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Research Article

WATER LOGGING HAZARD AT NORTHERN PART OF PADMA BRIDGE ADJACENT AREA

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ABSTRACT
Bangladesh government has taken the initiative to construct the Padma Bridge from Mawa point that will ease our communication system as well as boost our GDP. The area is suffering from water logging problem and the problem can be increased by different mega construction for development purposes. The water logging problem is seen this area for various anthropogenic causes like unplanned construction and random sand filling by different government, private organizations and individuals, construction of micro dam by land owners, embankment by local government. Siltation is one of the factors of water logging. A remote sensing based approach discloses that in 1991, total water body in the study area was 10,697 hectares where as in 2014, that was 14,930 hectares. Water logging problem hampers the social, physical, environmental life of the area. It also has the negative impact on economy. To overcome this problem, some measures can be taken including awareness programme, legal action and plan wise development activities. On a whole, government and people should work together to remedy the problem and keep the pace of development.

Keywords: *Government, Padma Bridge, Development, Water Logging, Remote Sensing*

INTRODUCTION
The government of Bangladesh has taken an initiative to construct a bridge on the Padma River that will connect the southern part of Bangladesh including Barisal, Patuakhali, Bhola, Pirojpur, Jhalakathi, Khulna etc. with the capital city Dhaka and other parts of the country. It is to be predicted that our GDP growth will increase around 1% after constructing the bridge.
The communication system will be better and goods transportation will be easier by this bridge. Numbers of people will be involved in many occupations during and after the bridge construction. There will major development works be implemented on centering the Padma bridge.
Furthermore, government has taken some major initiatives to construct mega infrastructures for the development of the area. The study is aiming to talk about the factors that responsible for the existing water logging problem that will enhance in future due to major construction works and remedial processes of this problem.

The Study Area
The investigated area lies in the central part of Bangladesh, consisted Sreenagar, Sirajdikhan and Lohajang upazilas of Munshiganj District. In the present aspect, the area is very important as the Padma Bridge is constructed there. The study area extends between the latitudes from 23°25´N to 23°45´N and longitudes from 90°10´E to 90°30´E. The study area is surrounded by the Dhaleswari River in the north, The Padma River in the south, Dohar and Nawabganj upazilas of Dhaka District in the west and Tongibari Upazila of Munshiganj District in the east (Figure 1). The area is about 25km south from the Capital City and well connected with Dhaka by metaled (pucca) road and by river in the rainy season.

General Geology of the Area
The Ganges-Brahmaputra Delta is one of the largest deltas in the world. This delta covers a large part of the Bengal Basin. The main progradation of the delta is continuing to the south into the Bay of Bengal. The main sediment sources for the delta are the Ganges and Brahmaputra river systems. These two river systems are presently estimated to discharge 1×10^9 ton/year of sediments (Milliman and Syvitski, 1992).
The present study area is a part of Ganges-Brahmaputra Delta and is situated in the central part of Bangladesh. The evolutionary history of the area is directly related to the frequently changing courses of

the Ganges and Brahmaputra River System in the past in order to deposit the deltaic sediments of fluvial origin. Tectonically, the investigated area falls into the Faridpur Trough elements (Khan, 2002).

