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Development-Environment Nexus: A Case Study on Dhaka City

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Abstract

Development and environment have a very debatable inter relationship. There are arguments that development has negative correlation with environment and there is still lack of coordination between development and environment. Only sustainable management of resources can ensure long-term development. Bangladesh, as other developing countries, is facing the negative impacts of unplanned development activities. With rapid urbanization and rapid increase of population, Dhaka city is expanding both horizontally and vertically. The land use pattern of the city has been changed for rapid, unplanned development activities and as a result waterlogging situation is observed in the city. Dhaka has been experiencing a gradual increase in waterlogging over the last decade. Waterlogging problem of Dhaka city has worsened over the years due to the destruction of water retention/storage areas both inside and outside of Dhaka city in the name of development. Waterlogging has negative financial as well as other tangible and intangible impacts including assets damage, reduced income, interrupted supply of water, devastated transportation and traffic system, health hazards etc. There is a lack of coordination among the concerned authorities related with waterlogging and a synchronized coordinated collaboration with proper long-term planning among the relevant authorities can only solve the problem.

Keywords: Development, environment, development-environment nexus, sustainable development

1. Introduction

Development and environment have a very intricate relation. Development versus environment debate recurs frequently. 'Environment' can be defined as the entire physical world which includes the land masses, oceans and atmosphere. The definition of 'development' includes the process of growth and change in people's social, political and economic systems. Environment plays a very important role to support life and provide inputs for production which increases the development for any country. There is a mounting concern around the world about the impacts of development activities on environment. There are arguments that economic growth has caused serious environmental damage and that the current state of the environment will constrain future economic development (Thirlwall, 1994). There

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exists a close relationship between development and environment. It is not possible to perform development activities without environmental resources. At the same time, changes in environment also take place when development activities are done. In the developing countries, the poor people also depend on the environment for their livelihoods. It is found from various researches that developing countries are more prone to environmental degradation than the developed countries.

Development activities enable people for their better well-being. Sustainable management of resources can ensure long term development. Unsustainable and unplanned use of natural resources such as land, water, forests can hamper the environment. Although it is well established that there is a correlation between development and environment, it is difficult to create policies which will ensure sustainable development. There is still a lack of coordination between development and environment.

Bangladesh, like the other developing countries, is facing the brunt of rapid unplanned development activities by means of rapid urbanization. Dhaka has been observing unprecedented growth since the independence of Bangladesh. Being the capital, Dhaka has become the centre of both administrative and commercial activities. The city is the most populated city of Bangladesh as well as one of the most populated cities of the world. In 1971, the total population of Dhaka city was 1.5 million, whereas the city has 22.5 million people in 2022 (Dhaka Population 2022). Rural-urban migration is considered as the principal reason behind this. Gross socio-economic disparities among the rural as well as other smaller cities of the country have attracted people to migrate to Dhaka for better livelihood. Better and well-paid job opportunities, better educational, health and other daily life facilities attract the rural-urban migrants from all over the country to Dhaka city (Islam, 1999). This increasing number of population put pressure on the city in various forms including unplanned urbanization, extensive urban poverty, water logging, growth of urban slums and squatters, traffic jams, environmental pollution and other socio-economic problems (The World Bank, 2007). To fulfil the demand of this huge population, the city is developing both horizontally and vertically, which is ultimately affecting the environment and environmental components.

The aim of the present study is to find how the development activities are affecting the environment and its impacts on Dhaka city. The study has taken Dhaka city as a case study and a time period from 1990 to 2020 as study time to find out the impacts. The present study will consider the urban land use pattern change as a result of development activities in Dhaka city and increasing of waterlogging as the impacts of that land use change. The study is qualitative in nature based on both primary and secondary data. Satellite imageries are used as primary source of data to identify how the land use of Dhaka city is being changed. The satellite images are collected from the United States Geological Survey (USGS) website and land use maps are created from these images to observe the sequential changes over time. Interviews of relevant stakeholders are taken for getting information about rapid urbanization and waterlogging in Dhaka city. The secondary information sources

include books, journal articles, daily newspaper, published documents of the government, non-government and international organizations. The paper is divided into six sections including the introduction and conclusion. Following introduction in the first section, the second section deals with the concepts and ideas of the nexus between development and environment. The third section describes the study area of the present research. The fourth section delves with the development activities of Dhaka city i.e., the changes of land use in Dhaka city and finally the fifth section will focus on the impacts of development activities of Dhaka city in the form of changing pattern of waterlogging in Dhaka city and the concerns and consequences related with it. The sixth section concludes the paper.

