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Research Article

A GEOSPATIAL APPROACH TO IDENTIFY THE CHANGES IN WATER BODIES AND ITS CONSEQUENCES IN DHAKA NORTH CITY CORPORATION, BANGLADESH

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ABSTRACT
Dhaka, the capital and the prime city of Bangladesh has been divided into two city corporations in recent time for its increasing population, activities and importance. The north city corporation occupies the major portion in both territorial and population. The north city corporation has large number of water-bodies both big and small, which includes river, *khals*, lakes, ponds, flood plain low-lying areas etc. As the city is increasing at a rapid rate, the drainages are lost due to random unplanned urbanization practices. The work is an initiative to measure the shrinkage of water bodies of Dhaka North City Corporation from 1991 to 2014 and its consequence impacts on people life. This is done by using some softwares like Arc GIS 10 and Erdas Imagine 2010. This study uses satellite images (Landsat 1991, 2005 and 2014). The study reveals that the water body is shrinking at a accelerate rate. In 1991, the total area of water bodies was approximately 1676 ha. Whereas in 2005, the total water body decreased and it stood approximately 727 ha. This deteriorated further, occupying an area of 460 ha in 2014 which indicates that the water bodies continued to decrease. Thus the water bodies decreased 72.5% between the time span 1991 to 2014. The losing trend of drainage system is one of major causes of water logging that is a curse. Immediate actions including political, social, legal and technical should be taken to minimize the problem.

Keywords: *Water body, Dhaka North City Corporation, Urbanization, GIS, Remote Sensing*

INTRODUCTION
Dhaka is the capital city of our lovely motherland. Like many other cities in the world, Dhaka is also the outcome of spontaneous rapid growth. As a result, the city has been divided into 2 City Corporations for its fast increasing population, activities and importance. The north city corporation covers the major area and population of the city. It also occupies the vast water bodies and drainages also. There existed a numerous drainages and water bodies including khals, low land, jheel, pond in the area a few years ago. So, the City was regarded as the Venice of the East or the *City of Channels* (Dani 1962). But with time and different activities, the area lost its drainage. This process of losing is also going on till now. The major khals, canals, rivers, ponds are disappeared and the banks of the rivers are encroached by different peoples and groups. There are many reasons behind this. Among them, unplanned construction i.e. urbanization, non cooperative relation between different government and non government agencies, industrialization in residential area are mentionable. The consequence of this problem is water logging. During monsoon rains, many areas of Dhaka go under water, because canals, being the primary drainage system of the city are blocked, cannot carry the huge volume of storm water. Even in dry season, sewage water over flows and severely interrupt the city dwellers life. The objectives of this study therefore were to identify the past and present spatial extent of wetlands, their changing patterns during 1991-2014, and environmental consequences on the area.

Location of Dhaka North City Corporation Area
Dhaka North City Corporation area is is located in the central part of Bangladesh. The city corporation area is bounded by the Balu river in the East, Tongi *Khal* in the North, Turag River in the West and Dhaka South City Corporation in the south. The study area lies between 90°20´ and 90°28´ east longitude

and 23°44´ and 23°54´ north latitude (Fig. 1). The average elevation is 6 to 8 meters from MSL (Mean Sea Level). The total area of this city corporation is 82.638 square kilometers, total population is about 3957302 (census, 2011) (DNCC website 20/05/2016).