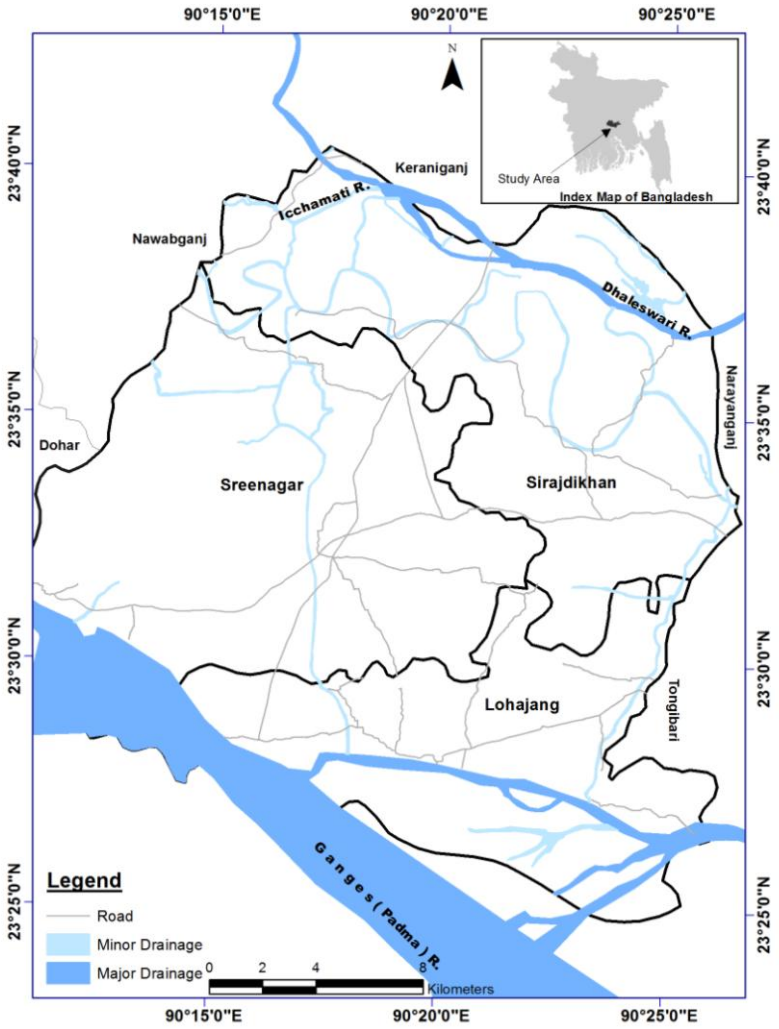

Figure 1: Location Map

Geomorphology

The area is low flood plain area influenced mainly by the Padma and Brahmaputra river system and some parts of the weatern side are dominated by Arial bil. A gentle, low and flat topography and abundance of low-lying depressions characterize this area. The western edge of the area shows comparatively lower elevation possesses most of the depressions.

Physiograpically, the mapped area belongs to the Brahmaputra-Jamuna Floodplain (Alam *et al.*, 1990); Brahmaputra-Jamuna Floodplain, Ganges River Floodplain, Old Floodplain Basins, Meghna Estuarine Floodplain (Brammer, 2012). According to Rashid (1991) the study area falls under i) Ganges Food plain, ii) Old Meghna Estuarine Floodplain and iii) Arial bil.

Hydrology

The study area comprises mainly of flood plain and a part of Arial bil. Western part of the area is comparatively low lying due to Arial bil. The Padma, the Dhaleswari and Ichhamati are the main rivers in the area (Figure 2). The Padma (Ganges) River is a one of the major river of the country which flows through the southwestern part of the area. The area has a network of channels with a considerable

numbers of distributaries and tributaries besides the three main rivers. Few channels are flowing north western part of the area which carry water from the Dhaleswari and the Ichhamati and finally drained to the Aria lbil. A number of abandoned channels are also found in the study area. The water of all the rivers is sweet.