2. Development-Environment Nexus: Concepts and Ideas

Development is a complex, contested, ambiguous and elusive term which can be defined as bringing about social change which allows people to achieve their human capital. The term is political and the meaning also varies to the context in which it is used. Development is not an outcome, rather it is a process which involves changing from one state to another and often regarded as something that is done by one group to another. Rabie has identified development as an economic concept with positive connotations which involves the application of certain economic and technical measures for utilizing available resources for increasing economic growth and improvement of people's quality of life (Rabie, 2016). Development not only implicates between groups; it also involves nature. Thus, development can be defined as conversion of natural resources which have been taken place throughout the history of human society and increased in pace and complexity with time. As Braudel (2001) states, "The actual situation of a civilization depends, to a significant extent, on the advantages or disadvantages of its geographical space (surrounding environment)". Development was referred to economic growth, a quantitative rather than qualitative change in economic performance, in the 1950s and 1960s. 1970s saw the emergence of a new concept of development which mentioned that as the depletion rate of arable land, water and other natural resources are fast, the rate of economic growth could not be sustained at the then prevailing levels. It is evident from the case of Dhaka that how the urban land use pattern is expanding with population growth and economic development. In 1987, the Brundtland Report was published and made "sustainable development" a key concept and the report warned against the depletion of natural resources and called for economic growth strategies that could be sustained without harming the environment or compromising the welfare of future generations engaged in development (Rabie, 2016). Adams has pointed out the concept of sustainability as the core of the challenge of environment and development, and the ways how the governments, business and environmental groups respond (Adams, 2009).

In the 'Earth Summit' of 1992 the concept of 'sustainable development' was introduced as a global priority. Economic development, social development and environmental development were the three pillars of sustainable development. Then,

most of the countries of the world refreshed their commitments to achieve sustainability. Now-a-days, the major crisis the world is facing includes over population, economic inequalities, unplanned urbanization and excessive resource depletion. Increasing of greenhouse gas emissions, global warming, climate change, biodiversity loss has become major concerns around the globe. To respond to these challenges, in 2015 the 193 members of the United Nations officially adopted the UN Sustainable Development Goals (SDGs) and efforts are well on their way to achieve these goals by 2030. The 11th goal of the SDG is "Sustainable Cities and Communities" i.e., 'make cities and human settlements inclusive, safe, resilient and sustainable' (United Nations). SDG 11 has 10 targets and 14 indicators at the global level. The ten targets of SDG 11 include – (i) adequate, safe and affordable housing; (ii) accessible and sustainable transport system; (iii) inclusive and sustainable urbanization; (iv) safeguarding world's cultural and natural heritage; (v) reducing the number of people affected by disasters; (vi) reducing the environmental impact of the cities; (vii) providing universal access to safe public spaces; (viii) supporting link between urban, peri-urban and rural areas; (ix) increasing integrated policies and plans towards mitigation and adaptation to climate change; and (x) build sustainable and resilient buildings using local material (Sustainable Development Goal 11). The developing countries of the world are facing an unprecedented growth of urban areas due to rural-urban migration which leads to the thriving of mega-cities. The urban areas of the world are inhabited by more than half of the world's population now and rural-urban migration has become a challenge for the whole world too. People are migrating from the rural areas to the urban areas for work or better livelihood both in the developing countries as well as the developed countries. This internal migration has become the principal reason of rapid unplanned growth of cities in the developing countries. In 1990, there were ten mega-cities with 10 million inhabitants or more whereas it is predicted that by 2050, that figure will have risen to 6.5 billion people – two-thirds of humanity (Joint SDG Fund). As a result of these over population, cities of the developing countries are facing major challenges including extreme poverty, environmental degradation and risks due to climate change impacts and natural disasters.

3. The Study Area: The Capital City - Dhaka

Dhaka is located in central Bangladesh at 23°42′N and 90°22′E, on the eastern banks of the Buriganga River covering a total area of 306.38 sq. km. (118.29 sq. mi). As part of the Bengal plain, the city is surrounded by Buriganga, Turag, Dhaleshwari and Shitalakshya Rivers. The city is within the monsoon climate zone having a distinct monsoonal season, and nearly 80 per cent of the annual average rainfall of 1,854 mm (73.0 in) occurs during the monsoon season which lasts from May until the end of September. Rivers and canals of Dhaka city are working as the lifelines of drainage system of the city as well as water reservoir and retention sites and river routes. The drainage system of Dhaka city is facing two extremely unacceptable processes at present which include the encroachment and filling up of the natural drainage khals and wetlands by different vested groups on the one hand

which leads to serious waterlogging in the city and discharging of untreated domestic sewage and industrial effluent on the other which is grossly polluting the water bodies and making them unusable for any intended purpose totally (Parliamentary Standing Committee on Ministry of Environment & Forests, 2010).

