

Environmental Challenges Associated with Land Use Plan in Dhaka City

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Abstract – Urban services and quality of life measurements show that Dhaka has a lot to do to become more livable and many competing priorities to achieve that goals. In this research the basic socioeconomic development goals and environmental problems while the land use plan is being developed are studied in Dhaka City. At first problems about land management resulting from the existing land use types and then quantitative and geo statistical analyses in Dhaka City, national plans and government policies have been evaluated. As a results, the most significant environmental problems regarding land management in Dhaka City appear to be seismic movements, floods and stability problems. If the high population density and anthropogenic pressures in the region are taken into consideration, it can be clearly perceived that it would be much more convenient and sustainable to simply abstain from any construction in low-resilience areas rather than trying to take structural measures after enhancing construction there. On the other hand, above 50% of Dhaka is low-lying and inundated during the monsoon season. Encroachment of rivers and canals, construction in floodplains and filling up of wetlands maximizes flood risk and increases the elements of risk by making environmental threats much more complex.

Keywords: Socioeconomic development, Land use plan, Environmental Problems

1. Introduction

Dhaka is one of the world's most populous megacities and a major contributor to Bangladesh's economic transformation. But the city faces growing challenges to its economic competitiveness, overall livability, and social inclusion. Land use plans are essentially zoning plans which outline the future location and type (residential, office, retail,

industry) of development activity that is to be permitted and not permitted within urban and regional areas over a set horizon period (normally 5-15 years). Urban services and quality of life measurements show that Dhaka has a lot to do to become more livable city. So it is necessary to consider the basic socioeconomic development goals and environmental problems while the land use plan is being developed in Dhaka City.

The Aim of This Study

The main aim of this study is to realize the most significant environmental problems regarding existing and future land use plan in Dhaka City. Problems of land use in the study area have been determined. The most important anthropogenic pressures in the region are taken into consideration, and some suggestion and alternatives that the government must consider for prevention of environmental degradation are mentioned. Developing a number of alternative urban centers in surrounding areas especially in the northern part of the city in order to mitigate the pressure resulting from urbanization and industrial mobility over Dhaka Metro North and Dhaka Metro South is another key component that will outline the future changes in land use.

Materials and Methodology

While determining problems about land management resulting from the existing land use types, at first, current land use plans have been examined, and quantitative and geostatistical analyses have been conducted. After that, other studies on the topic, national plans and government policies have been evaluated. A number of meetings and workshops have already been held to gather the opinions of the relevant institutions and individuals regarding the content of the plan/programme suggested with in the context of land use plan and environmental problems in Dhaka City. The current land use plans of Dhaka City have been examined and then quantitative and geostatistical analyses have been conducted. Population distribution and density in Dhaka Structure Plan (2016-2035) which is prepared by RAJUK, 2015, was examined and then the challenges related to this plan were expressed.

In addition to assessing previous plans and conducting fieldwork studies to make direct observations in study area, geographical information system (GIS) has also been utilized. The main factors that pose a threat to environment have been evaluated in this study on the basis of the current land use plans and the basic land use trends in Dhaka.

In this research, the study area is divided into ten sections as: Bandar, Dhaka Metro North, Dhaka Metro South, Gazipur, [Khilgaon](#), [Keraniganj](#), Narayanganj, Rupganj, Savar and Sonargaon.

Socioeconomic Development Goals

The Socioeconomic Development Goals are the blueprint to achieve a better and more sustainable future for all in a society. Some of growing challenges that Dhaka City is facing along with its development are poverty, inequality, climate change, environmental

degradation, peace and justice. The following table demonstrates the categories of socioeconomic development goal indicators that the government must consider to have a more livable city.

Table 1. Socioeconomic development goal indicators

SOCIOECONOMIC DEVELOPMENT GOAL INDICATORS	
Demographic Indicators	
Population density	Net migration rate / Urbanization level
Employment Indicators	
Unemployment rate / Employment rate	Proportion of working age population (aged 15-64) to total population
Labor force participation rate / Average daily income	Proportion of employment in agriculture and manufacturing sector to regular employment
Proportion of active working population under social security coverage to total population	Average daily income for women
Education Indicators	
Literacy rate / Secondary education schooling rate	Proportion of literate women population to total population of females
Proportion of higher education or college graduates to total population aged over 22	Schooling rate for vocational and technical high schools
Health Indicators	
Hospital beds per 100 thousand people	Number of dentists per 10 thousand people
Number of physicians per 10 thousand people	Number of pharmacies per 10 thousand people
Competitive and Innovative Capacity Indicators	
Share of Dhaka's exports in total exports of the country	Export amount per person

Share of manufacturing industry in the national GDP	Manufacturing industry electricity use per person
Proportion of the surface area used for production in organized industrial zones to total surface area of the country	Share of small and medium-sized enterprises in total number of enterprises in the country
Domestic share of total capital holdings of newly established companies	Foreign-invested companies per 10 thousand people
Trademark application per 100 thousand people	Patent application per 100 thousand people
Proportion of masters and PhD graduates to total population aged over 30	Agricultural production per person in rural areas
Domestic share of total bed capacity of the facilities holding tourism operation licenses	Domestic share of investments with incentive certificate
Financial Indicators	
Domestic share of bank loans borrowed in Dhaka	Domestic share of saving deposits in Dhaka
Bank deposit per capita / Domestic share of tax revenues in Dhaka	Per capita budget revenues
Accessibility Indicators	
Proportion of asphalt roads in rural areas	Distance of densely populated areas from the airport
Distance of densely populated areas from the other public transport points / stations	Broadband subscribers per household
GSM subscribers per household / Railway coverage ratio (total length of tracks/ country area)	Ton/ km values for highways /airways / waterways
Life Quality Indicators	
Gross rentable shopping-mall area per one thousand people	Proportion of population covered by sewage network to total population
Proportion of population provided with	Proportion of population covered by waste

qualified drinking water to total population	collection services to total population
Proportion of population who have access to recreational areas within walking distance to total population	Private cars per10 thousand people
Average sulphur dioxide (SO ₂) and particulate matter (PM) value	Proportion of uninsured people in total population
Convicted persons per100 thousand people	Suicidecases per100 thousand people / Household electricity use per person

Curent Land Use Plan of Dhaka City

Dhaka, country's capital, is located at the centre of the Bangladesh. It is the world's fastest growing megacity. In this research, the study area is divided into ten sections as: Bandar, Dhaka Metro North, Dhaka Metro South, Gazipur, [Khilgaon](#), [Keraniganj](#), Narayanganj, Rupganj, Savar and Sonargaon. Figure 1 demonstrates the districts of Dhaka City.

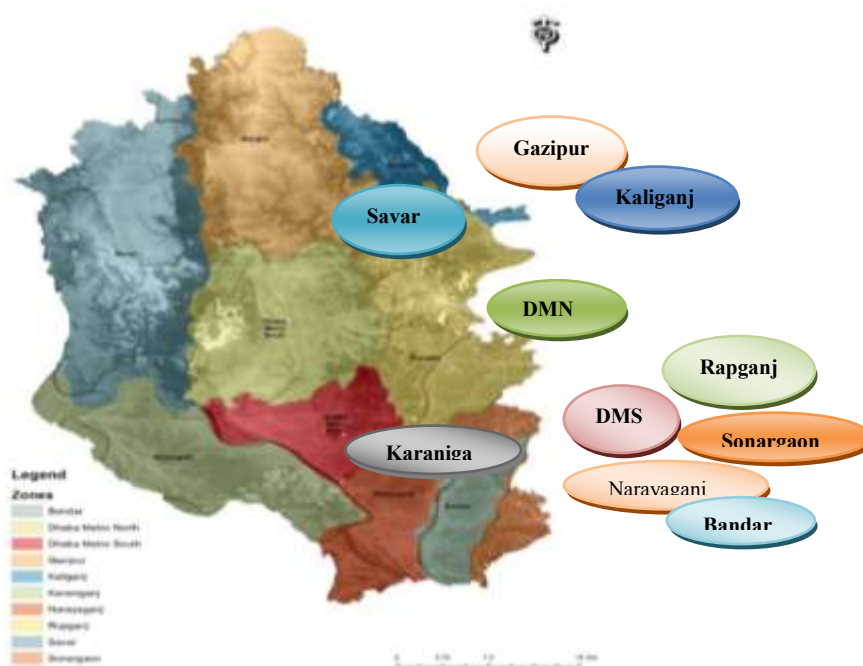


Figure 1. Districts of Dhaka City

Population distribution and density in Dhaka Structure Plan (2016-2035)

Population distribution is about how people are spread across a region. When Dhaka Structure Plan (2016-2035) is evaluated, it can be clearly seen that the existing and prospective population of the city concentrates in the area comprises of Dhaka Central (DMS&DMN), Northern, Western and Southern regions. Population distribution and density in different regions of Dhaka City is given in Figure 2.