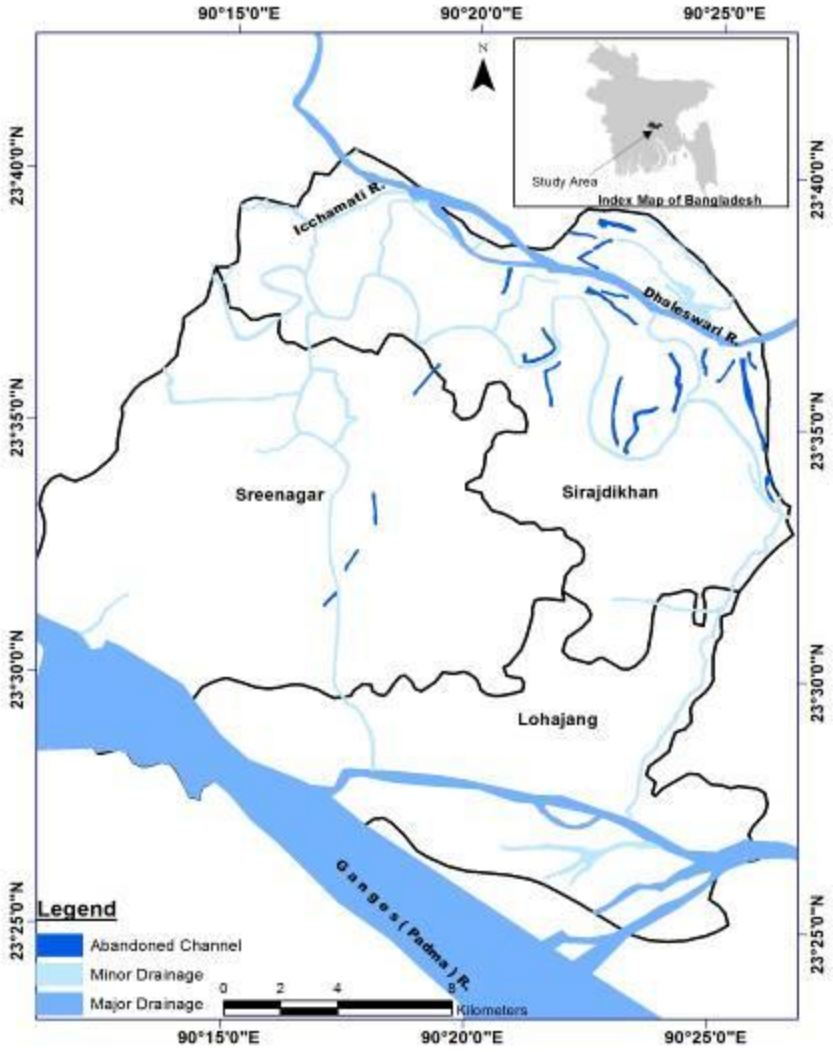

Figure 2: Drainage Map of the Area

MATERIALS AND METHODS

Both primary and secondary sources data have been used in this study. The area was physically investigated during February to April, 2014. During field time, local peoples were interviewed for various information to get actual scenario of the study area. A plenty of data have also been collected from various organizations including Local Government Engineering Department (LGED), Agriculture Office, Department of Public Health and Engineering (DPHE) etc. A number of photographs were taken at that time. Various satellite imageries especially Global Land Survey GLS (Band 4, 3, 2) of 1991 and Landsat L8 Level1 (band 4, 3, 2) of 2014 were used for this analysis. Resolutions of images are 30m respectively. All the images are taken in dry period and geo referenced in UTM/WGS 84 projection system. Required processing of images like layer stack, mosaic, geo processing, principal component analysis and image classification were done by Erdas imagine 2010, Arc map 10. Besides, News paper references were also collected for this purpose.

Causes of Water Logging

Basically different anthropogenic activities are responsible for water logging specially, development works without proper planning liable for this problem. Some are discussed briefly:

I) *Unplanned Construction:* The importance of the area is increasing day by day; especially the Padma Bridge makes the area worthy in economic aspect to the people. In recent years, People have been fast erecting their residential buildings on agriculture lands in the district since the multipurpose bridge was proposed over the Padma river. The residence of that area are constructing very whimsically without considering the trend or attitude of the channel or wet lands (Plate-1). Hence, unplanned residency is blamed for water logging in the district (Dhaka Tribune-15.11.2014). They also construct various shops or trade centre for their professional needs. Different government agencies also built multipurpose structures which are responsible for water logging. Rehabilitation centre for land loser due to Padma Bridge are one of the reasons of water logging (Plate-2). People are constructing roads on the low land for communication purposes that hampering water flow path and this causes water logged like pocket.