Figure 1: Location and administrative map of Dhaka city

Source: Swapan, et al. (2017)

Dhaka is the most populated city of the country as well as one of the most populated cities of the world with a population of 18.89 million people in the Greater Dhaka Area. It is also the 4th most densely populated city in the world. A UN report ranked Dhaka as the 11th most populous city in the world and projected that Dhaka would become the 6th most crowded city by 2030 with a population of over 2.7 crore (The Daily Star, 2014). Dhaka megacity is also one of the most densely populated cities of the world having a density of 11,910 persons per sq. km. (Swapan et al., 2017). Dhaka is the chief economic, political and cultural centre of Bangladesh. One of the most important reasons of the over population of the city is rural-urban migration. About 63 per cent of the total population growth is contributed by in-migration and remaining growth is due to natural increase. According to the World

Bank, Dhaka's urban population is growing at an estimated 4 per cent rate each year since independence, at a time when national population growth rate was at 2.2 per cent (RAJUK, 2015). The rapidly growing population is putting tremendous pressure on the environment of the city.

4. Development Activities Induced Environmental Changes: The Scenario of Dhaka City

Han, Baik and Lee has identified that urbanization creates artificial changes in land use/land cover and creates substantial contrasts in land surface characteristics between urban areas and surrounding rural areas (Han, Baik & Lee, 2014). Dense infrastructures established for development activities reduce the land surfaces in the urban areas. Brookfield has pointed out urbanization as a demand driven unplanned bottom-up process which transforms the existing landscape without considering the possible consequences and requirements for environmental sustainability (Brookfield, 1988). As a result, with urbanization, the impervious surface[2] area of the city increases continuously, while water storage facilities like lakes, canals and other water retention areas decrease which lead to increase surface run off and water congestion. The development and construction work taking place in the urban areas used to change the natural geographical environment of the cities. Urban expansion in the low-lying sub-urban areas is often becoming waterlogged after rainfall, as the rain water cannot be discharged in time due to the location and filling up of the surrounding waterbodies. Urban environment is more compacted and densely populated compared to other areas.

Dhaka is one of the fastest growing cities of the world and could be taken as the best example of human activities induced environmental changes. Increased economic activities in Dhaka is putting immense pressure on the limited land and degrading the environmental conditions. The land use pattern of the city is transforming at an alarming rate. Dhaka is expanding apace, at an average rate of 4.24 per cent per year and is projected to be the third largest megacity in the world by the year 2020 (The World Bank, 2007). Dhaka is becoming urbanized at a very high rate over the past few decades. Being the political, administrative and economic hub, the city has become the centre of all activities. The rapid rise of urban population works as a triggering factor for developing the infrastructure and services which include road networks, water supply, sanitation, sewerage and drainage services and hence expansion of the city towards the surrounding floodplain and low-lying areas (Sultana, Islam & Islam, 2009).

4.1 Land Use Change Scenario of Dhaka City from 1990-2020

For detecting the land use changes of Dhaka city of the last 30 years (1990 – 2020), four images i.e., Landsat TM image of 1990, Landsat TM image of 2000,

[2] Impervious surfaces mean hard surface areas preventing or retarding the entry of water into the soil which gradually cause water to run off in greater quantities or at an increased rate. For more details, Impervious surfaces, Law Insider, https://www.lawinsider.com/dictionary/impervious-surfaces