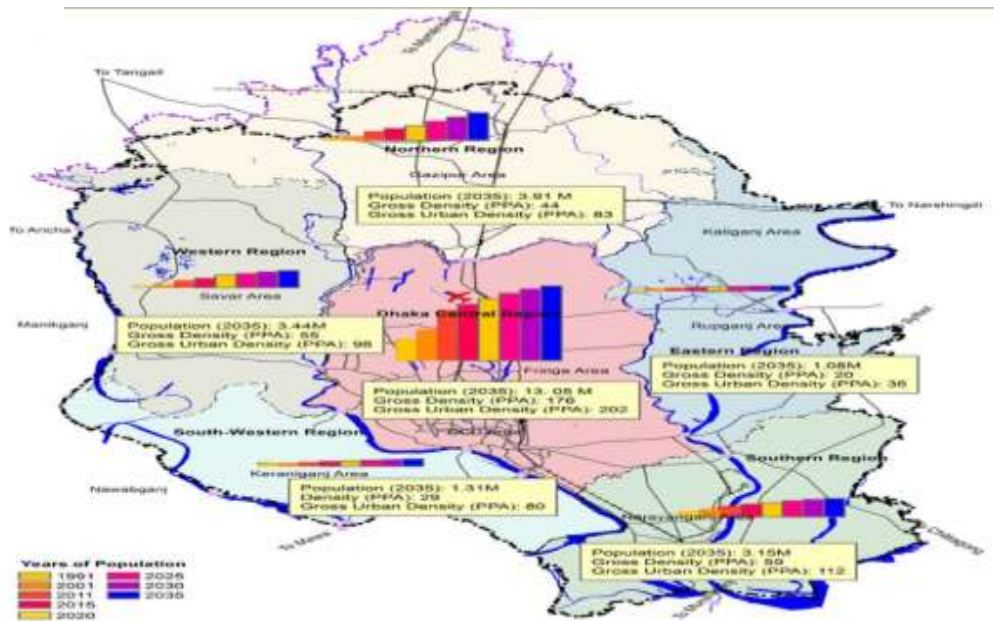


Figure 2. Population distribution and density in different regions of Dhaka City

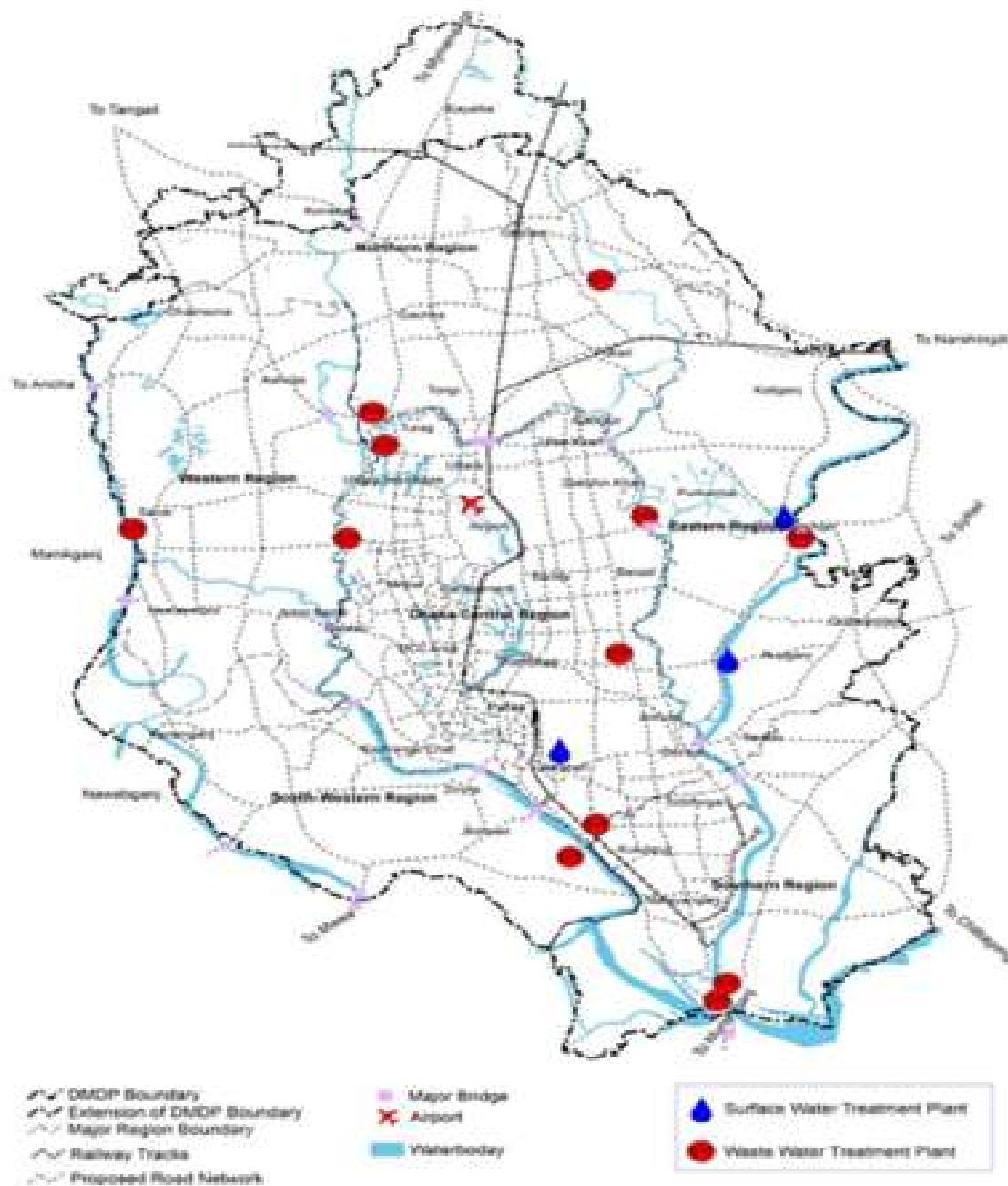
Challenges of Land Use Plan in Dhaka City

There are some problems of land use plan in different regions of Dhaka City. These problems are as follow:

- Access to education facilities is inconvenient in some areas.
- There are no designated university, institute and [Research and Development](#) zones.
- Some health care facilities are not located in easily accessible areas to the existing and prospective population.
- Industrial facilities -especially the brickfields- are located mostly in fire-prone and flooding zones.
- In the public transport plans prepared for the populous Dhaka Metro North and Dhaka Metro South regions, hydraulic potential of the area is not taken into consideration sufficiently.

- Existing sewage networks are not appropriate in accordance with the climate conditions of the region.
- As demonstrated in Figure 3, enhancing drinking water supply trend by monitoring groundwater use, increasing the quantity of surface water, and establishing water treatment plants in strategic areas by taking especially prospected population density into account seem to be an urgent need.

Figure 3. Prospected locations of water treatment plants



According to information gathered from observational environmental research and previous plans, choosing methods such as sorting in the source, recycling and recovery over storage in waste treatment, increasing public awareness, and developing alternative waste storage areas by rehabilitating uncontrolled waste disposal areas are urgently needed in Dhaka.