Plate 1: Private Construction at Khidirpara, Lohajang

Plate 2: Rehabilitation Center at Kumarvog, Lohajang

II) *Unplanned Sand Filling:* The people of the area increasing day by day and at the same time the land which is suitable for making house or other structures is decreasing. So, they need new land to build infrastructure. In that case the low land is filled by river sand in very unplanned way and ultimately the surrounding area undergoes water logging problem (Plate-3 and 4).

Plate 3: Unplanned Sand Filling at Holdia, Lohajang

Plate 4: Unplanned Channel Filling at Kumarvog, Lohajang

III) *Embankment and Micro Dam:* In some cases, people change the channel courses or interrupt the water flow by making micro-dams on their flow-paths (Plate-5). This is another reason of water logging. Again, Embankments are frequently constructed on both the banks of water body or channel to protect the area from flood or to construct roads (Plate-6). In general, these embankments increase siltation on the

river bed which causes drainage congestion. In the field visit, it is found that embankment without required drainage line (water passing line) is also responsible for water logging. During rainy season, heavy rainfall is seen and excessive rain water cannot drain out properly. This is one of the reasons for water logging of the area.

Plate 5: Micro Dam for Walkway at Singpara, Sreenagar

Plate 6: Embankment at Bejgaon, Lohajang

IV**.** *Siltation:* Siltation in natural drainage system is another problem of water logging. During flood time, the mighty river and other rivers and channels are over flooded and deposited sediment in the lowlands, water bodies and channels that disrupt the water flow (Plate-7 and 8). Again, rain water carry out different construction materials like bricks, sands, and stones; leaves; household wastes; street sweepings etc. therefore, increased impervious surface of storm water drainage and created favourable condition for water logging by reducing the runoff capacity of the drainage system. Five canals including Baligaon-Ghordaur canal, Atigaon-Morshodgaon canal, Puraganga canal, Manda-Sreenagar canal and Dakhin Halodia-Goali have been filled up with sand. People said the canals linked to agriculture lands have been filled up with sands or silt and so water cannot be removed from agriculture lands (The Daily Observer-20.11.2014) and reduced the carrying capacity.

Plate-7: Siltation at Goalimandrakhal, Patavog, Sreenagar

Plate-8: Siltaion at Baligaon khal, Khidirpara, Lohajang

RESULTS AND DISCUSSION

A Remote Sensing Based Approach

Water logging is the most vital problem in many parts of the study area. A remote sensing based approach has been taken to illustrate the water logged area. Two satellite imageries have been utilized to analyze the problem. One is Global Land Survey GLS (Band 4, 3, 2) of 1991, and another is Landsat L8 Level1 (band 4, 3, 2) of 2014. Resolutions of images are 30m respectively. All the images are taken in dry period (26 November, 1991 and 03 April, 2014) and geo referenced in UTM/WGS 84 projection system.

Required processing of images like mosaic, subset and projection changes were done by Erdas imagine 10 and Arc GIS 10. Analyzed data of different time series indicates that, in the study area, specially, Lohajang and Sreenagar areas, water logging have been increasing during the last few years (Figure 3 and 4). It is also noted that, Arial bil area in Sreenagar was full of water all the year during 1991. But, in 2014, the area was found sporadically filled with water. This is occurred due to unplanned random construction of residences, trade centers and communication ways that interrupt the natural channels flow connected with the Arial bil. As a result, water logging problem is increasing day by day in the surrounding areas of the bil. The analysis reveals that, in 1991, there was around 10,697 hectares water body in the study area, whereas, in 2014, the total water body was approximately 14,930 hectares. The analysis indicates the increasing trend of water logging in the area that will be accelerated in future with the development activities if the proper measurements are not taken in time.