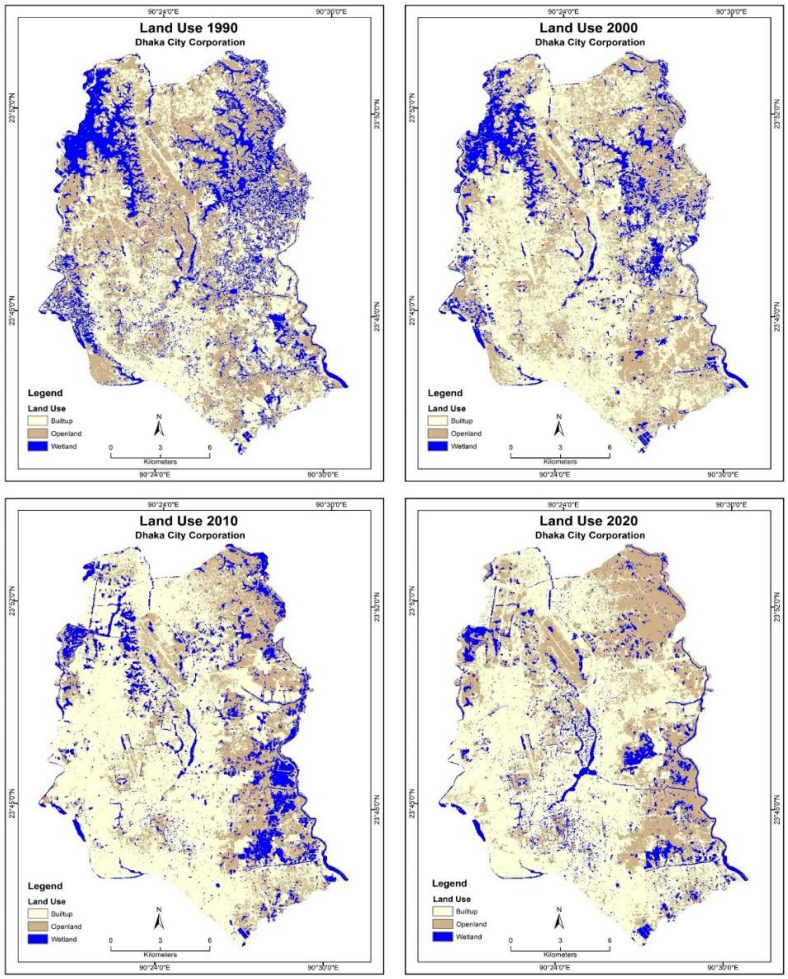
Landsat TM image of 2010 and Landsat OLI image of 2020 have been interpreted (Hossain, 2022). The interpretations of the images present the changing pattern of the land use of Dhaka city.

Table 1: Land use and land cover changes of Dhaka city (1990-2020)

Year	1990		2000		2010		2020	
Land use type	Area (acres)	Area (%)	Area (acres)	Area (%)	Area (acres)	Area (%)	Area (acres)	Area (%)
Built-up	33590.3	44.5	39693.1	52.6	45165.1	59.8	45340.1	60.1
Open Land	26325.8	34.9	25436.0	33.7	20526.6	27.2	22844.0	30.3
Wetland	15563.0	20.6	10350.0	13.7	9787.4	13.0	7295.0	9.7

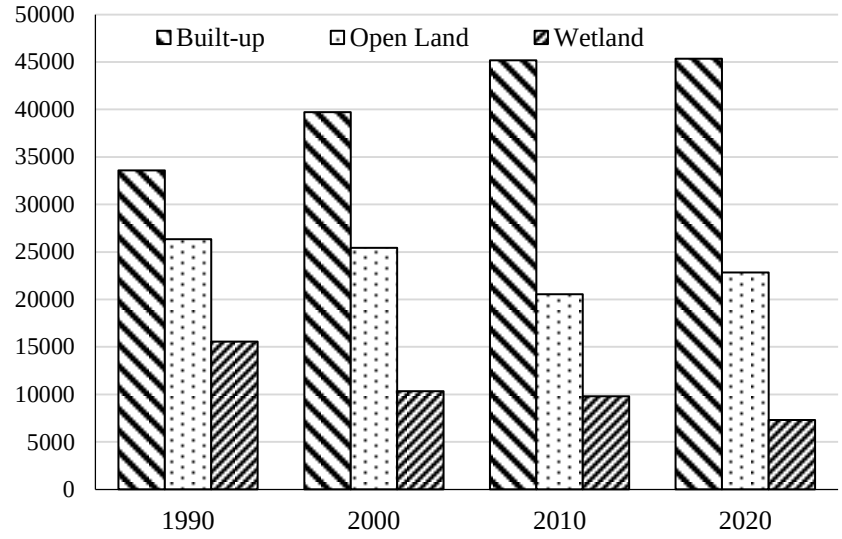
Source: Hossain (2022)

Figure 2: Land use changes of Dhaka city from 1990-2020



Source: Hossain (2022)

