The Integration of Urban Life with the Hierarchical Structure of Urban Parks Distribution in Developing Countries: A Case Study of Dhaka City, Bangladesh

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Declaration and statement of copyright

I hereby confirm that the materials presented in this thesis, in full or in parts, have not been submitted by me in any previous application for a degree to any other university or academic institution. In all cases, where it is relevant, material from the work of others has been specifically acknowledged at the appropriate point in the text by references and quotations and paraphrases suitably indicated.

Ummeh Saika
September, 2017

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Abstract

The inhabitants of Dhaka city suffer from lack of proper urban facilities. The urban parks are needed for different functional and leisure activities of the urban dwellers. Again growing densification, a number of urban parks are transferred into open space in the Dhaka city. As a result, greenery of the city's decreases gradually. Moreover, the existing urban parks are frequently threatened by encroachment. The role of urban parks, both at community and city level, is important to improve the natural environment and social ties in urban life for future generations. Therefore, it seems that the urban parks need to be more effective for public interaction. The main objective of this research is to address the spatial structure and consequence of urban parks in Dhaka city, Bangladesh as an example of developing countries. Four approaches were selected to fulfill the study. Firstly, identifying the typology and characteristics of urban parks with their service area; secondly, regional differentiation of urban parks; thirdly, investigate the relationship of urban parks with physical and social environment; fourthly, proposed some models to accommodate the present condition.

Based on urban growth and structure, Dhaka city divided into two parts: old Dhaka or the historic core, and new Dhaka or northern expansion. The city is actually post colonial development, an effect of modernization, still unplanned and organic in the nature. Old Dhaka predominantly built up with narrow streets and congested patterns with few open spaces and functional areas. In old city, green spaces and urban parks are unplanned and has a historical aspect. The modern city (New Dhaka), in contrast, allocated a more spacious layout and geometry. In the new part of the city, urban parks are better located and maintained. Moreover, Dhaka city has a detail park regulations which developed in 9th March, 1904. After liberation war, this park rules and regulations little changed and update in 1973 (Act No. VIII of 1973). According to the regulations, government make rules for the management and preservation of any park and also for regulating the use thereof by the public. All parks management by “Superintendent” means the person in executive charge of a park. But this superintendents are not same for all parks. In old Dhaka mainly located in the southern part of the city, so in here parks are managed by Dhaka South City Corporation (DSCC). And in new Dhaka most of the park managed by Dhaka North City Corporation (DNCC). This superintendents selected by the local government. Furthermore, Public Works Department (PWD) only takes care of large green spaces and urban parks, such as, Botanical Gardens, Zoo, Baldha Garden etc. Again, in this regulations also clearly mentioned the using restriction of parks and also some prohibit or regulate for park users.

The case study site covered eight urban parks of Dhaka metropolitan area of Bangladesh. Three aspects (Physical, Social and Living) were applied for this study. For physical aspect

methods were used, RS (Remote Sensing) and GIS (Geographic Information System) of three periods of satellite images and aerial photos (Dhaka city). For social aspect methods were used questionnaire survey, observation, photographs, sketch and previous information about parks. And for living aspect, check table format, interview, case study, photographs and sketch were used. After calculation of all data analysis by descriptive statistics, result was showed by maps using GIS.

First approach: According to physical size, parks of Dhaka city were classified into four types: Small, Medium, Large and Extra Large parks. Small size parks of Dhaka city were situated beside the residential area and were used as daily purpose. Medium size parks were located beside commercial area and it's used for daily and weekly. Large size parks were placed at city center and people mainly visited monthly to attended some events. Only one extra-large size park was found in city boundary and people were come from every parts of the city area for tourism purpose. Moreover, in this research tried to measure the service area of parks in Dhaka city. For this analysis used average distance of park visitors consistent with different size parks and after applied this average distance in buffer approach to prepare the service area maps. As a result, it's proved that the service area of parks in Dhaka city different from the NRPA American standard. Unplanned urban grow and over population influence the service area of parks. According to accessibility of parks, in small and medium size parks people mainly visited from near place. In large size parks people came from different distance. Again in the extra-large park covered the whole city area. Mainly distance from origin to parks, time and purpose control the accessibility of parks.