- There are almost no alternative recreational areas planned especially in currently and prospectively populous districts.
- There lacks sufficient legislation on where industrial facilities as sources of emission can operate, environmental impact assessment processes have not been properly handled in many cases, and use of newer Technologies has not been popularized yet.
- The number of vehicle inspection stations in the strategic areas where the number of vehicles is relatively high is not sufficient enough, and thus, monitoring system is very poor. The main problems regarding land management determined by taking socioeconomic goals into account can be presented in this way. Apparently, the most important environmental problems for land use planning in study area stem from seismic, hydraulic and geological factors. Such that, as Figure 4 clearly demonstrates, many faults (red lines are fault lines in the figure) run under highly populated areas in Dhaka. Figure 5, on the other hand, presents the major rivers, other types of water bodies and surface faults (yellow lines) in the city.

An evaluation of the geology, geomorphology and hydrology of the region indicates that a stability problem seems inevitable in and around the wetlands and water bodies of Dhaka. In sum, the most significant environmental problems regarding land management in the study area appear to be seismic movements, floods and stability problems. In the case that the aforementioned problems emerge, partly controlled point and non-point pollutants may spread over the city and its vicinity, and make direct and indirect impacts. If the high population density and anthropogenic pressures in the region are taken into consideration, it can be clearly perceived that it would be much more convenient and sustainable to simply abstain from any construction in low-resilience areas rather than trying to take structural measures after enhancing construction there.

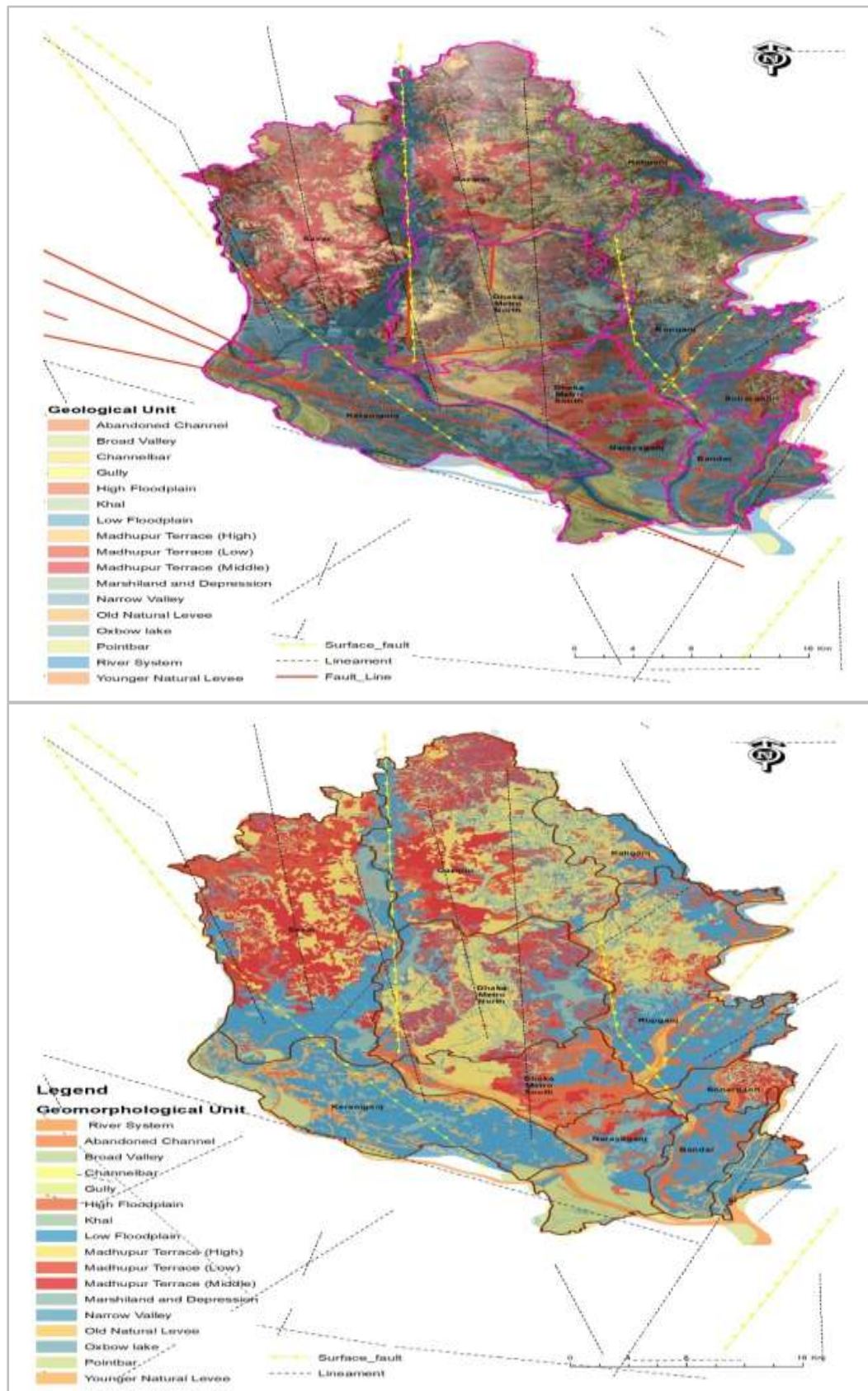


Figure 4. Faults and lineaments in Dhaka City

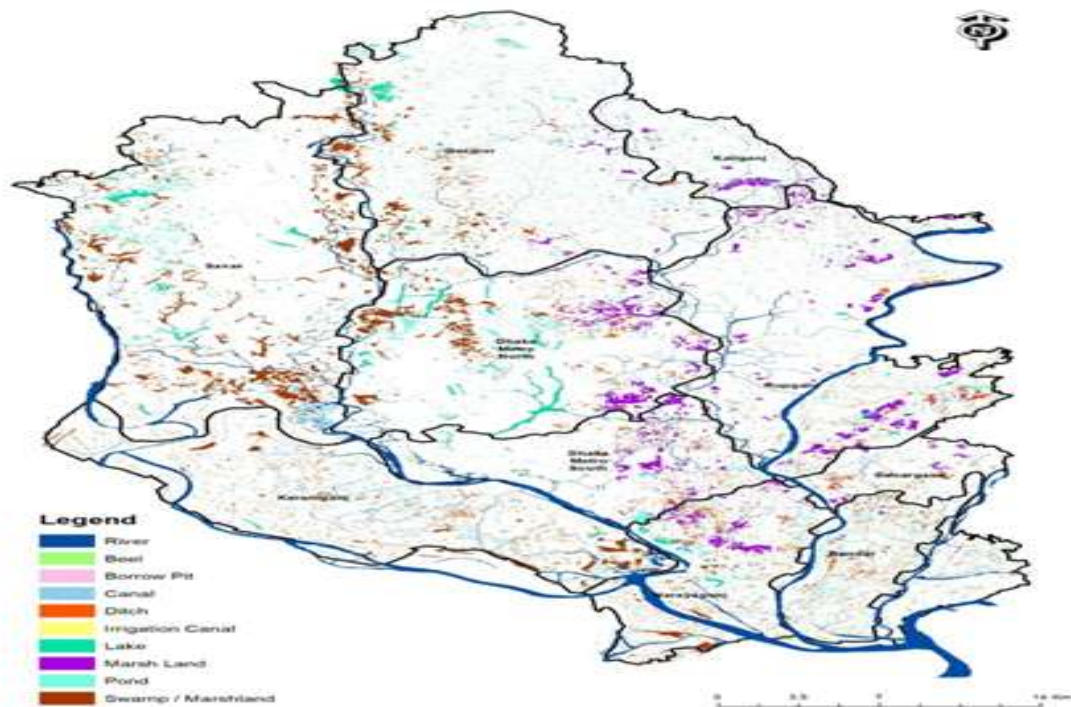




Figure 5. Major rivers and other types of waterbodies in DhakaCity

Evaluation of the Basic Land Use Trends in Dhaka

The main factors that pose a threat to environment in study area have been evaluated on the basis of the current land use plans and the basic land use trends in Dhaka. In addition to assessing previous plans and conducting fieldwork studies to make direct observations in study area, geographical information system (GIS) which is arguably one of the greatest steps for ward in terms of geographical information use ever since the invention of geographical maps have also been utilized. GIS' scope of application has been expanding rapidly, and this tool helps decision makers significantly by making policy decisions easier to take and solving the existing problems regarding land use management in the fastest way possible, all over the world. Basically, GIS is a computer-based tool that analyzes stores, manipulates and visualizes geographic information, usually in a map. On the most basic level, GIS technology is used as computer cartography that is for straight forward map making. The real power of GIS, however, is through using spatial and statistical methods to analyze attribute and geographic information. Methods used in GIS are briefly presented below:

Topography and DEM Files

	<p>In this study, contours have been obtained from DEM (Digital Elevation Model) file. The linear elevation data with a precision of 0.3 m to be used in the later steps of study for the purposes such as hydrological analysis, 3D visual effect creation, and so on.</p>
	<p>By following the polyline of a particular contour, one can identify which location has the same value. Contours also offer a useful surface representation. Because they allow one to simultaneously visualize flat and steep areas (distance between contours) and ridges and valleys (converging and diverging polylines).</p> <p>The example on the left shows an input elevation dataset and the output contour dataset. The areas where the contours are closer together indicate the steeper locations. They correspond with the areas of higher elevation (in white on the input elevation dataset).</p>

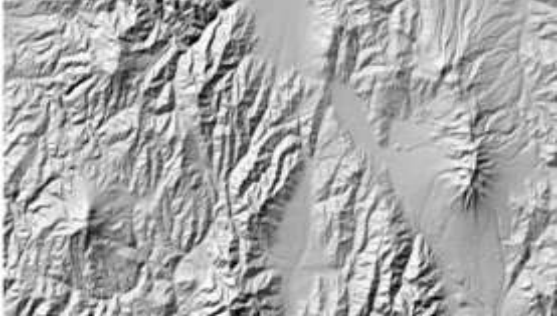
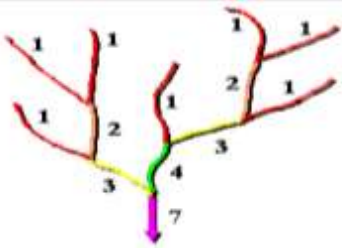

Georeferencing

Georeferencing means the internal coordinate system of a map or aerial photo image or any raster or vector data may be related to a ground system of geographic coordinates. Some vector data (zones, ring roads, fault lines, etc.) used in GIS analysis of this study have been obtained by digitizing raster data provided by previous studies.



Hillshade

A hillshade is a grayscale 3D representation of the surface, with the sun's relative position taken into account for shading the image. This function uses the altitude and azimuth properties to specify the

	<p>sun's position.</p>
<p>Hidrological Analysis (Proposed Flood Area by HecRAS)</p>	
<p>Firstly, detailed hydrological analyzes have been conducted in the study area including capillary rivers, and these have been sorted according to their flow directions, basin feeding areas, sizes and flow orders. Such that the algorithm used by the Stream to Feature tool is designed primarily for vectorization of stream networks for any other raster representing a rasterlinear network for which directionality is known. Stream ordering is a method of assigning a numeric order to links in a stream network. This order is a method for identifying and classifying types of streams based on their numbers of tributaries. Some characteristics of stream can be inferred by simply knowing their order. As a result of the analysis. 11 flow order details have been obtained, but inundation area estimation has been made only for the major/big rivers in this study.</p>	 

Conceptual Model of GIS

Existing and proposed strategic locations for open spaces in Dhaka Metropolitan Area (DMR) which is prepared by RAJUK, 2015 are given in Figure 6.

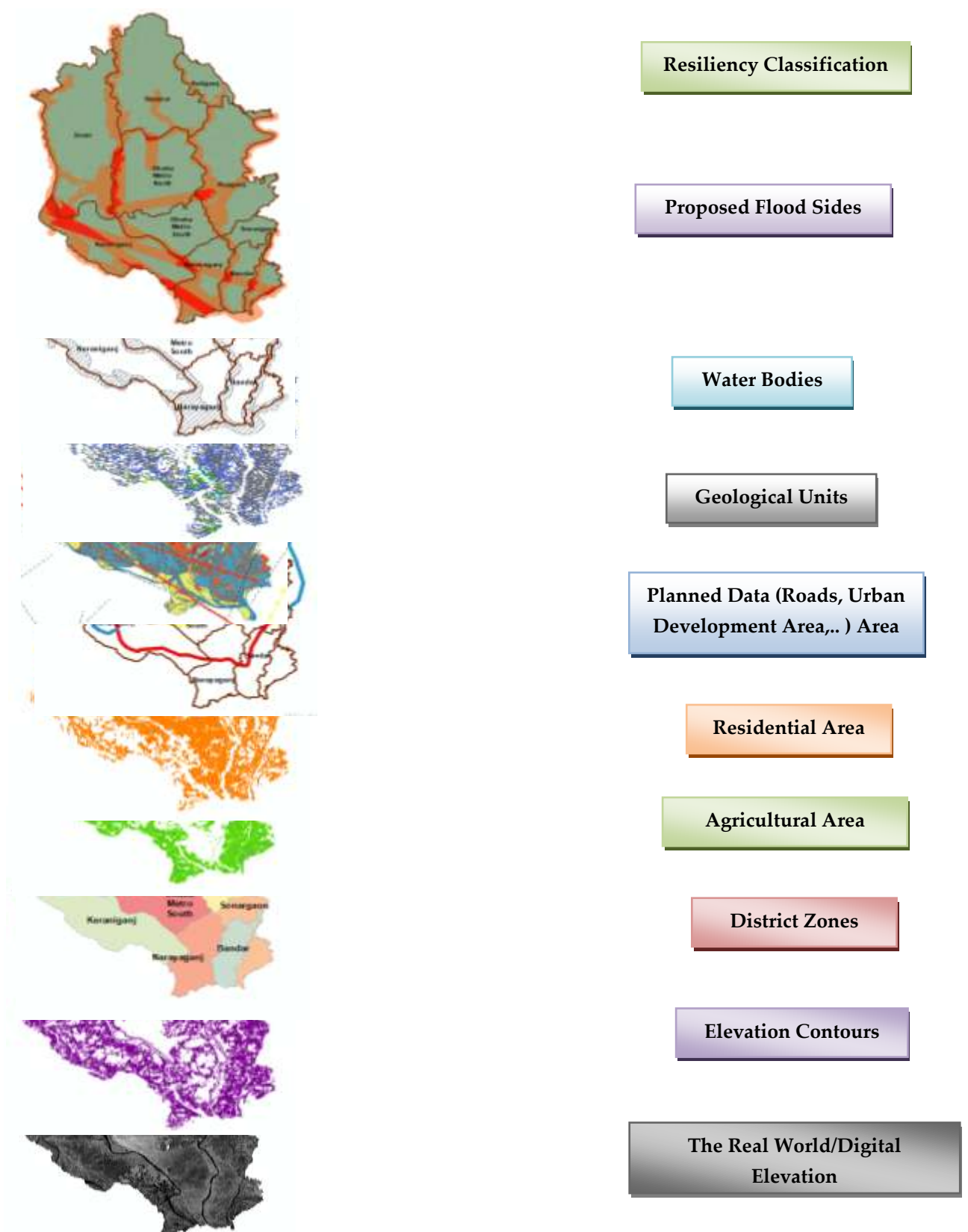


Figure 6. Existing and proposed strategic locations for open spaces in DMR

The matic map below demonstrates not only the changes in land use during the previous decades (1967-2010) but also the outcomes of the implementation of previous land use plans as well as the geomorphological situation resulted from the flood disasters that took place in the past. As the figure presents, amount of Agricullture/ vegetation regions (green regions) are drastically reduced and settlements/urban developed areas (red regions) is severely increased in DMR.

Thematic maps below demonstrate the changes in land use during the previous decades in Dhaka City.