Figure 3: Land use changes of Dhaka city 1990-2020



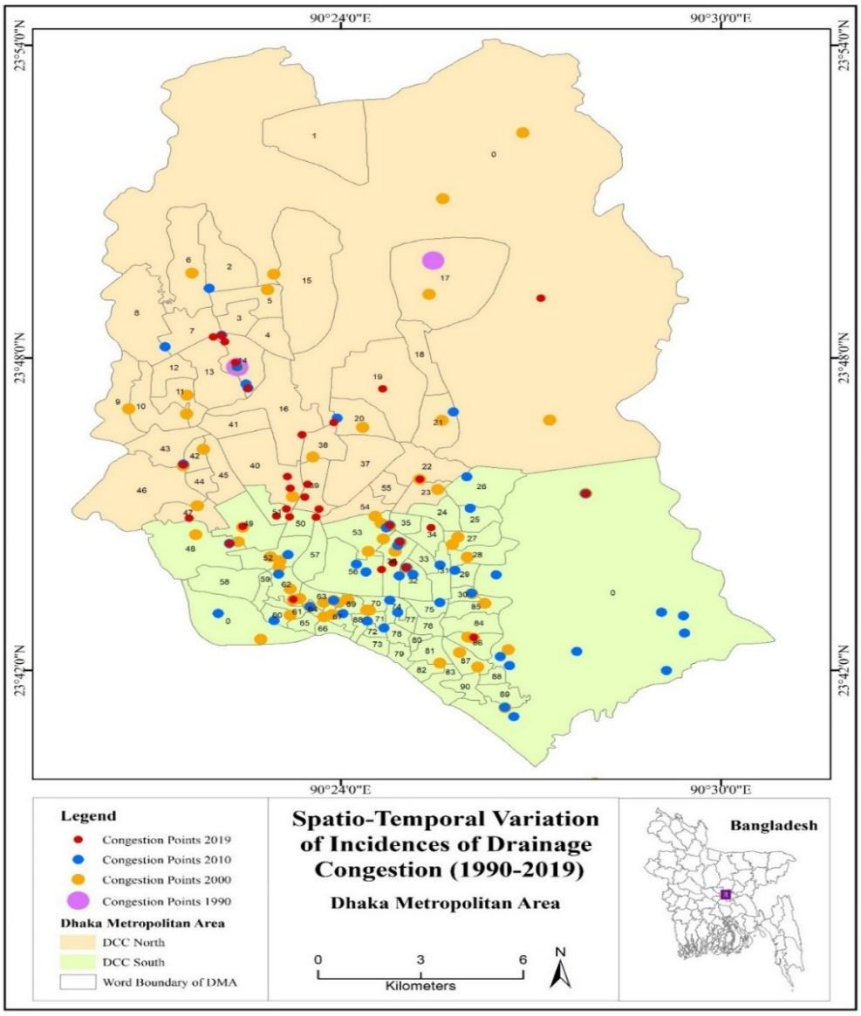
Source: Hossain (2022)

The maps (Figure 2) and statistics (Table 1 and Figure 3) depict how rapidly the land use pattern is changing in Dhaka city over time due to the immense pressure of ever-increasing population and to fulfil their demands. It is seen from the data that the built-up areas are increasing at an alarming rate that is 44.50 per cent in 1990 to 60.07 per cent in 2020. The open land and waterbodies/wetlands are decreasing at the same pace in which the built-up areas are increasing and these built-up areas include residential, commercial, mixed use, industrial, slums and squatters and paved road networks. The wetlands or waterbodies of the city have seen a drastic reduction, i.e., from 20.62 per cent in 1990 to 9.66 per cent in 2020. Dhaka is growing in an uncontrolled and unplanned manner which is creating more congestion. As the lands inside the city have become scarce, the surrounding low-lying areas of the city are becoming prone to conversion which is gradually hampering the environment of the city.

5. Impacts of Development Activities in Dhaka City: Concerns and Consequences of Waterlogging

It is mentioned earlier that the waterlogging situation of Dhaka city will be considered as the impact of development activities in the city. The Annex Table A1 and Figure 4 depict how waterlogging prone areas are increasing in Dhaka city in ten years' interval. The table and figure portray those new areas which are becoming prone to waterlogging with the existing locations and the rate of increasing is very high. The available information shows a very limited number of areas were prone to waterlogging in the 90s whereas in 2019 there is an enormous increase in the waterlogging prone areas in Dhaka city.

Figure 4: Location of waterlogging prone areas in Dhaka city (1990-2019)



Source: Compiled information from the Daily Ittefaq, the Daily Sangbad, Prothom Alo, the Daily Star and Dhaka Tribune

The present section will deal with the impacts of development activities i.e., unplanned urban expansion and the concerns and consequences related with its impacts in the form of waterlogging in Dhaka city.