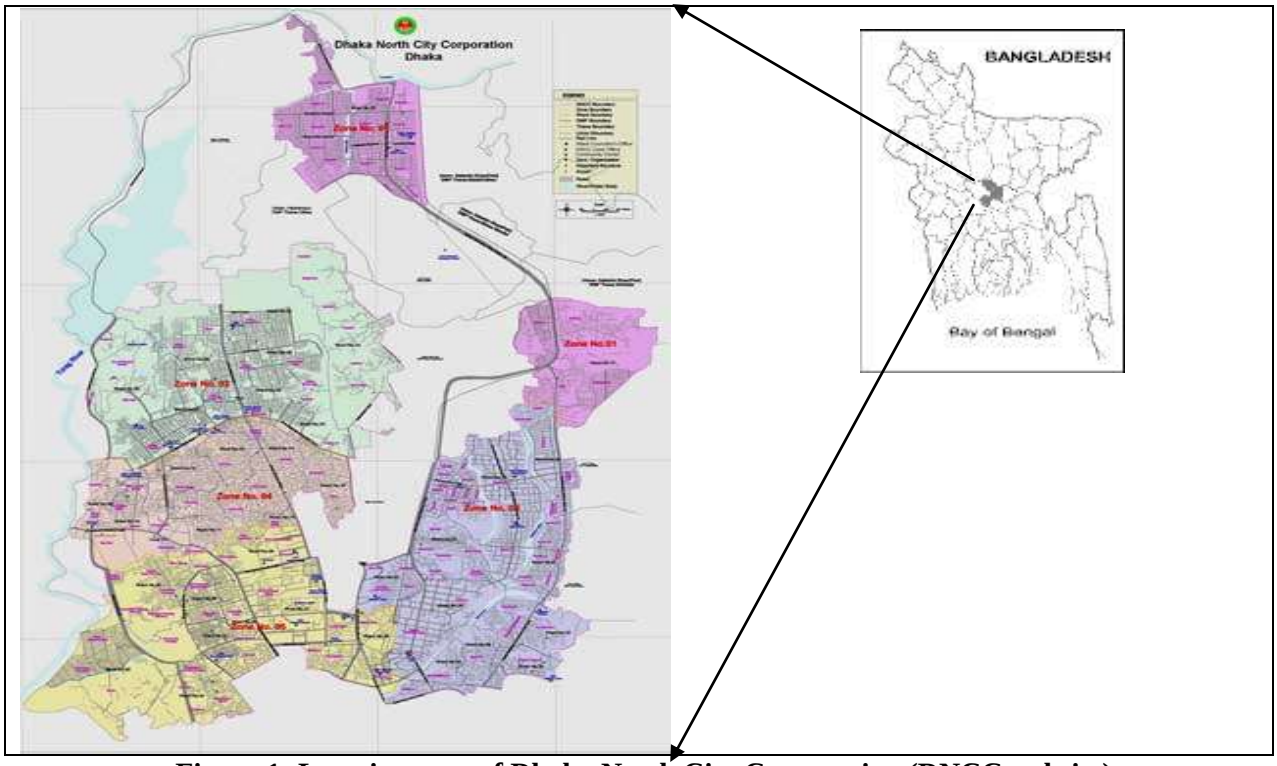


Figure 1: Location map of Dhaka North City Corporation (DNCC website)

Ibrahimpur khal (Canal)

Mirpur Journalist colony Khal (Canal)

Plate 1: Present photographs of major water bodies (Dhakar khal)

Major Water bodies in DNCC

Dhaka city is bounded by number of water bodies for its geographical position. After liberation war, according to the Dhaka WASA, there were 47 khals in Dhaka. Now the number of khal is reduced and it stands at only 26. There are a numbers of water bodies including khal in Dhaka North City Corporation (DNCC) territory. Among them Hatirjheel, Kallyanpur khal, Ibrahimpur Khal, Abdullahpur khal, Baisteki

khal, Gulshan lake, Banani lake, Uttara lake, Rupnagar khal, Kalshi khal, Baunia khal are mentionable. Theses water bodies have vast impact in these area in various purposes including draining rain water, domestic waste water, entertaining people etc. But the present conditions of these water bodies are very much critical and severely under threaten to be vanished.