Second approach: The regional differentiation influence parks of Dhaka city. Based on regional differentiation, in old Dhaka parks were well vegetated but have maintenance problem. Intersection zone of old and new Dhaka parks were used in national occasion more than daily recreational purpose. In new Dhaka, parks were well organized and maintenance than other part of the city. Again based on distribution model of parks of developing countries, in old part of the city, parks were in traditional pattern, scatteredly situated and small size parks were high number than the other size park. On the other hand, in the new part of city, parks were more planned, modernization and also small and medium size parks were well distributed and balanced. Large parks situated in the city center beside sub CBD and easy to access. This parks mainly used for different events. Extra-large park situated in city boundary and tried to serve the whole city.

Third approach: Physical and social environment of parks influence the type of parks. There is a relationship between park size and facilities. When park size increase facilities of the park also increase. In small and medium size park's facilities are lower than the large size parks. By using questionnaire data found that different size of park influence the characteristic of park's users. Moreover, distance of visitor related with some factors, such as respondent age, transport system, transport cost etc.

Fourth approach: To identify the park systems of Dhaka city used the concept of areal functional organization model. According to parks distributional model and areal functional

organization model, in Dhaka old part of city dominated by first order functional area. And in new city, both small and medium size parks were good in number and well planned. So in here first and second order functional areas overlapping. Large size parks situated in city center and it's mainly covered the center area of the city. According to the functional model, it is third order which cluster the focal point. Moreover, the extra-large park which situated in city boundary, largely served the new part of city than the older part. It's fourth order functional area which cluster all focal point of the parks. As a result, it is clear that the park systems of Dhaka city constituted by fourth order park system which is compounded by different lower order park systems. Park systems in Dhaka city indicate the hierarchical structure. This structure showed the vertical integration of parks by their different physical size.

Moreover, for the difference of urban structure such as, old and new cities, parks system also different. Based on urban structure, park systems were classified into two types. In old Dhaka number of small size parks were more than the other size parks. So in here park system mainly controlled by the first order park system. On the other hand, in new Dhaka small and medium size parks were well distributed and both first and second order park systems were active in here. As a result, it's found that the several order park systems show regional patterns of parks user which influence by different urban structure.

Overall findings of this research showed parks size and distance influence the user pattern and the parks distribution control by urban structure. This research tried to develop a new park systems for Dhaka city base on the user's characteristics of parks. In Dhaka city, urban life (characteristics of park users) integrated with different order park systems which illustrate hierarchy structure of parks. Furthermore, this research tried to find out the spatial importance and efficiency of parks in urban area. Analyzed information and model will be helpful to urban planner for the future perdition and planning. Urban park is an important element of recreation facilities for urban people. It is easy to access for all aged and group of people. Developing countries, like Bangladesh where over population and lack of recreation facilities are already present, urban parks play a important role for constructing better urban life and society.

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List of Acronyms

BBS	: Bangladesh Bureau of Statistics
CBD	: Central Business District
DAP	: Detailed Area Plan
DCC	: Dhaka City Corporation
DMAIUDP	: Dhaka Metropolitan Area Integrated Urban Development Plan
DMDP	: Dhaka Metropolitan Development Plan
DNCC	: Dhaka North City Corporation
DSCC	: Dhaka South City Corporation
GIS	: Geographic Information System
GoB	: Government of Bangladesh
PWD	: Public Works Department
RAJUK	: Rajdhani Unnayan Kortiporko
RS	: Remote Sensing
SANGS	: Suitable Accessible Natural Green Space
SOB	: Survey of Bangladesh
SPARRSO	: Bangladesh Space Research and Remote Sensing Organization
UGS	: Urban Green Space

Chapter One
Introduction

1.1 Introduction

The global population pressure has increased in urban areas with people thronging the cities in quest of a better life. According to the UN Population Division, about 44% of the total populations in developing countries are living in urban areas. There is no doubt that the urbanization will proceed to have significant impact on the ecology, economy and society at local, regional, and global levels. The great impact has been observed in the urban green spaces including urban parks, forestry, playgrounds, domestic gardens, roadside open spaces and urban vegetation (Rahman and Siddiquee 2012). Apart from the benefit, they also support the construction of high-quality human settlements, since green spaces act as the ‘‘lungs’’ of the city (Jim and Chen 2006). Parks are an important source of green spaces inside the urban area. Nowadays urban parks are emerging as one of the most important spaces in the urban fabric. They help to enhance the image of a city and improve the quality of urban life; people come to them for recreation, social gathering and passive enjoyment (Iqbal et al. 2010).