5.1 Concerns of Waterlogging in Dhaka City

5.1.1 Changes of Land Use and Its Impacts on Waterlogging of Dhaka City

The changes of land use are affecting the waterlogging scenario of Dhaka city. The rapid conversion by development activities and infrastructure building inside the

city has affected the natural drainage systems which were used as runoff[3] earlier. Conversion in the water retention sites (low-lying areas/waterbodies located in surrounding areas of the city) in the name of development and infrastructure building also have detrimental effects. As a result, waterlogging has become a very common chronic problem in Dhaka city during the monsoon period as well as all the year round. Dhaka has been experiencing a gradual increase in waterlogging over the last decade. Moderate to heavy rain causes serious drainage problems in many parts of the city.

5.1.2 Dysfunctional Drainage System

With rapid urbanization and rapid increase of population, Dhaka city is expanding both horizontally and vertically. The population of Dhaka city is increasing at a very high rate and this increased population is putting tremendous pressure on different utility services. Drainage system is one of such facilities. As a result of this pressure, problems like waterlogging have now become a crucial problem for the city. The main canals that drain water to the nearby waterbodies have been grabbed by land grabbers for establishing settlements for the people migrating from the other parts of the country. Apart from this, culverts, box culverts and drains have been obstructed due to lack of maintenance. Experts have opined that the storm-water drainage system of the city is inadequate and only capable of dealing with 20 mm of rainfall and the streets get waterlogged if the rainfall exceeds 40 mm (The Daily Star, 2017). As a result, there is a lack of outlets for the rainwater to pass. For this, even a little rain causes serious problems in many parts of the city on every occasion and can create waterlogging situation for several days which in turn causes huge infrastructural damages. The drainage system in the capital is dysfunctional due to the clogging of the drains.

5.1.3 Lack of Sustainable Initiatives

No sustainable initiative has been taken to address the waterlogging problem of Dhaka city. The waterlogging in the city normally occurs due to unplanned infrastructure development, insufficient or limited drainage systems, blockage of drains. Lack of consciousness of the inhabitants, unplanned build-up of areas within the city, filling up off the canals, lake and waterbodies in areas which are mainly acquired by housing companies and brick burning industries within and around the city make the scenario graver and complex. Elimination of local water storage areas by land filling is one of the major causes of rainfall flooding and waterlogging in many locations of Dhaka city. There is a lacking of proper implementation of any of the city development plans for Dhaka city including the Detailed Area Plan (DAP) of Dhaka by the city development authority Rajdhani Unnayan Kartripakkha (RAJUK). A large number of drainage channels, water reservoir and flood flow zones inside and surrounding Dhaka city have been filled up by construction activities whereas the Flood Action Plan and DAP have

[3] Runoff occurs when there is more water than land can absorb. For details, Runoff, National Geographic, https://www.nationalgeographic.org/encyclopedia/runoff/

mentioned that the city should have 5,523 acres of conserved water retention areas, 20,093 acres of canals and rivers and 74,598 acres of flood flow zones (The Daily Star, 2017).

5.1.4 Lack of Maintenance and Management of Existing Infrastructure

The Dhaka City Corporations (DCC) and Dhaka Water Supply and Sewerage Authority (DWASA) were mainly responsible for water discharge and maintenance of drainage lines across the city. On the other hand, RAJUK is responsible for preserving wetlands and floodplains around the capital where the rainwater is discharged. But, RAJUK has failed in its duty to preserve the wetlands and floodplains around the city. Most of the two and a half thousand ditches and waterbodies which were located across Dhaka city found in the DCC statistics have been either grabbed or filled up with waste. The blockage in drainage system is also caused by improper maintenance of existing drainage system and the disposal of solid waste into the drains which gradually increases the waterlogging of the city. A total of BDT 303 crore has been spent between 2012 – 2015 for reducing the waterlogging problem of the capital city (The New Nation, 2015). The Dhaka WASA has taken up a BDT 550 crore project for canal development to solve the waterlogging problem of the capital (The Daily Star, 2018). But, the results of these projects are not satisfactory and the waterlogging situation of Dhaka city has not seen much improvement.

Waterlogging due to drainage congestion has almost become a regular phenomenon. Drainage system of Dhaka apparently failed as the city sees frequent water congestion even after a brief shower. The increased waterlogging which is seen every year during the monsoon season are triggered due to poor drainage systems, mismanagement in pipeline renovation work and unplanned infrastructure development. This situation deteriorates more for the inadequate conveyance capacity of the sewer system because of solid waste accumulation in the sewers. As most of the canals are grabbed or filled up with illegal dumping of wastes and due to the poor drainage system in Dhaka city, waterlogging remains persistent.