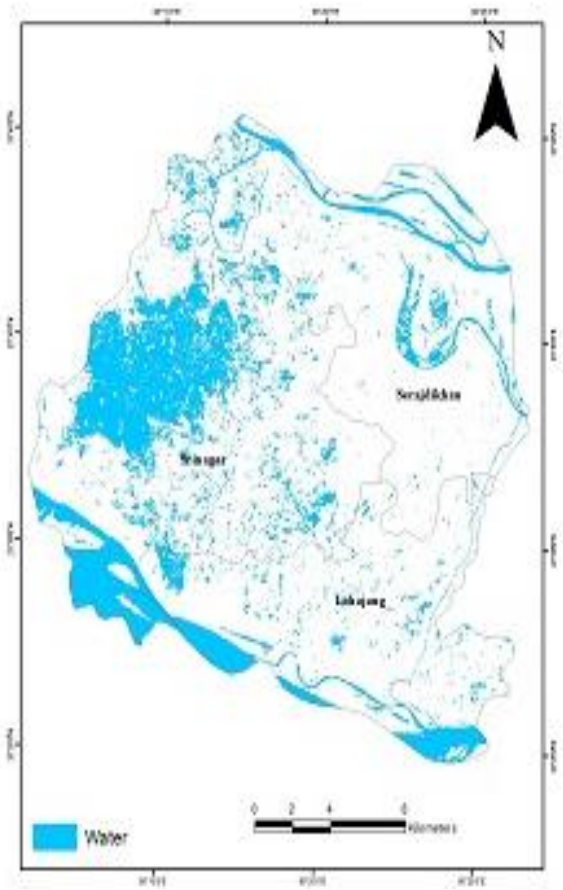

Figure 3: Water Body of the Area in 1991

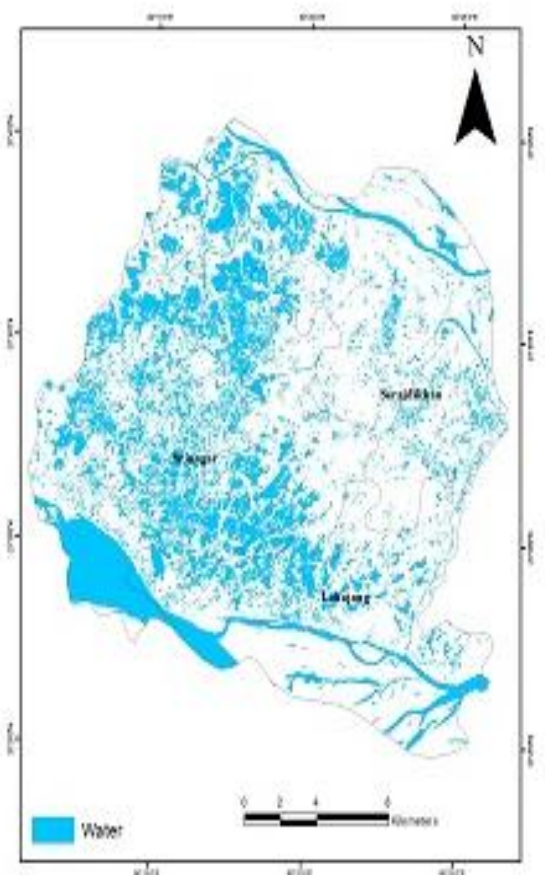

Figure 4: Water Body of the Area in 2014

Impact

Social

Regular life: Water logging seriously disrupts regular life and it has direct impacts on the poor, as they often live on unsuitable, low-lying and flood prone or steep, and unstable sites, have high-density housing (increasing the impermeability of the ground), poor urban planning and control and lack of investment in urban infrastructure.

Communication: Water logging hampers the communication system of the people. People cannot move one place to another comfortably. Most of the low lying internal roads are gone under water and disrupt the communication system.

Physical

Damage structure: The structure of the pucca houses in the low laying areas remains underwater due to water logging. The brick foundation losses its longevity by the long term water contact. At the same time a mentionable number of people face the problem of damage of katcha houses. In slums and low income areas, most of the people are used to live in katcha and vulnerable houses. These houses become badly damaged during the period of water logging. Water enters into houses and the floor and walls remain wetted for a long period. Sometimes they can't live in the houses and had to shift their living areas, which again creates an economic burden for the poor people.