Cities, like Dhaka, in the developing countries are mostly built-up areas due to the pressure of rapid urbanization. Dhaka, the capital city of Bangladesh, is now a member of the “mega-city” family of the world. Because of rapid and unplanned urbanization, commercial development, along with population pressure, the overall city environment is being worsened seriously day by day. But Dhaka city was once known for its serenity, beautiful parks, clean roads and lush greenery, various biodiversity and the places within the present Dhaka city boundary were forested, but at present those tree covers are almost transformed to urban habitats to accommodate excessive population due to high rate of rural–urban migration. In addition, industrialization in the urban fringe areas and transformation of different land use within the city as well as the surrounding urban fringes caused to the depletion of existing tree covers so rapidly during the last half century. The depletion process of green resources got impetus, as the government had no long term planning to keep city green except establishment of few parks and road side plantation under the city beautification programme (Islam 2002).

As the city is, however, in a stage of transition, struggling with the challenges of urban expansion, over population, poverty alleviation and improve the quality of life and environment, all these facts raise the question about the future planning and managing strategies for open green spaces and urban parks. In Dhaka city within multiple and rapidly changing urban demands and particularly, what opportunities exist for the development and what challenges should be overcome in the future for enhancing the overall parks condition in Dhaka city.

1.2 Statement of the problem

As a result of urbanization, the world's population has become increasingly concentrated in cities. In 1940, only one in eight people lived in an urban center, but this increased to one in three by 1980 (WCED 1987). It is expected that about 65% of the world's population will live in urban areas by 2025 (Schell and Ulijaszek 1999). Population increases triggered the rapid growth of urban centers and the environmental and socioeconomic consequences of this growth are profound; the increasing alienation between humankind and the natural world is a particularly fundamental consequence of urbanization (Gordon 1990).

Parks are one of the important source of maintenance natural ecosystem and also preserving the biodiversity in the urban area. Moreover, parks also play considerable role in physical health for the majority of the people in city areas. (Nicholls 2001). The benefits of parks and green spaces in urban contexts have been widely acknowledged as they play an important role in an urban environment (Shin and Lee 2005; Yang et al. 2005; Escobedo et al. 2011; Wolch et al. 2014) and biodiversity (Kowarik 2011). By facilitating socialization and creating a sense of community, parks and green spaces improve the quality of life of urban dwellers (Comber et al. 2008; Wendel et al. 2012).

Most of the environmental impacts of urbanization are associated with green space. The loss or degradation of green space may deprive the habitats for creatures, reduce biodiversity and disrupt the structure and process of the urban system. Due to rapid urbanization, there is huge encroachment upon green spaces which contributes towards deforestation, water logging, flooding and pollution of water, soil and air. This is particularly evident in the developing countries where cities sprawl extensively (Tabassum and Sharmin 2013). However, urbanization has posed great threat to the connection between human and natural environment, especially in the developing countries (Maller et al. 2008; Maruani and Amit-Cohen 2007). In particular, rapid urban growth has raised a wide range of land use conflicts and the capacity has been largely exceeded to provide enough green infrastructure such as parks for their citizens. Like any other sustainable city, Dhaka needs a huge stock of green spaces for urban services or utilities and circulation and for environmental stability.

1.3 Justification of the study

The inhabitants of Dhaka city suffers from lack of proper urban facilities. The urban parks are needed for different functional and leisure activities of the urban dwellers. Again growing densification, a number of green spaces and parks are transferred into open space in the Dhaka city. As a result greenery and recreational facilities of the city's decreases gradually. Moreover, the existing parks are frequently threatened by encroachment. The role of urban parks, both at community and city level, is important to improve the natural environment and social ties for future

generations. Therefore, it seems that the urban parks need to be more effective for public interaction. The utilization of the existing park is irresistible; and their impact on urban life appears to be massive.

Most of the areas of Dhaka city are so unplanned that there is very little scope for creating a new park or open space to meet the needs of the growing population. In this case, it is inevitable that the existing parks need to be improved or developed. But unfortunately till now no initiatives have been taken to improve the parks of Dhaka city (Alam 2012). Additionally, there are many new unauthorized housing projects that are being developed in Dhaka at present. These will shrink the greenery and wetlands to create extra and unbearable pressure on the overburdened public utility. Allocating more areas for new parks in Dhaka city is very difficult as Dhaka due to land scarcity. Improvement of the condition of the existing parks seem to be the only the viable solution to meet the needs of the citizens (Neema et al. 2014).

Again, parks in Dhaka city are not equally distributed. In the historical city of Dhaka, commonly called Old Dhaka, open spaces and parks are limited rather than the whole city. On the other hand, in New Dhaka few spaces and newly developed parks are kept in planned residential areas which are also being swallowed day by day (Nilufar 2000). Moreover, parks of Dhaka city used in different purposes. Such as, the urban parks serve as recreational ground for the middle-income urbanity. The upper income people use those areas for their personal care; and the poor comes to earn by serving others (Nilufar 2000). Besides small and medium sized parks and playgrounds, are frequently used by the local children and youth. All these parks are helping to enhance a better urban living condition. So, it's very important to identify the present status of parks and should take proper steps for future betterment.