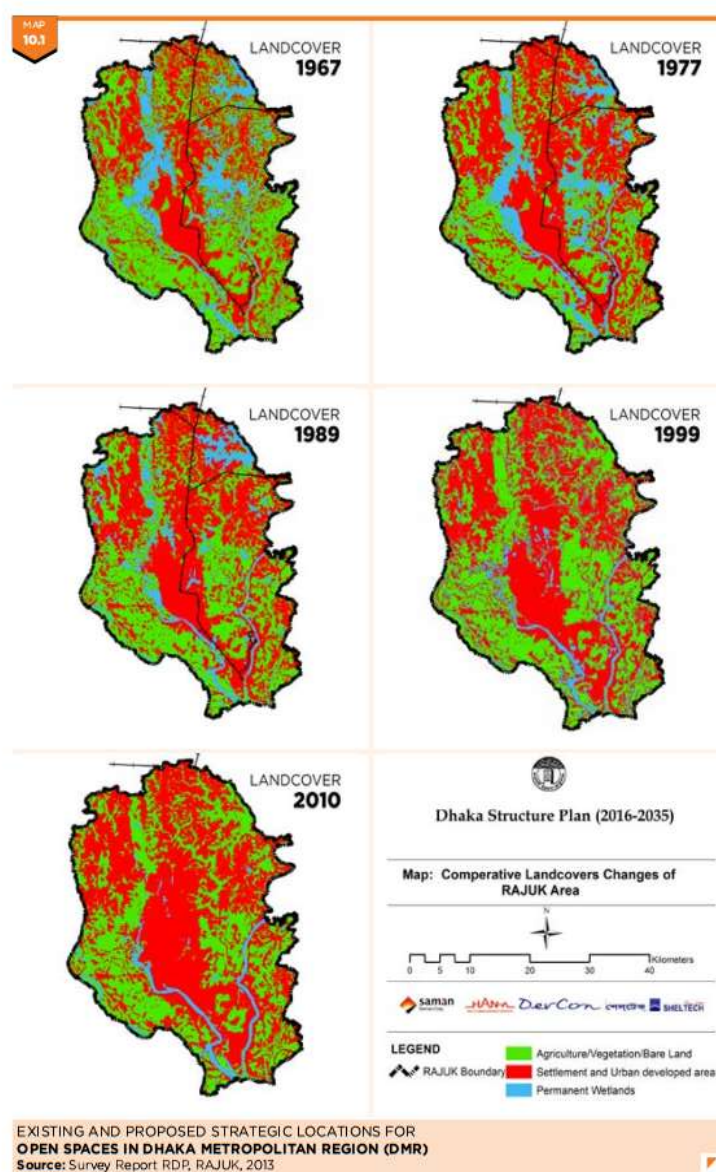


Figure 7. Thematic maps of changes in land use during the previous decades in Dhaka City

Thematic map below, demonstrates the existing residential areas, industrial areas, agricultural areas and forest areas.

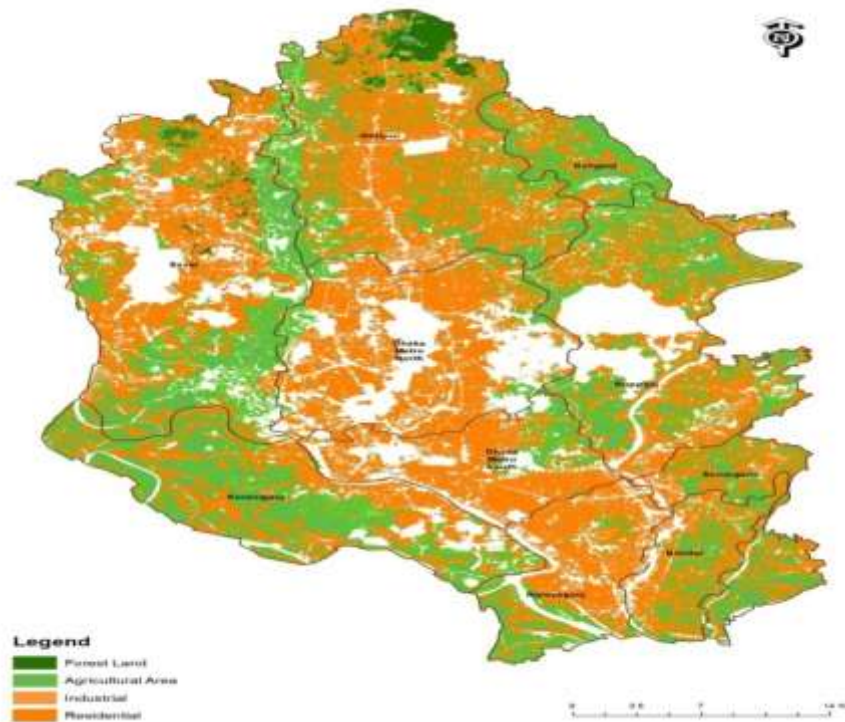


Figure 8. Forest, agricultural, industrial and residential areas in Dhaka City

Most of the green fields other than private gardens, nurseries, farmland, orchards and green areas around the households are managed by the local authorities in Dhaka City.

Although the settlements are located mostly in the high-altitude areas on the roadsides, it can be asserted that they spread all over the region rather than being localized due to easy access to water throughout the city. Even if they are located at a certain height above the river flow regime, a large percentage of households still remain in the possible inundation zone. As a result of the growing awareness about this fact, it has been observed that the new housing developments have been initiated in the highlands as scattered settlements recently. Settlement growth tendency and density are both greater around the main roads and industrial facilities. Provision of sewage treatment, drinking water supply, waste management and other social services to scattered settlements is more difficult. Since Dhaka is a migration-receiving city, this problem is felt more severely. Being financial and administrative center-and thus, the main source of public employment-of Bangladesh, and having the highest quality health care and education services in the country make Dhaka the most attractive destination for the poor domestic migrants from the countryside. Being home to more than 80% of the clothing industries in Bangladesh is a significant reason why huge masses of young women migrate to Dhaka today. Approximately one third of Dhaka's population resides in slums and slum areas, and this number ever increases due to consistent domestic migration. Yet, this trend

results in the growth of unplanned settlements in the wetlands and even inundation areas of the city.

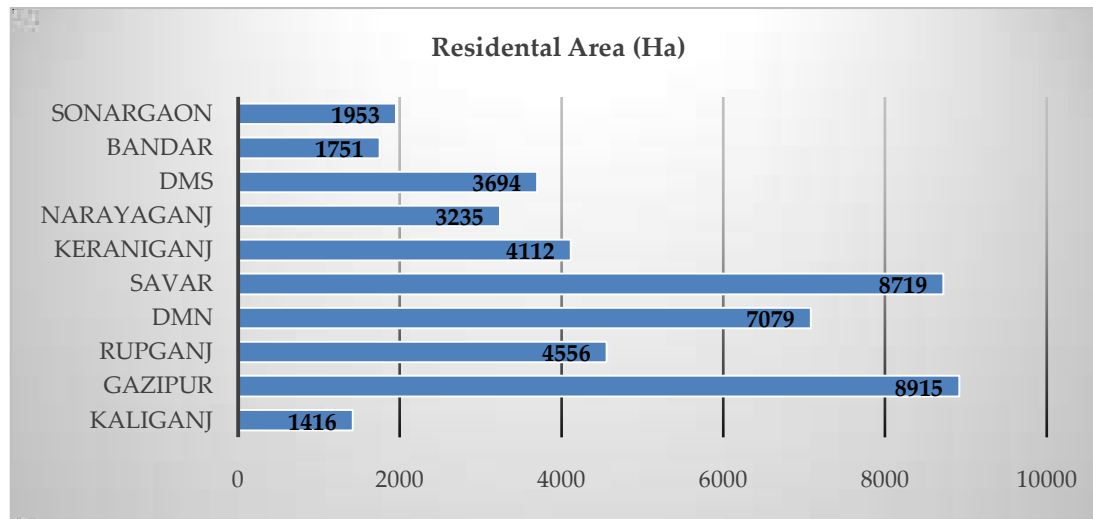


Figure 9. Residential area by district (Dhaka City)

It can be seen that Dhaka Metro North and Dhaka Metro South regions which are located mostly outside of the inundation areas and have relatively developed transport networks as well as physical infrastructure have been designated as industrial development zones. At present, these two regions are home to the highest number of industrial plants. Establishment of DEPZ (Dhaka Export Processing Zone) in Savar has also turned this district into a suitable place to invest in for industries. The most important problem regarding industrial development in Dhaka is uncontrolled expansion of industries all around the city. Such that, most of the brickfields are located in the potentially inundated areas today. Under these circumstances, current land use poses a huge threat to environment despite all the precautionsal ready taken.