Damage infrastructure: Water logging of the ground contributes to ground heave, subsidence, dampness and other damage of property. It damages the roads (both pucca and katcha) in the rainy season every year which leading to the movement problem and interrupts the journey.

Environmental

Water borne diseases: In the water logged area, different types of water borne diseases are broken out. Sometimes, the poor people had to rely on surface or shallow groundwater sources that are polluted, as they don't have access to portable water during the period of monsoon. Malaria, Diarrhea, respiratory problems, eye and skin diseases are the worst impacts in water logged area.

Breeding Site of Mosquito: The stagnant water body is the breeding ground of mosquitoes. Among the diseases associated with mosquito, dengue is the main and it spreads by special mosquitoes named "Aedes". Entomologists say the population of Aedes mosquito, carrier of dengue virus, increases with excessive rainfall and its result of water logging, which fuels the breeding of Aedes. Dengue breaks out in May and causes major threat to public health.

Damage of Vegetation and Reduce Aquatic Habitats: Water logging is the after effect of improper drainage management. Stagnant water for a long time and continuous release of waste water damages the trees and vegetation which result in a reduction in the numbers of aquatic plants and animals. The increased flows resulted from traditional drainage systems cause streams to scour deeper and wider channels, adversely affecting aquatic habitats.

Economic

Farmer's lose: Agricultural activities are highly interrupted for this water logging problem. Due to water logging, monsoon water stays longer and farmers do not start their cultivation in proper time. As a result they do not get their crops in time. Thus, they are financially loser. In the field interview, it is reported that potato farmers are losing 1 lac (1, 00,000) taka per acre land for getting their crops after a month in the season time. They are in panic that water stagnation may hamper the cultivation of Rabi crops, including potato, on 20,000 hectares of land at Sirajdikhan and Lohajang upazilas in Munshiganj (The Daily Observer-20.11.2014).

Maintenance and construction cost: Due to water logging phenomenon, Katcha and Tin made houses are damaged easily so, these require remake or renovation. For this purpose, more money is needed which would be burden for poor people.

Recommendations

i) *Awareness Development:* The natural drainage and water bodies and its surrounding lands are day by day occupied by the people who are living nearby. Most people of our country are illiterate and they even don't know the after-effect of the filling of natural drainage and water bodies. Therefore, the concerned development authority should take steps for awareness development about the necessity of natural canals. If it is necessary they can involve NGOs for this purpose. Media (both electronic and print) can play a positive role to promote some awareness programme to make the people conscious about this issue.

ii) *Legal Action:* Legal instruments play a vital role towards the changes in behavioral attitude of the people in a democratic society. There are a set of acts, rules, and policies in the country to deal with the problems of environment.

Some laws are century-old and cannot cater to the need of the day. Some are new that need amendment to accommodate the existing environmental scenario. Though a single issue, environment encompasses different ministries in respect of preventing pollution. Consolidation of all environment laws into a single

law and arrangement of all environmental activities under one umbrella may bring better result towards conservation and improvement of the environment.

iii) *Proper and Combined Planning:* Proper planning can reduce or eliminate this problem. Government agencies along with private and individuals should work together for the development of the area in a methodological way. Random and unplanned development will enhance the problem.

Conclusion

The area is facing a vulnerable condition. This is happened for unplanned and random construction of residence, trade centers, roads and embankment. Haphazard sand filling is also responsible for this situation. Moreover, a major bridge is under construction on the Padma River to facilitate the communication system of the southern part of the country with the capital city Dhaka. Besides, Government has taken some schemes for constructing major and mega structures. As a result, comprehensive works will be done near future in the area. So, the authority and the people should address the existing water logging problem appropriately and will take proper steps to over come the problem.

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