1.4 Important terms of this research

1.4.1 Developing countries

The countries who are going through the initial levels of industrial development along with low per capita income are known as Developing Countries. These countries come under the category of third world countries. They are also known as lower developed countries. The country has a low Human Development Index (HDI), such as, the country does not enjoy healthy and safe environment to live, low Gross Domestic Product, high illiteracy rate, poor educational, transportation, communication and medical facilities, unsustainable government debt, unequal distribution of income, high death rate and birth rate, malnutrition both to mother and infant which case high infant mortality rate, poor living conditions, high level of unemployment and poverty.[1]

[1] See more in http://keydifferences.com/difference-between-developed-countries-and-developing-countries.html

1.4.2 Definition and functions of Urban Green Space (UGS)

Urban green spaces can be defined as outdoor places with significant amounts of vegetation, and exist mainly as semi-natural areas (Jim and Chen 2003).

The definition of urban green space (UGS) is all publicly owned and publicly accessible open space with a high degree of cover by vegetation, such as parks, woodlands, nature areas and other green space. It can have a designed or planned character as well as a more natural character. Only areas that can be entered and used from 'within' are included (Schipperijn et al. 2010). Urban green space provides the following functions and objectives:

- Recreation and well-being;
- Aesthetics;
- Nature and landscape conservation;
- Biodiversity preservation;
- Climate and hygiene;
- Wood production;
- Food production (Chiari and Seeland 2004)

The most common definition of urban green space that has been used in studies in Europe is based on the definition from the European Urban Atlas (EU 2011). The Green Urban Areas as defined by Urban Atlas code 14100 include public green areas used predominantly for recreation such as gardens, zoos, parks, and suburban natural areas and forests, or green areas bordered by urban areas that are managed or used for recreational purposes. In policy terms, it is important to focus on urban green space that is open to the public particularly when considering universal green space access for all urban residents, regardless of socioeconomic circumstances. However, where relevant the overview includes studies that have used wider or more inclusive definitions of urban green space (WHO 2016).

1.4.3 Urban green spaces as a part of urban open spaces

Open space is any open part of land that is undeveloped (has no buildings or other built structures) and also accessible to the public. There are different types of open spaces, such as,

- Green space (land that is partly or completely covered with grass, trees, shrubs, or other vegetation). Green space includes parks, community gardens, and cemeteries.
- Schoolyards
- Playgrounds
- Public seating areas
- Public plazas
- Vacant lots (EPA 2014)

1.4.4 Definition and benefits of urban parks

According to Konijnendijk et al. 2013, urban parks are defined as delineated open space areas, mostly dominated by vegetation and water, and generally reserved for public use. Urban parks are mostly larger, but can also have the shape of smaller 'pocket parks'. Urban parks are usually locally defined (by authorities) as 'parks'. Again they also point out the following potential benefits of urban parks:

- **Human health and wellbeing:** i.e. positive impacts of parks and park use on human health (both mental and physical) and wellbeing, either through direct or indirect effects such as recreation and leisure activities.
- **Social cohesion / identity:** the role of urban parks in strengthening social ties, relations and cohesion.
- **Tourism:** leisure visits outside of the own living or working environment, typically longer-term stays. Apart from potentially promoting the health and wellbeing of visitors, tourism is also of interest due to its contributions to the local economy.
- **House prices:** the value of urban parks as part of the living environment as reflected in higher real estate prices (for both houses and apartments).
- **Biodiversity:** the role of parks in harboring and promoting biodiversity, and species diversity in particular. Biodiversity has a direct link to human wellbeing.
- **Air quality and carbon sequestration:** positive impacts of urban parks in terms of reducing air pollutant levels and carbon sequestration.
- **Water management:** contributions of parks to storm water / run off regulation.
- **Cooling:** the role of parks in the cooling of urban areas.

1.4.5 Importance of parks in urban life

NRPA (National Recreation and Park Association) of USA declared that parks and recreation have three values that make them essential services to communities: 1. Economic value 2. Health and Environmental benefits 3. Social importance (NRPA 2010). Again according to Casandra Campbell (Green Ribbon) eight reasons are important for Parks:

- Storm water collection
- Reduction of the urban heat island effect
- Centre of community
- Clean air
- Mental health boost
- A place for physical activity
- A place for kids to be outside

- Protect natural ecosystems (Casandra 2016).