It has been observed that there is shortage of entertainment centers, living spaces, recreational areas, play grounds and parks throughout the city. Lack of living spaces adversely affects mental and physical health of especially children and adolescent groups. This fact demonstrates socioeconomic context to land use. Within the study area, most of the vacant lands in densely populated districts are either low-lying lands (possible inundation areas) or agricultural lands and lands with water bodies. Northern part of the study area, where the population density is relatively low, still offers huge opportunities for urban expansion. However, urbanization in these areas will bring about costly excavation and filling works, since structural measures such as land-filling, dike etc. are required to prevent these areas to be adversely affected by floods especially during the monsoon season.

Outline of the Future Changes in Land Use, and Assessing the Main Environmental Problems and Habitat Restoration

The availability of unused vacant land in the countryside for planned development of land use provides a general framework for the outline of the future changes. Expansion of the existing transport networks -the highway- in North and South of Dhaka towards rural areas to provide public transport services will constitute a cornerstone for spatial development. Reducing the population in Dhaka city will ease traffic congestion. Developing a number of alternative urban centers in surrounding areas especially in the northern part of the city in order to mitigate the pressure resulting from urbanization and industrial mobility over North and South of Dhaka is another key component that will outline the future changes in land use. Once some administrative buildings, various industrial facilities and hence, a part of the population move towards these new urban centers developed in surrounding districts, freed up space can be converted into recreational areas to improve life quality of the residents. Around Dhaka City, there are some major seismic sources such as surface faults, Dauki fault and Madhupur fault. In terms of earthquake severity, Dhaka is located in Zone 2 (moderate risk zone) in Bangladesh. A study by Geological Survey of Bangladesh, suggests that the Eastern Fringe of Dhaka lie within the high to very high liquefaction susceptibility range. In Dhaka, an earthquake caused by active faults might cause severe liquefaction effects to buildings, especially those developed on marshylands on the eastern and western fringes, and even within the city areas like Begunbari and parts of Mirpur where lands are filled with sand and garbage materials. In addition, energy transmission pipelines might constitute a secondary source of danger during an earthquake due to the possibility of leakage and explosion. Absence of critical public facilities and failure of their proper functioning might have indirect but serious impacts on the dwellers, after a possible earthquake. Considering the previous flood modeling studies conducted and the previous disasters that have taken place, Dhaka City can be defined as a high flood risk area. The main cause of floods in Dhaka is not the natural water cycle or rainfalls. Rather, damage maximization is highly related to the anthropogenic presence in the flood zones in Dhaka's case. A part of Dhaka is protected from river floods by elevated roads and embankments. However, all sides of the city are surrounded by rivers and canals. Above 50% of Dhaka is low-lying and inundated during the monsoon season. Encroachment of rivers and canals, construction in floodplains and filling up of wetlands maximizes flood risk and increases the elements of risk by making environmental threats much more complex. As demonstrated clearly in previous plans and data obtained, groundwater of Dhaka has been depleting at an alarming rate. This is an outcome of not only population density and excessive groundwater use but also unplanned urbanization and landfilling practices. Thematic map presented below shows current land use patterns create pressure on wetlands, and affect groundwater levels as well as drainage areas in Dhaka City.

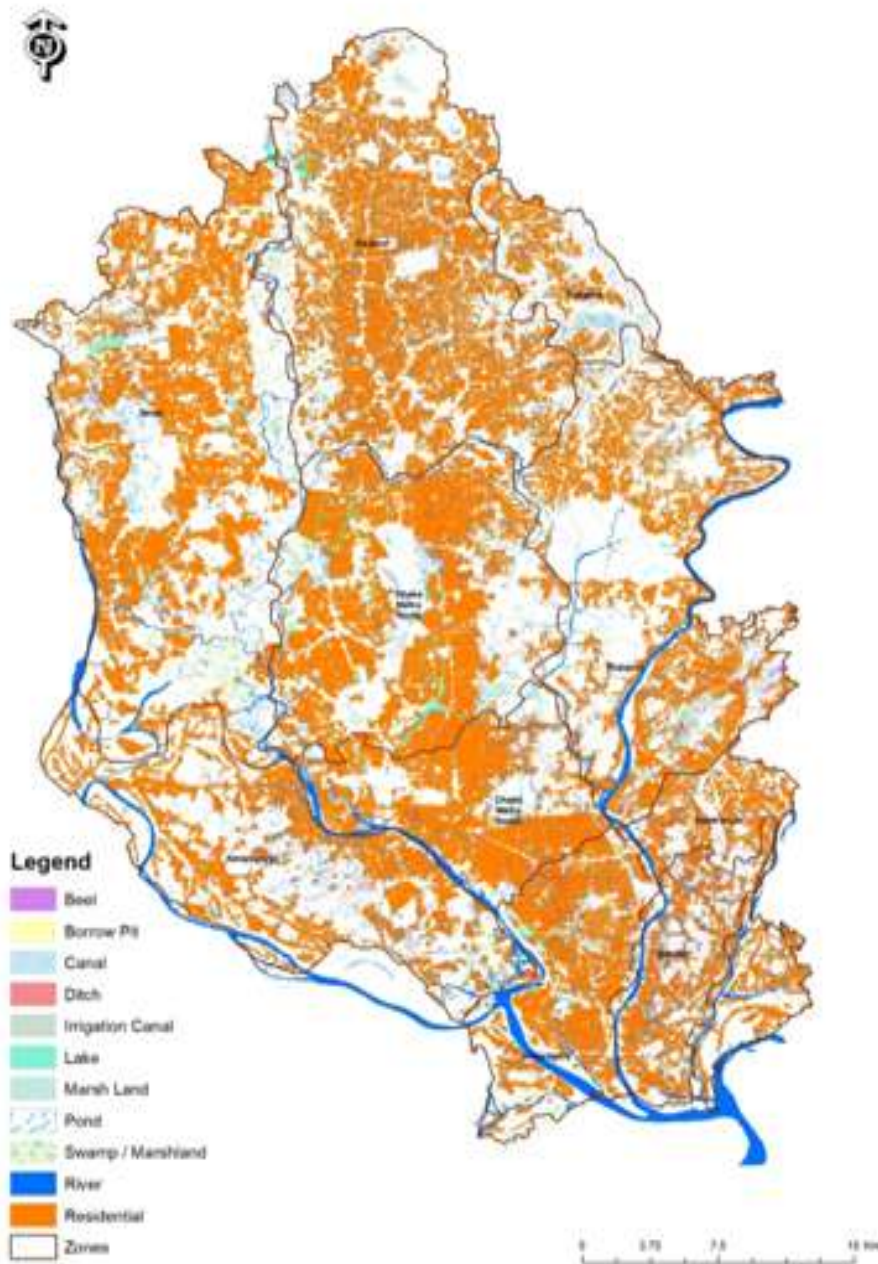


Figure 10. Impacts of the current landuse on the waterbodies of Dhaka

Regional distribution of inundation areas obtained through hydraulic modeling prepared by GIS tools is presented below. Regions with blue stripes are inundation areas in the area.

