ (১) খুব বেশী (২) মাঝারী (৩) কিঞ্চিৎ (৪) মোটেও হয় না।
- ১৫। আপনার এলাকায় বনভূমি/গাছপালা ব্যাপক হারে কাটা হয় কিনা?
উঃ (১) কাটা হয় (২) কাটা হয় না (৩) অন্যান্য।
- ১৬। আপনার এলাকায় পাহাড় কাটা হয় কিনা ?
উঃ (১) কাটা হয় (২) কাটা হয় না।
- ১৭। ২০০৭ ও ২০০৮ সালে অত্র এলাকায় ভূমি/পাহাড় ধসের সম্ভাব্য কারণ কোনটি বলে আপনি মনে করেন?
উঃ (১) প্রাকৃতিক (২) মানুষের কার্যক্রমের ফল (৩) উভয়ই (৪) কোনটাই নয়।

তথ্য সংগ্রহকারীর স্বাক্ষর ও তারিখ :

গণপ্রজাতন্ত্রী বাংলাদেশ সরকার
নগর উন্নয়ন অধিদপ্তর
৮২, সেগুনবাগিচা, ঢাকা-১০০০।
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খ-অংশ

জরিপকৃত দপ্তরের নাম :

নমুনা নম্বর :

শাখা-----

১। সাড়াৎ প্রদান কারীর নাম ও পদবী :

২। আপনার শিড়াগত যোগ্যতা :

(১) এস এস সি (২) এইচ এস সি (৩) স্নাতক (৪) স্নাতকোত্তর (৬) এমফিল/ডক্টরেট।

৩। আপনি প্রাকৃতিক পরিবেশ সংরক্ষণ সম্পর্কে ওয়াকিবহাল কিনা?

উঃ (১) হ্যাঁ (৩) না।

৪। আপনার দপ্তর প্রাকৃতিক পরিবেশ সংরক্ষণ বিষয়ে কোন কার্যক্রম পরিচালনা করে থাকে কি?

উঃ (১) হ্যাঁ (৩) না।

৫। পাহাড়/ভূমিধ্বস প্রতিরোধে আপনার দপ্তর ইতোমধ্যে কি কি উদ্যোগ গ্রহণ করেছে?

উঃ (১) অবৈধ বসতি উচ্ছেদ ও পুনর্বাসন (২) অপরাধীকে চিহ্নিত করণ ও শাস্তিপ্রদান (৩) প্রতিরোধমূলক নজরধারী

(৪) ড্রাফটিকর প্রভাব সম্পর্কে সচেতনতা বৃদ্ধি মূলক প্রচারণা।

৬। ২০০৭ ও ২০০৮ সালে চট্টগ্রামে সংঘটিত পাহাড়/ভূমিধ্বসের সম্ভাব্য কারণ কি বলে আপনি মনে করেন?

উঃ (ক) প্রাকৃতিক (খ) মনুষ্য সৃষ্ট (গ) উভয়ই (ঘ) জানা নাই।

৭। উপরের উত্তর 'ক' হলে নিচের কোন কারণটি বলে আপনি মনে করেন?

উঃ (১) ভূমিকম্প (২) পাহাড়ী ঢল/বন্যা (৩) উভয়ই (৪) অন্যান্য।

৮। উপরের উত্তর 'খ' হলে নিচের কোন কারণটি বলে আপনি মনে করেন?

উঃ (১) ব্যক্তি (২) গোষ্ঠী (৩) ব্যবসা (৪) প্রতিষ্ঠান।

৯। ২০০৭ ও ২০০৮ সালে সংঘটিত পাহাড়/ভূমিধ্বস চট্টগ্রামের কোন কোন এলাকায় সংঘটিত হয় এবং কি পরিমাণ
ড্রাফটি সাধিত হয়?

উঃ (ক) সাল : (খ) এলাকা : (গ) জীবন হানি : (ঘ) বাড়ীঘর ধ্বংস (ঙ) অন্যান্য।

(১) (১) (১) (১) (১)

(২) (২) (২) (২) (২)

১০। ভবিষ্যতি চট্টগ্রামে পুনরায় পাহাড়/ভূমিধ্বসের সম্ভাবনা কি পরিমাণ বলে আপনি মনে করেন?

উঃ (১) খুব বেশী হবে। (২) বেশী হবে (৩) কম হবে (৪) মোটেও হবে না।

১১। পাহাড়/ভূমিধ্বস প্রতিরোধে কি কি উদ্যোগ গ্রহণ করা প্রয়োজন বলে আপনি মনে করেন ?

উঃ (ক) তাৎক্ষণিক (খ) স্বল্পমেয়াদী (গ) দীর্ঘমেয়াদী (ঘ) অন্যান্য।

তথ্য সংগ্রহকারীর স্বাক্ষর ও তারিখ :