Among the world's major cities, Greater Dhaka probably has the lowest number of playgrounds, parks, open spaces and swimming pools per capita (Hossain 2006).

1.5 Objective and Approaches

The main objective of this research is to address the spatial structure and consequence of urban parks in Dhaka city, Bangladesh as an example of developing countries.

To achieve the main objective, four approaches are pointed out：

- To identify typology of urban parks with their regional characteristics.
- To analyze the regional differentiate of parks of Dhaka city.
- To investigate the relationship of urban parks with physical and social environment.
- To frame some models to accommodate the present condition.

1.6 Research questions and Hypothesis

To address this main objective, this thesis tries to explore the answers of the following question:

- Dose spatial and temporal change impact on green space of an urban area?
- Are environmental factors such as size and distance related to the use of the urban parks?
- How regional difference influences urban parks?
- What is the effect of urban structure on parks?
- What is the environmental role of urban parks?
- How size of parks control the characteristics of park's users?

Considering some factors (type of parks, distribution of parks, users distance from home to parks, Characteristics of parks user) of urban parks following hypothesis were made:

Hypothesis 1: Environmental factors (size and distance) of parks positively influence the use of parks in Dhaka city.

Hypothesis 2: Regional differentiation inequitably effect on urban parks in developing countries.

Hypothesis 3: Environmental role (both physical and social) positively enhance the type of parks in Dhaka.

1.7 Organization of the thesis

Chapter 1 focuses on the background and statement of this research including the aim and objectives. Research questions and hypothesis also briefly outlined in here. This chapter also included some important terms and definitions which related with this research work.

Chapter 2 mainly discuss literature review and theoretical background of the research work. This chapter also highlighted the methodology of research work in detail. Different limitations are reviewed in this section.

In Chapter 3 gives an overview of the study area at macro level, within which the study is carried out. The chapter ends with analysis of some images data. This part helped to get past, present and future prediction about UGS in Dhaka city. Moreover, this chapter described urban parks location, authorities and regulation of parks in Dhaka city.

First objective of this study, mainly discuss in chapter 4. Based on physical size, typology of parks in Dhaka city with their different characteristics describe in here. Moreover service area and accessibility of parks also identifying in this section and showed by maps.

Chapter 5 describes the regional differentiation of parks in the study area. Changes and present condition of case study parks of different region describe in here. Again, briefly discuss the regional difference of Dhaka city based on the urban structure. Lastly proposed the spatial distribution model of parks in developing countries.

The main deliberation of Chapter 6 is to find out the relationship of urban parks with physical and social environment. Relationship between size of parks and characteristics of users are illustrate in this chapter. Finally, based on previous two chapters and previous model (Philbrick model) describe parks system of Dhaka city which is also suitable for developing countries.

Chapter 7 is the final concluding section of the research report. The overall scenarios of the study are discussed briefly in general discussion part.