Significance of Water bodies in Dhaka

a. **Reduce water logging:** During monsoon, there is heavy rainfall and to release the excessive rain water Khal and canals are playing the most significant role. Wide and bigger water bodies can carry huge quantity of water. The more the water body the less the water logging. For this, people will get rid of water logging curse.
b. **Communication purposes:** In order to avoid traffic congestion and reduce communication cost, different water bodies like khals and rivers can be the major media of communications.
c. **Entertainment:** In many cities, water body is one of the salient sources of entertainment. People are getting rid of mental and physical fatigue by the close contact with water and its surrounding natural beauty. They can boat and fishing in the water.
d. **Fishing:** water is only source of fish. If the wider and fresh water bodies exist, city dwellers will get fresh fish at cheap rate. This will help to meet the protein demand as well as to create employment opportunities.
e. **Ecological balance:** To keep the ecological balance of the city, water bodies play an inevitable role. The water can reduce the heat ant temperature of the city. Furthermore, many types of plankton are born in water which is ecologically very important. So, to keep the green and clean Dhaka i.e. ecologically balanced Dhaka, water body is must.

Causes of Water bodies decrease

I. **Unplanned Construction:** With the increasing rate of population, numbers of residential and commercial building are also increasing. To build the new establishment, water bodies are filling up randomly and thus these are lost. Again Government takes various development programme to construct road and communication way for the city dwellers. For this they fill up the water bodies and gain land for constructing roads. This is one of the prime reasons for losing water bodies.
II. **Waste Filling:** Maximum water bodies of Dhaka are filled up by domestic and industrial waste. People are not concerned with their waste management system and drop and dump the waste near open places specially in near water bodies. Government also takes initiative to use the water bodies as dustbin. As for example, Kalshi khal is used as dustbin for waste disposal.
III. **Encroachment:** Encroachment is a vital reason for loss of water bodies. The first step of encroachment is to build structures along the banks of water body and further out on the water body itself. To do this, rods and bamboo posts are positioned and fixed on the water body bed along the bank and extending into the main body of the wetland. Then huts and shops are built on these stilts. The owners of these structures are then start reclaiming land by earth fills and dumping garbage. A good number of land development companies are involved in land encroachment activities. Each company maintains its tentative boundary adjacent to the project. These companies try to occupy all the lands including water bodies within their tentative boundary.
IV. **Lack of social awareness:** Most of the people are not conscious about importance of water bodies in their daily and social life. So, they are not proactive to preserve the water bodies. Moreover, they are taking the destructive role.
V. **Lack of legal action:** There are numbers of law to conserve the water bodies, but these are not properly implemented. Environmental Act, Environmental Conserve Law 1995 (corrected 2010) are formulated but are not executed. So, people are not afraid to break these laws.

MATERIALS AND METHODS

Both primary and secondary sources data have been used in this study. Various satellite imageries especially Global Land Survey GLS (Band 4, 3, 2) of 1991, Landsat L4-5 TM Level 1 product (4,3,2) of

2005 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 georeferenced in UTM/WGS 84 projection system. Required processing of images like layer stack, mosaic, geoprocessing, principal component analysis and image classification were done by Erdas imagine 2010 and Arc map 10.