5.1.5 Lack of Capacity of Existing Infrastructures

The people of Dhaka city are suffering for waterlogging during the monsoon in spite of various plans, projects and programmes taken by the authorities. Extensive waterlogging takes place from May to October every year during the monsoon season due to the result of rapid and unplanned urbanization in the city and surrounding areas. So, the waterlogging situation of Dhaka city has reached to a dangerous magnitude with the rapid urbanization and increase of infrastructure, reduction of water retention areas inside and outside of the city. In an interview, the Director (Technical) of Dhaka WASA mentioned that the drainage lines of Dhaka city were designed taking the record of 100 years rainfall intensity data and they are designed for 30-40 mm rainfall per hour, but when it rains for more than this it takes time for the water to pass through the lines and

waterlogging is generated.[4] According to the researchers of urban studies, now-a-days half of the city becomes waterlogged, if it rains 30-50mm. Climate change has played a vital role in changing the climate behaviour of Bangladesh, consequently increasing the extreme rainfall events of the Dhaka city. According to a newspaper report street went under water with only 41 mm rainfall in Dhaka in July 2021 (The Daily Star, 2021). The waterlogging situation has become so grave that a mere amount of 41 mm of rainfall creates havoc in the city and different types of hazards are also associated with this waterlogging which are hampering the life and livelihoods of the people of the city.

5.2 Consequences of Waterlogging in Dhaka City

5.2.1 Tangible Damages Due to Waterlogging

City dwellers are experiencing severe waterlogging after a little rainfall which damage assets, buildings, reduces income, interrupted supply of water, devastated sanitation system. Unfortunately, these damages are not insured, as such there is no scope of compensation or incentive from either government or any other organizations. Households in the slums and people living in the ground floors used to face loss and damage of household assets. In the business sector, there is a decline in number of customers and sales as well due to lack of transportation facilities. Damages of products are also reported due to inundation.

5.2.2 Intangible Damages Due to Waterlogging

Waterlogging in Dhaka city comes along with disruption of transportation and traffic movement. Normal traffic movement faces obstructions during waterlogging and creates heavy traffic jam in the city which wastes valuable time of people. Income loss due to inaccessibility to workplaces due to abrupt disruption of the transportation and traffic system is inevitable when waterlogging takes place. This happens mainly to the people engaged in the informal sectors. Apart from these materialistic damages, people become affected with various waterborne diseases. Prevalence of diseases are reported during waterlogged period rather than non-waterlogged period. The increase of diseases increases the medical related expenditures. In the slum areas, high risks remain with damaged sanitation system. Psychological stress and the loss of trust in authority are also identified as intangible impacts suffered by the affected households during the waterlogging period (Nithila, Shome & Islam, 2022). Different types of wastes including, medical wastes, industrial wastes, garbage and wastes of streets and drains get mixed with the water of the waterlogged areas which pollute the stagnant water as well as result in inconvenience, odour, breeding sites for disease vectors like mosquitos, water borne diseases, skin diseases, etc. Increased number of diseases such as cholera, diarrhoea, typhoid, amebiasis, hepatitis, gastroenteritis, giardiasis, campylobacteriosis, scabies and worm infections are seen when the pathogenic microorganisms, their toxic exudates and other contaminants together become active (Hossain, Islam & Aktaruzzaman, 2020).

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[4] Information collected from the interview with Director (Technical), Dhaka WASA.

5.2.3 Financial Impacts of Waterlogging

The waterlogging problem also has negative financial impacts. According to a World Bank study published in November 2015, even without climate change, likely damage from waterlogging in Dhaka by 2050 is BDT 11,000 crores and in a changing climate with more intense rainfalls, the loss will be BDT 139,000 crores between 2014 and 2050 (The World Bank, 2015). Government has handed over the responsibility to tackle the waterlogging of Dhaka city from DWASA to the two city corporations. The two city corporations have taken short and mid-term solution strategies for managing the waterlogging of Dhaka city. The two city corporations of Dhaka spend around BDT 2 billion to BDT 3 billion every year for resolving waterlogging problems of the city, but to no avail (Hossain & Mostafa, 2020). According to a news, the two city corporations have spent around BDT 13.16 billion for the construction and repairing of drains to address the water logging problem whereas DWASA has spent around BDT 1 billion on this purpose (Hossain & Mostafa, 2020).

The waterlogging situation of Dhaka city has reached to a dangerous magnitude with rapid urbanization and increase of infrastructure, reduction of water storage or retention areas in the name of development inside and around the city. Waterlogging has both direct and indirect negative physical, social, economic and environmental consequences and demands robust and well-planned actions for its solution. There is a lack of coordination among the concerned authority related with this menace. An effective synchronized collaboration among the concerned authorities can help to improve the waterlogging situation of Dhaka city.