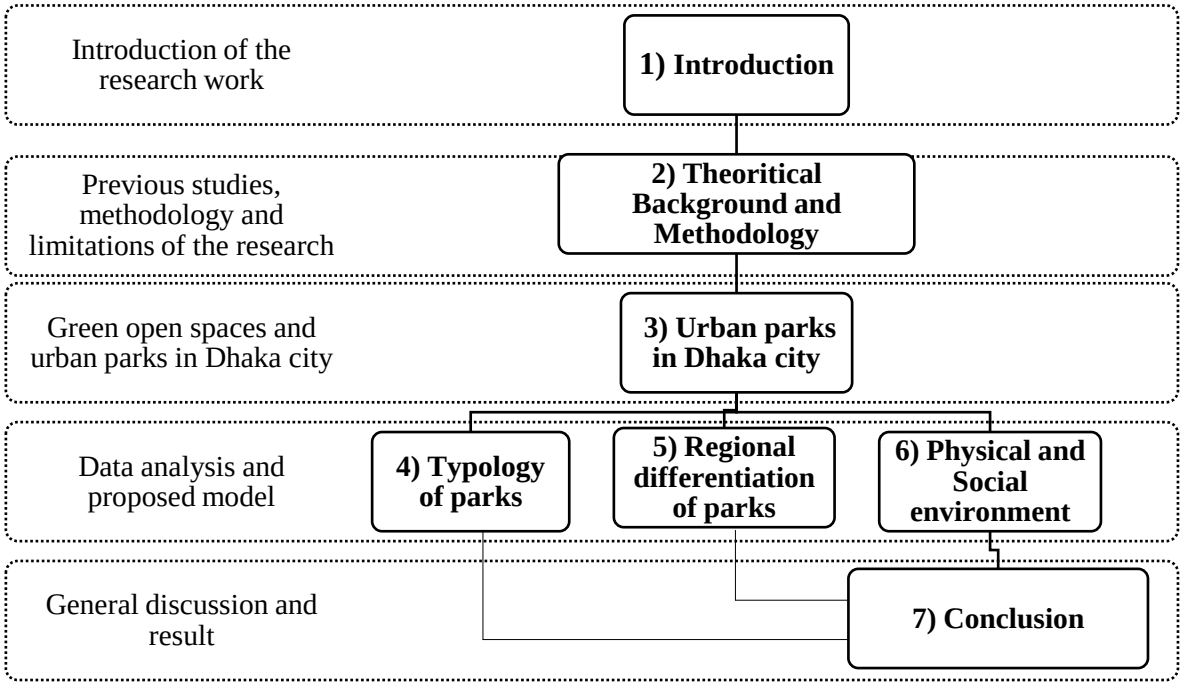

Figure 1.1 Flow chart of thesis outline

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Chapter One

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Chapter Two
Theoretical Background and Methodology

2.1 Introduction

This chapter deals with literature of parks situation of developing countries and different theories in order to urban green spaces and land use for researching distribution and importance of urban parks of Dhaka city, Bangladesh. It begins with a brief literature review of the conceptual context of characteristics of developing countries, type of parks, urban parks condition of developing countries and also Dhaka city. Then the chapter moves to the key conceptual and theoretical frameworks that underpin this thesis. Moreover, this chapter also provides strategic aspects of methodology and the choices of data collection tools which used in this study in order to address the research questions posed in chapter one. Finally, denote the constraints and limitations which faced during the fieldwork and also data collection from both primary and secondary sources.

2.2 Literature review

In the developing countries, cities, like Dhaka, are mostly built-up areas due to the pressure of rapid urbanization. Over population and different pollution are common characters in here. Urban parks and green open areas are very essential inside the city for its environmental and ecological balance. Again for the passive need, one of the primary need of urban parks and open spaces in urban life is for recreational[2] purposes during the leisure[3] time. The importance of recreation in people's physical, intellectual and emotional development is now undisputed.

2.2.1 Developing countries

2.2.1.1 Identifying developing countries by HDI

According to Human Development Report 2016 (UNDP), the Human Development Index (HDI) is a summary measure of achievements in three key dimensions of human development: a long and healthy life, access to knowledge and a decent standard of living. The HDI is the geometric mean of normalized indices for each of the three dimensions.[4]

[2] Recreation is 'Any pursuit engaged upon during leisure time, other than pursuits to which people are normally 'highly committed'. [Roberts, 1974: 328]

[3] Leisure is the time available to the individual when the disciplines of work, sleep and other basic needs have been met. [Roberts, 1974: 328]

[4] See more in http://hdr.undp.org/en/data

Data sources

- Life expectancy at birth: UNDESA (2015).
- Expected years of schooling: UNESCO Institute for Statistics (2016), United Nations Children's Fund (UNICEF) Multiple Indicator Cluster Surveys and ICF Macro Demographic and Health Surveys.
- Mean years of schooling: Barro and Lee (2016), UNESCO Institute for Statistics (2016), Human Development Report Office updates based on UNESCO Institute for Statistics (2016), UNICEF Multiple Indicator Cluster Surveys and ICF Macro Demographic and Health Surveys.
- GNI per capita: IMF (2016), UNSD (2016) and World Bank (2016).

2.2.1.2 Steps to calculate the Human Development Index

There are two steps to calculating the HDI.

Step 1. Creating the dimension indices

To measure the dimension indices need to measure minimum and maximum value if indicators. These values are already define by UNDP:

Table 2.1 Minimum and Maximum values of HDI

Dimension	Indicator	Minimum	Maximum
Health	Life expectancy (years)	20	85
Education	Expected years of schooling (years)	0	18
	Mean years of schooling (years)	0	15
Standard of living	Gross national income per capita (2011 PPP $)	100	75,000

Source: Human Development Report, 2016

Having defined the minimum and maximum values, the dimension indices are calculated as:

$$\textbf{Dimension index} = \frac{\textbf{actual value} - \textbf{minimum value}}{\textbf{maximum value} - \textbf{minimum value}} \quad \text{.....(1)}$$