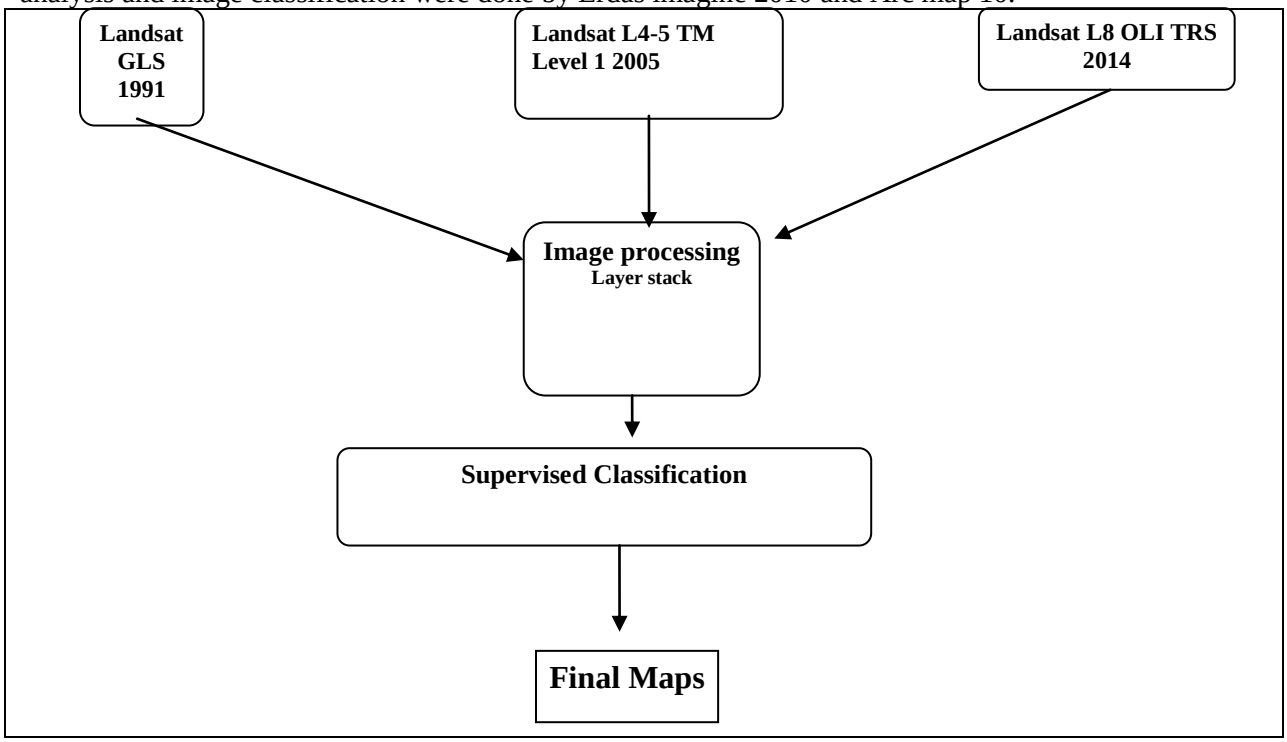


Figure 2: Flow chart of image analysis

Other relevant maps such as Dhaka City map, Ward map, road map and general land use map were used as ancillary data. Further more, some photographs are taken from different sources.