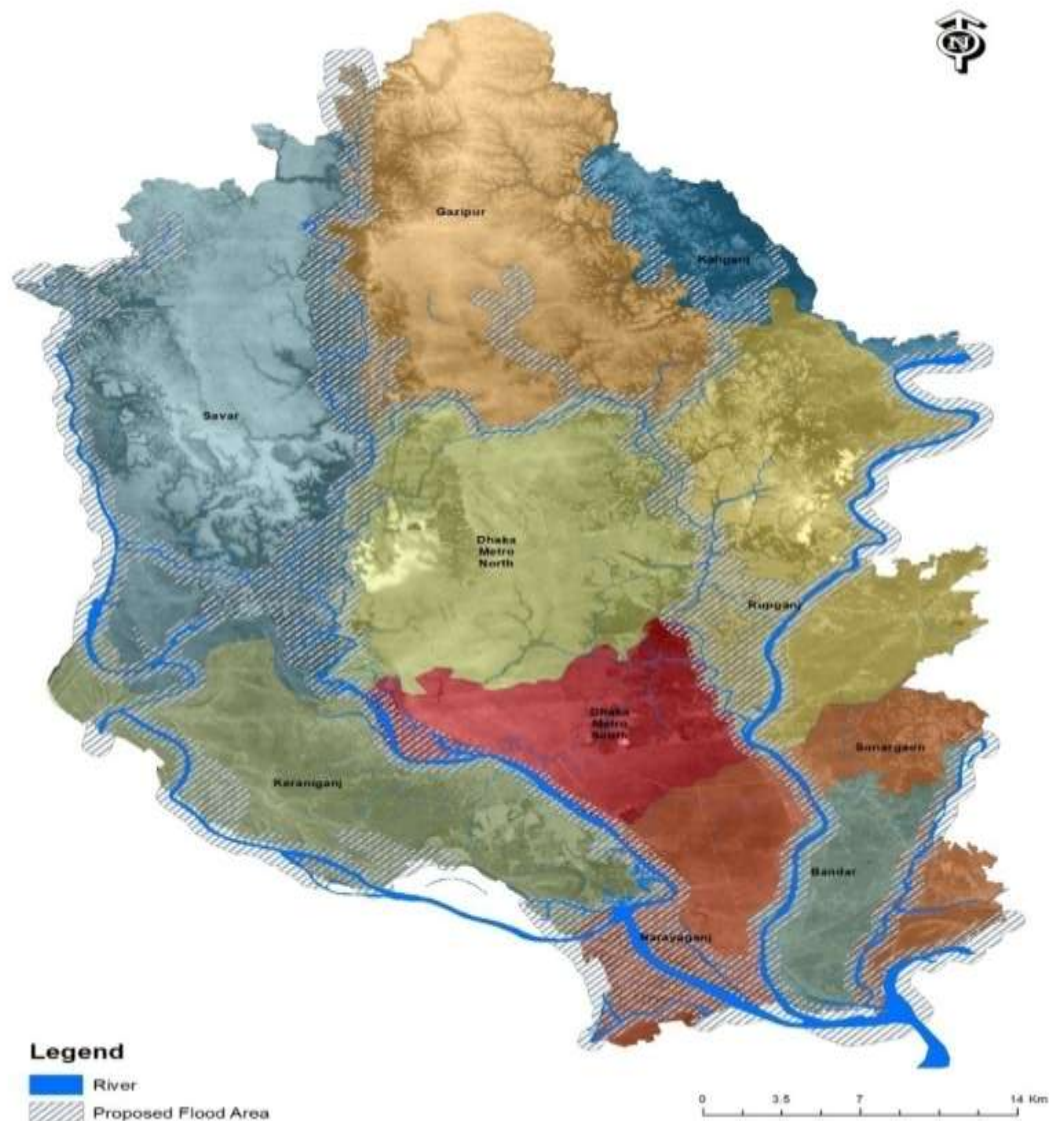


Figure 11. Possible inundation areas in Dhaka

Figure 13 below, on the other hand, demonstrates possible inundation areas in Dhaka along with 1 km severe intensity zone around the fault lines, which is defined as another major limiting factor in terms of environmental impacts regarding potential land use on the current landuse map.

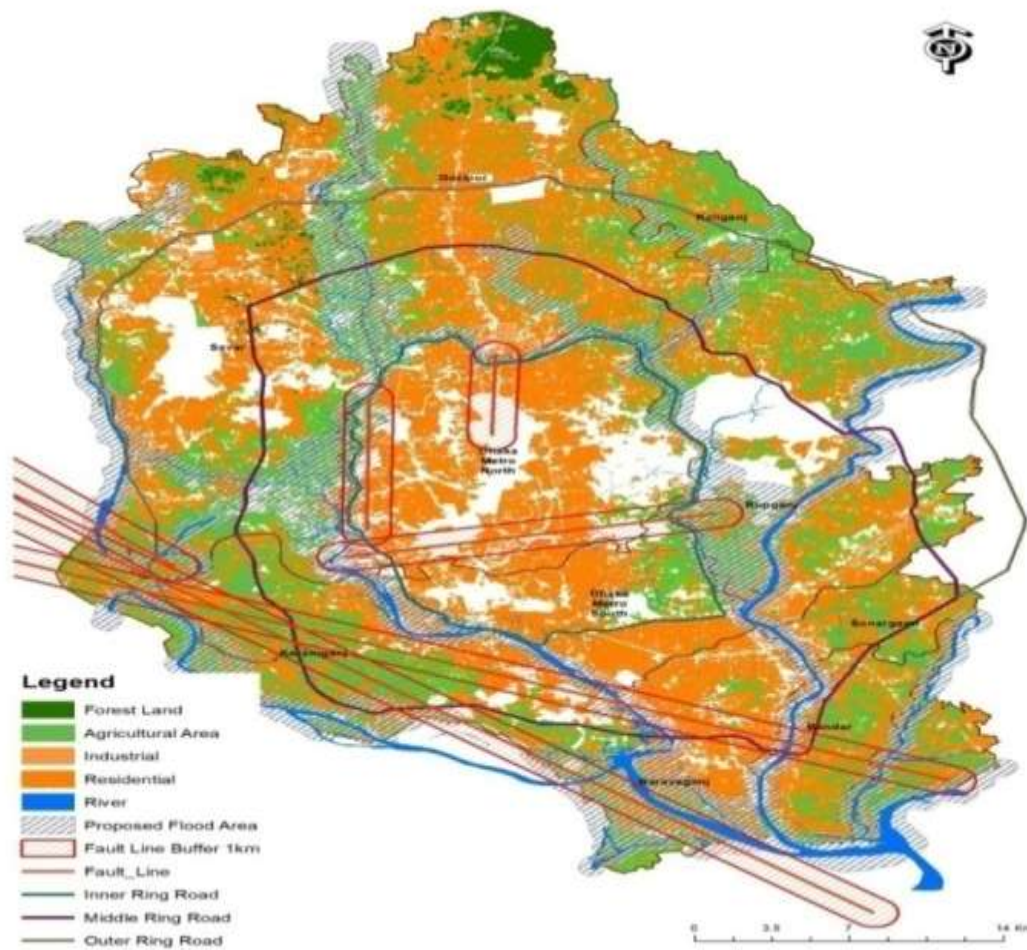


Figure 12. Severe intensity zone around faultlines and possible inundation areas in Dhaka

In this study, an approach that maximizes land use potential while minimizing the main environmental impacts associated with land use has been adopted. This GIS-based study has shown that while planning land use, the relevant authorities and agencies should shift their attention towards the hidden potential of the unused and underused lands in Dhaka City. Within the scope of this study, the main limiting factors in the context of environmental impacts regarding land use have been interpreted all together, and a regional baseline resilience assessment has been conducted. The areas marked with red in Figure 14, can be defined as those with very low resistance, areas marked with orange can be defined as those with low resistance, and areas marked with green can be defined as resistant areas.