Step 2. Aggregating the dimensional indices to produce the Human Development Index

The HDI is the geometric mean of the three dimension indices:

$$\textbf{HDI} = \frac{(I_{\text{Health}} . I_{\text{Education}} . I_{\text{Income}})}{3} \quad \text{.....(2)}$$

Source: Human Development Report, 2016

Country groupings

After calculating HDI for grouping countries that were introduced in the 2014 Report:

Table 2.2 Groups of countries.[5]

Groups	Value	Countries
Very high human development	0.800 and above	Developed
High human development	0.700–0.799	Economies in transition
Medium human development	0.550–0.699	Developing
Low human development	Below 0.550	Undeveloped

Source: Human Development Report, 2016

2.2.1.3 Urbanization of developing countries

Characteristics of urbanization in developing countries,

- Most of the countries has long colonies history.
- Since 1950, rapid growth in urbanization.
- Countries located in South America, Africa and Asia.
- Between 1950 and 1990, the urban population become doubled.
- Rural to urban migration.

According to Cohen (2004), Nature of the urban transition in developing countries:

- Mega city
- A rapid pace of change
- More rapid urbanization in relatively poorer countries
- Urbanization in an increasingly global world
- The convergence of urban and rural lifestyles
- Urbanization under different prevailing demographic conditions
- Major regional differences

2.2.1.4 Urban life of developing countries

- Infrastructure risk (Wilson 2015)
- Natural environment deteriorating (Emmanuel 2010)
- Urban ecosystem degradation (Molla 2015)
- Urban poverty and inequalities (Stephens 1995)
- Increases crimes and violence (Odafivwotu and Abel 2015)
- Health and quality of life decline (Rabare et al. 2009)
- Lack of all civic amenities like parks, lakes and other recreational facilities (Zaman et al. 2010)

2.2.1.5 Urban parks distribution of developing countries

Rahnama and Akbari (2013) revealed that green space areas in the Mashhad city during the years 1987–2012 have become isolated and decreased. Even, in some cities per capita of green space land-use is low from optimum range. The green spaces development process of Mashhad city

[5] See more in Available on: http://dev-hdr.pantheonsite.io/sites/default/files/hdr2016_technical_notes_0.pdf

show that the first modern green space is not racemization correctly and different groups have different idea about this subject but what of many of citizens have agreed about that is the Kohsangi urban park is an old urban park in Mashhad but National garden park in fact is the oldest park in Mashhad city. It has been made in 1952. Then, in order to balancing between urban park, green spaces land-use and other land-uses (such as: residential, commercial, administrative and etc.) were made parks in 1962 decade.

Nagendra and Gopal (2010) established that older parks had the greatest proportion of introduced species, followed by recent parks. In comparison, parks of intermediate ages appeared to have the highest proportion of indigenous species, although these were also largely dominated by exotics. Parks intermediate in age had greater canopy cover than older and more recent parks. Old parks had the least number of trees compared to other categories. The size of trees (DBH and height) in older parks was however significantly greater in old parks compared to those established in more recent years. While no significant differences in tree species richness were found amongst parks of different age categories, the Shannon diversity of tree species was highest in the older parks. The size class diversity was also significantly greater in old parks, as may be expected considering that the trees in these locations are likely to be older than in other parks, and may have been planted at multiple points in time.

Iqbal et al. (2010) described Dhaka is badly served for open space according to any per capita measure. Distribution of open space does not correspond to population distribution. Indeed the more crowded area, the less open space available. The existing urban parks in Dhaka city also are not equitably, even equally distributed throughout the city as seen in other developing cities. It varies one area to another. According to population (1996) and amount of open space (1999), a 1arge portion of the city does not have any open space. 52 out of 90 wards of DCC (about 60.1% of total DCC area) are deprived of park and playground. Out of 90 wards only 36 wards (24.9 % of total DCC area) have open space ranging from 0.01 acre to 0.21 acres per 1000 people. Only 4 wards (3.1% of DCC area) have open space within range of 0.64 acres to 0.85 acres per 1000 people. Better picture is prevailing in the ward 1 (Uttara) having 1.07 acres of open space per 1000 people, though it is remaining below the standard of other developed cities.

In kenya, Kisumu district, Poor maintenance and lack of adequate facilities had hindered optimal social, economic, environmental and educational benefits of the parks. Children were the least users of parks in Kisumu and the main reason being that there were no children friendly activities or facilities within all the parks. The social-cultural set up of the communities living within Kisumu Township was a key hindrance to female utilization of the Parks as more male than female visited the Parks and yet statistics from MCK indicate that female population exceeded male population. (Rabare et al. 2009).