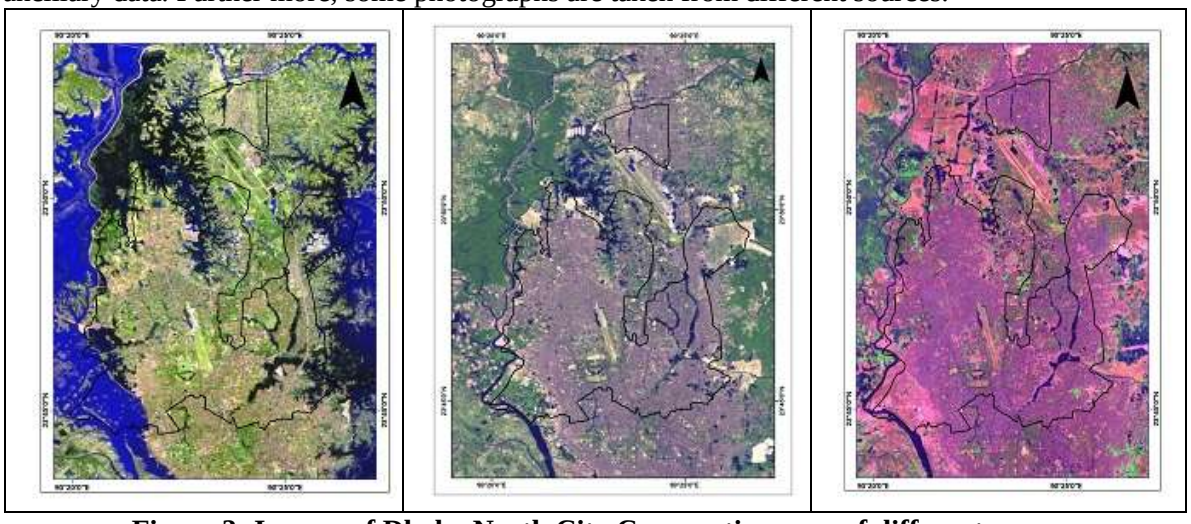
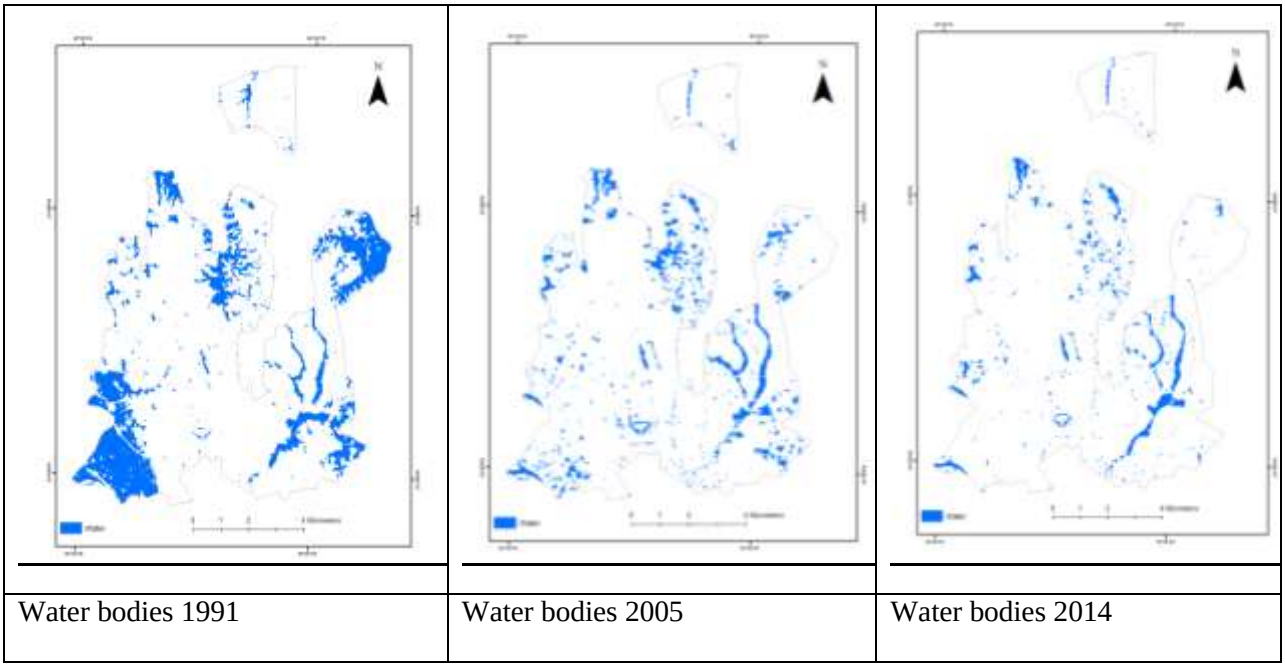


Figure 3: Images of Dhaka North City Corporation area of different years

RESULTS AND DISCUSSION

Land sat images of 3 different years (1991, 2005, and 2014) have been utilized to perform the analysis. It is alarming both for the people and the authority that Dhaka North City Corporation (DNCC) is losing its