6. Conclusion

There is a constant argument between development and environment. Environment should not be considered as an obstacle for development rather environmental conservation and development should proceed in a unanimous way. The inter relationship between development and environment is not to contradict, but to complement each other. Development that preserves natural environment or sustainable development is the best solution of the development-environment debate. Sustainable development increases economic benefits as well as curb negative impacts of development activities on environment. The environmental damages created by development activities have got increased recognition and there is a pressing need around the world for combining environment in development activities. Both development activities and environmental protection is important as one is required for poverty reduction and country's development and another one is required for the long-term future prospects. Developing countries face difficulties to have a balance between development activities and environmental concerns.

Dhaka, being the capital of a developing country, is the best example of negative consequence of development-environment inter-relationship. Being the center of all activities and destination of the most of internal migrants, Dhaka faces the brunt of over population. To serve and fulfill the demand of the enormous number of

populations, the development activities, which are taken, sometimes become detrimental for environment. In Dhaka, due to the demand of people, the land use pattern is changing very frequently, which is affecting the environment of the city. Waterlogging, an indirect affect, as a result of the development activities has become chronic problem for the city. A well-crafted planning including all the stakeholders and proper implementation of that plan is necessary for solving the waterlogging problem of the city.

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Annex

Table A1: Location of waterlogging prone areas in Dhaka city (1990-2019)

Year	Location
1990	Kazipara, Khilkhet
2000	Hoseni Dalan, Nimtoli, Bakshi Bazar, BUET Staff Quarters, Nazirabazar, Kazi Alauddin Road, Khaje Dewan, Mouchak, Rampura, Jigatola, Rajarbagh Police Line, Government Laboratory School, Nayem, Farmgate, Mogbazar, Dhanmondi, Mohakhali, Motijheel, In front of Prime Minister's Office, Paikpara, Kazipara, Kallayanpur, Madartek, Shyamoli, Basabo, Malibagh, Shantinagar, Shiddeshwari, Polashi, New Market, Nazimuddin Road, Urdu Road, Gandaria, Jatrabari, Lalbagh, Jurain, Mir Hajir Bagh, Central Jail, Golapbagh, North Jatrabari, Manikbagar, Khilgao, East Rampura, Badda, Satarkul, Noyanagar, Kuril, Uttarkhan, Dakshinkhan, Mohammadpur, Katasur, Rayer Bazar, Shyamoli, Pollobi, Kalapani, Gabtoli, Kakrail, Old Dhaka, Inside DND (Pagla, Noyamati, Nischintapur, Shimrail,Kodomtoli, Jalkuri, Chitashal, Nurbagh, Delpara, Shahi Mahalla, Kutubpur)
2010	Kazipara, Motijheel, Arambagh, Dainik Bangla Mor, Motsyo Bhaban, Malibagh, Mouchak, Bonoshree, Gopibagh, Maniknagar, Mugda, Komlapur, Chamelibagh, Rajarbagh, Manda, Goran, Khilgao, Segunbagicha, Jigatola, Mirpur, Shewrapara, Mohammadpur, Mirpur 10 no. Golchottor, Rokeya Sarani, Hoseni Dalan, Khaje Dewan, Azimpur Colony, Abul Hasnat Road, Joginagar Lane, Kaptanbazar, Noyabazar, Tatibazar, French Road, Kamrangir Char, urain, Inside DND (Sarulia, Dogair, Deila, Gobindopur, Rasulpur, Daulatpur, Munshibag, Adarshanagar, Kandapara, Sahebpara, Sanarpar, Bagmara, Mouchak, Kutubail, Noyamati, Chanmari, Shahidnagar), Donia, Shyampur, Matuail, amtoli, hajinagar
2019	Dhanmondi, Malibagh, Jahangir Gate, Mohammadpur, parts of Indira Road, Mirpur Road, Tejgaon, Panthapath, Kalabagan, Jhigatala, Shankar, Jatrabari, Bashundhara Residential Area, Old Dhaka, Shajahanpur, Nayapaltan, Khilgaon, Kazi Nazrul Islam Avenue, Karwan Bazar to Banglamotor, Motijheel, Nayapaltan, Green Road, Shewrapara, Rampura, Mirpur-10, Banani-11, Rajarbagh, Tejgaon, Purana Paltan, Tejturibazar, Karwan Bazar, Monipuri para, Senpara, Kazipara, Indira Rood, Begum Rokeya Sarani, old Dhaka and small scattered areas all around the city.

Source: The Daily Ittefaq, The Daily Sangbad, Prothom Alo, The Daily Star and Dhaka Tribune.