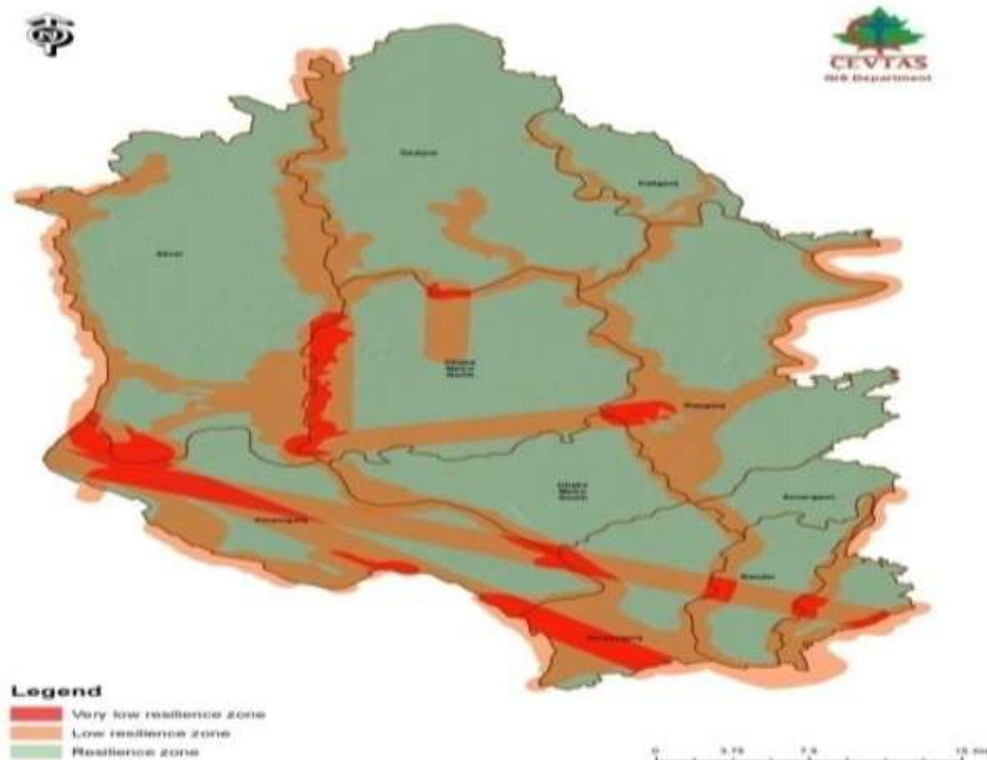


Figure 13. Low and very low resilience zones in Dhaka

It is argued here that developing transport infrastructure network as well as sewage and drinking water systems in northern parts of the city, where the current level of land use activity remains much below the potential, and relocating some administrative buildings and industrial facilities currently located within high population density zones or possible inundation areas to meteorologically and hydrologically more suitable places by developing alternative urban centers may provide with environmental benefits in terms of long-term land use plan.

Increase Public Awareness

In pursuit of this study, developers, policy makers and implementers should use all communication channels to inform all target groups and possibly affected communities like Bangladesh about the areas planned to be zoned for residential use and relocation. For example, information about the following should be shared with all the relevant stakeholders, public agencies, non-government organizations and public as soon as possible;

Recommended plans, Decisions to be taken, Public body in charge of taking these decisions,

Relevant procedure including times schedule and all accessible information types, Planned starting date for the procedures, Participation opportunities for the public, Important dates regarding consultation meetings, overall termination plan will allow target groups and

possibly affected communities to participate in the analysis of the causes and effects of the problems emerged during implementation of the previous plans as well as to propose mitigation measures and policy recommendations. It is also expected that such a participatory methodology is required to make the outcomes of the study to be accepted by a larger population and to increase public awareness about environmental protection.

While applying notification techniques, the following steps should be taken respectively:

Mapping, Grading (Defining the importance of problems, environmental concerns and risks),

Focus groups (To gather detailed information about specific topics, small group discussions should be organized), Surveys (or Q&A-type interviews with target groups about the existing and planned land use, future plans, priorities and environmental concerns). In the light of this perspective, this study was also conducted in a participatory manner based on an extensive stakeholder analysis as well as a series of stakeholder meetings and workshops held in Dhaka City.

Results and Discussion

It can be asserted that very small share of people are located at a certain height above the river flow regime (safe regions), a large percentage of households still remain in the possible inundation zone in Dhaka City. As a result of the growing awareness, it has been observed that the new housing developments have been initiated in the highlands as scattered settlements recently. If the high population density and anthropogenic pressures in the region are taken into consideration, it can be clearly perceived that it would be much more convenient and sustainable to simply abstain from any construction in low-resilience areas rather than trying to take structural measures after enhancing construction there.

So homogenizing the density in safe zones by taking environmental risks and planning educational facilities in the areas where the people residing in the present and future densely populated zones can conveniently access must be considered by the government.

Another important problem is uncontrolled expansion of industries all around the city. Such that, most of the brickfields are located in the potentially inundated areas today. Under these circumstances, current land use poses a huge threat to environment despite all the precautionsal ready taken. Developing a number of alternative urban centers in surrounding areas especially in the northern part of the city in order to mitigate the pressure resulting from urbanization and industrial mobility over Dhaka Metro North and Dhaka Metro South is another key component that will outline the future changes in land use. Industrial facilities should be concentrated on fixed areas, and relocated by taking meteorological, seismic, hydrological and other environmental risks into consideration. There lacks sufficient legislation on where industrial facilities as sources of emission can operate, environmental impact assessment processes have not been properly handled in many cases, and use of newer technologies has not been popularized yet.

It has been observed that there is shortage of entertainment centers, living spaces, recreational areas, play grounds and parks throughout the city. Lack of living spaces adversely affects mental and physical health of especially children and adolescent groups. This fact demonstrates socioeconomic context to land use. College, research institute, and R&D fields, banks, health facilities, power plants, treatment plants, professional workshops, hotels, restaurants, police stations and fire stations should be established all over the city. Planning health facilities in the areas where the people residing in the present and future densely populated zones can conveniently access.

Expansion of the existing transport networks -the highway- in Dhaka City towards rural areas to provide public transport services will constitute a cornerstone for spatial development. Reducing the population in Dhaka Metro North and Dhaka Metro South will ease traffic congestion in these parts of the city. Establishing vehicle inspection stations in highly populated strategic areas is necessary too. Public transport supply should be strengthened and hydraulic potential of the region should be used for transportation. Railway coverage should be improved especially in the northern part of study area, and public transport supply should be strengthened by establishing connections between railway, airway and waterway centers.

Enhancing drinking water supply trend by monitoring groundwater use, increasing the quantity of surface water, and establishing water treatment plants in strategic areas by taking especially prospected population density into account seems to be an urgent need.

Strengthening the existing sewage treatment system in accordance with the climate conditions in the region, and expanding the sewage network in accordance with the expected population growth.

Within the study area, most of the vacant lands in densely populated districts are either low-lying lands (possible inundation areas) or agricultural lands and lands with water bodies. Northern part of the study area, where the population density is relatively low, still offers huge opportunities for urban expansion. However, urbanization in these areas will bring about costly excavation and filling works, since structural measures such as land-filling, dike etc. are required to prevent these areas to be adversely affected by floods especially during the monsoon season. Once some administrative buildings, various industrial facilities and hence, a part of the population move towards these new urban centers developed in surrounding districts, freed up space can be converted into recreational areas to improve life quality of the residents. Choosing methods such as sorting in the source, recycling and recovery over storage in waste treatment by taking seismic and hydraulic risks in the region into consideration at the same time, increasing public awareness, developing alternative waste storage areas by rehabilitating uncontrolled waste disposal is necessary.

In sum, the most significant environmental problems regarding land management in the study area appear to be seismic movements, floods and stability problems. As demonstrated clearly in previous plans and data obtained, groundwater of Dhaka has been depleting at an alarming

rate. This is an outcome of not only population density and excessive groundwater use but also unplanned urbanization and landfilling practices. The rapid decline in groundwater level will bring about degradation of water chemistry as well as geomorphological circumstances such as drawdown. These aforementioned environmental problems start a domino effect and create multiple risk factors, which make environmental threats much more complicated.

This GIS-based study has shown that while planning land use, the relevant authorities and agencies should shift their attention towards the hidden potential of the unused and underused lands in Dhaka City.

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