Water bodies 1991	Water bodies 2005	Water bodies 2014

Figure 4: Water bodies of Dhaka North City Corporation area of different years

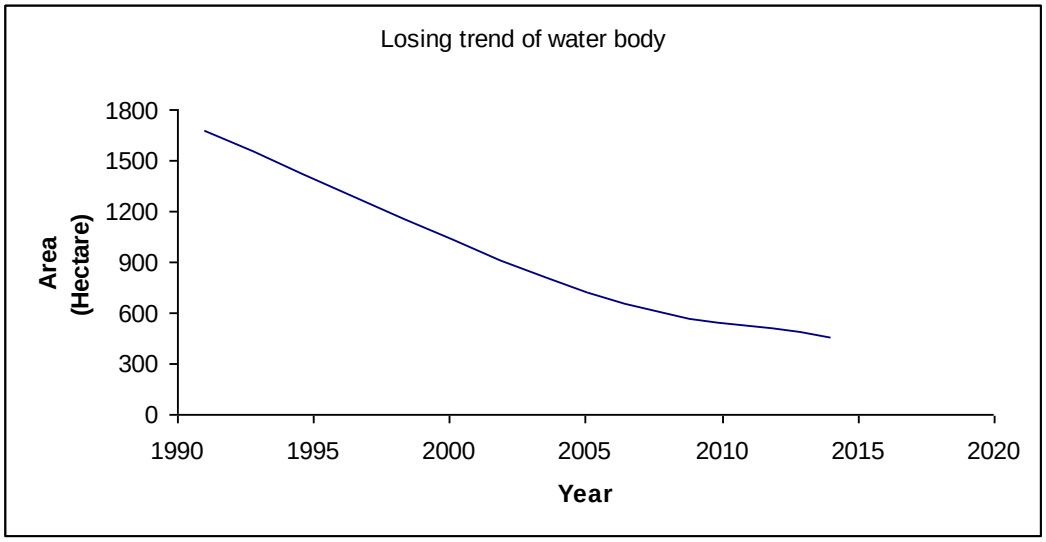


Figure 5: Trend of existing water body (1991 – 2014)

water bodies in increasing rate. If this rate continues, it is predicted that DNCC will lose its total water bodies with in very short time that will bring disaster for the DNCC dwellers

It is observed from the analysis that, in last few decades the water body was lost very rapidly. In 1991, the total area of water body was about 1676 hectares. In 2005, the water body was losing very fast and it became only approximately 727 hectares. It was only about 41% area of 1991 *i.e.* in 2005; water body was lost around 59% with respect to 1991. Again, in 2014, the estimated water body was 460 hectares. It indicates that, it is only about 27.5 % existed water body with respect to 1991. So, approximately 72.5% water body was lost during this time period.

The drastic change occurred in the south-western part of the study area. Mohammadpur and Hazaribag are situated in this part. In 1991, it is found that, a massive water body was existed in thia zone. But, in 2014, it is almost disappeared. Same things happened in northern (Pallabi and part of Cantonment) and north-eastern (Khilkhet and Badda) area of the study zone. The major reasons of these sharp changes are unplanned land filling and construction by both government and private organizations, encroachment by influential groups and individuals. The south-eastern part *i.e.* Khilgaon area has the same experience of water body loss.

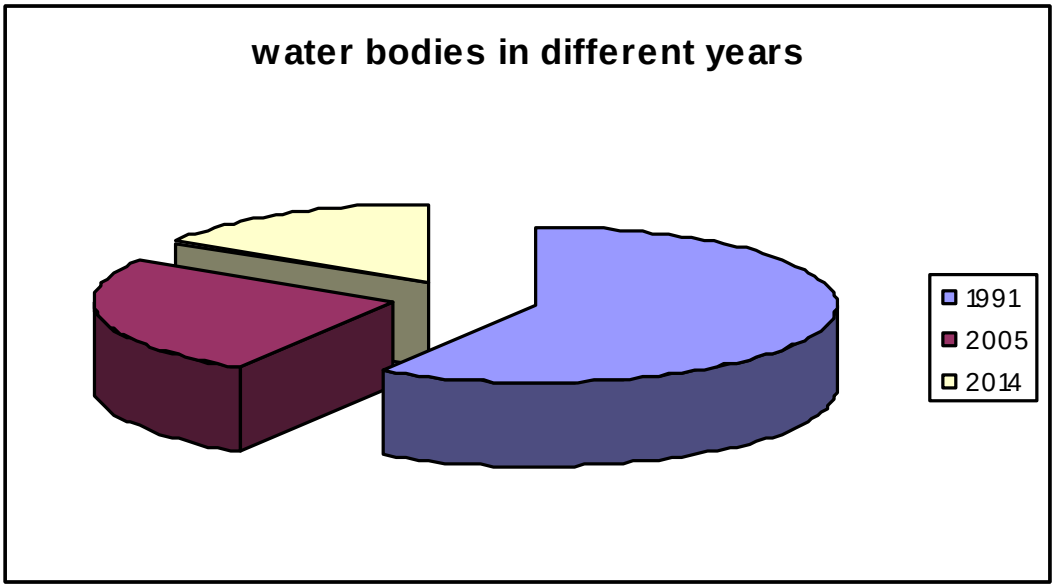


Figure 6: A pie chart illustrating water bodies (1991-2014)

Consequences

Water body has a significant importance both in environmental and economical and loss of water body in an area can create a large number of environmental problems.

i. **Water logging:** The present trends of residential land development in and around the city have posed environmental threat to the areas. The major drainage was subject to encroachment due to earth filling, deposition of city garbage and construction of building and roads. As a result, water logging has become a common phenomenon during monsoon in Dhaka city. This problem severely hampers city life. This causes traffic congestion that damages time, energy and money of the people. This also hampers the lower income people activities.
ii. **Scarcity of drinking water:** Due to losing trend of water body, aquifers are not recharged properly and completely. As a result, water crisis are often seen in the city. People are suffering from water lacking problem.
iii. **Diseases:** Various diseases are broken out for this problem. Water can absorb heat and can keep the environment cool. But now a day, heat stroke is occurred frequently with the increasing temperature. Besides this, dust related problem is also increasing especially in city area. Furthermore, in water logged area, diarrhoea, malaria, dengue and skin diseases are commonly seen.

Recommendation

i. **Awareness development:** The natural drainage and water bodies and its surrounded lands are occupied day by day by the people 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 and if necessary they can involve NGOs for this purpose. Media (both electronic and print) can play a positive role to promote some awareness programme to conscious people about this heated 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 good result towards conservation and improvement of environment.

Conclusion

Water bodies are the life line of the city. These also can be the source of protein and vitamin. A good number of people like fishermen, boatmen and farmer can find their occupation that completely depend on water. But these are haphazardly filled up and encroached by various agencies and individuals for their own benefit that brings sufferings of the people with different problems like water logging and numerous diseases. For our own existence, it is must to protect the water bodies from any kind of unlawful and unplanned random encroachment. To implement this desire all the stake holders should act collectively and cordially. Thus, we will able to conserve the popular motto "Green City, Clean City".

REFERENCES

Ahmed B and Ahmed R (2012). Modeling Urban Land Cover Growth Dynamics Using Multi-Temporal Satellite Images: A Case Study of Dhaka, Bangladesh. *ISPRS International Journal of Geo-Information* **1**, 3-31.

Alom MM, and Khan MZH (2014). Environmental and Social Impact Due to Urban Drainage Problems in Dhaka City, Bangladesh. *International Journal of Engineering and Advanced Technology*, **3** 6, 128-132.

Dani AH (1962). Dacca: A Record of Its Changing Fortunes.

Dhakar Khal (2010). Otit O Bortoman – WBB Trust, March, 2010.

Dhaka North City Corporation (2016). *Available at*: www.dncc.gov.bd *dated 20-5-2016.*

Hossain A and Arifeen HM (2017). Water logging hazard at northern part of Padma bridge adjacent area. *International Journal of Geology, Earth and Environmental Sciences* **7**(1), 47-54.

Islam MS, Rahman MR, Shahabuddin AKM and Ahmed R (2010). Changes in Wetlands in Dhaka City: Trends and Physico-Enviromental Consequences. *Journal of Life Earth Sciences*, **5** 37-42.

Tawhid KG (2004). Causes and Effects of Water Logging in Dhaka City, Bangladesh. TRITA-LWR Master Thesis, Department of Land and Water Resource Engineering, Royal Institute of Technology, KTH, Stockholm.