2.2.2 Types of parks

In 1974, according to Rangwala, although the park may be aside to serve as breathing spaces and attractive areas of refreshment to both, mind and body, they are subject to considerable variation in size, purpose, character, location, etc. and they are therefore amenable to a variety of classifications (Rangwala et al. 2003).

The parks can be classified into the following three ways:

1. According to character;
2. According to purpose; and
3. According to size.

2.2.2.1 Parks according to character

The parks, according to character, are classified into the following two types:

a. Artificial Parks;

b. Natural Parks.

a. Artificial Parks

These parks are prepared artificially with great care by experts in the park layout. They are planted with grass, shrubs, flowers and trees. The water may be introduced in the form of fountains and pools. The seats of suitable design may be provided. They are usually prepared in the heart of a town and given an attractive finish.

b. Natural parks

In case of natural parks, all efforts are made to maintain in tack the original features of the parks and only the necessary minimum adjustments are made to put them for public use.

2.2.2.2 Parks according to purpose

The parks according to purpose are classified into following two types and they provide green spaces for special use.

a. Botanical Parks; and

b. Zoological Parks.

a. Botanical Parks

These parks are primarily meant for the study of plant specimens. But their atmosphere can be made more pleasant and appealing by the presence of beautiful trees, flowers and lawns.

b. Zoological Parks

These parks contain zoo and it’s absolutely necessary for the zoo to be given an attractive park-like setting. It is undoubtedly true that for the vast majority of people, a visit to the zoological

park is more or less an outing or a picnic, usually accompanied by children. A zoological park contains houses and other facilities for animals to be maintained in the zoo.

2.2.2.3 Parks according to size

The parks, according to size, are classified in to the following five types:

a. Small size parks;
b. Medium size parks;
c. Large size parks;
d. Reservations; and
e. National parks.

a. Small size parks

These parks are generally in the form of square enclosing in the public building. They are provided in dense business or residential areas where land is costly. The area of these parks varies from 1 hectare to 4 hectares. These parks may also be located as setting for architectural public buildings or monuments at junction of roads or in the midst of blocks of flats. For children, small parks of size about 0.20 hectares can be developed at suitable sites in the town. Such children's parks should have easy accessible and safety and they should be well equipped with modern type of sporting items merry-go-round, slides swings, etc.

b. Medium size parks

These are also known as the neighborhood parks and they are preferred for every residential locality in a town. Both the type of recreation, passive as well as active, may be provided in these parks. The community centre can also be located in these parks. The size of these parks should not be less than 12 hectares.

c. Large size parks

These parks serve the town or city as a whole or a number of neighborhood units. They may provide active recreation for games like cricket, boating, swimming, riding, etc. and may also accommodate zoological gardens. The large beaches on the ocean can also be included in this class of parks. They should be provided with paved footpaths, drive ways, shelters, parking places, drinking water fountains, restaurants, etc. The minimum area required for this type of park is about 40 hectares.

d. Reservations

These parks are suited outside the city limits and they include extensive areas of natural sceneries. They also provide facilities of moving into the forests and sea beaches. They are kept in a natural condition. They are also used to conduct camps and picnics. The minimum area required for this type of park is about 400 hectares.

e. National parks

These parks are very extensive in area and they are mostly unexplored. They may include within their rivers, forests, waterfalls, mountains, wild life, places of historical importance, coastal belts, etc. Such parks should be evenly distributed throughout the country so that whole of population can enjoy them. They should be accessible from a number of towns. These parks also provide facilities to the scientists and students for the study of natural flora and fauna. The students of various branches of science such as zoology, entomology, ecology, meteorology and seismology can take advantage of these parks for their studies. The area for national park may run into thousands or lacks of hectares.

2.2.3 Urban parks of Dhaka city

According to daily newspaper (The Independent 2015) Dhaka fares poorly on availability of open spaces, compared to cities in the region and the rest of the world. Open spaces provide recreational areas for residents and help to enhance the beauty and environmental quality of any urban area. Open spaces are considered as 'oxygen' for any big city. Unfortunately, once a city known for its lush parks and gardens, Dhaka has been transformed into a haphazard concrete jungle. Even two decades back, there were numerous open spaces in Dhaka. At present the capital, for its more than 16 million inhabitants, does not have adequate number of playgrounds and parks.

Another daily newspaper (The Daily Star 2015) a report published by this newspaper reveals an alarming fact about Dhaka's parks. The capital city, ranked one of the worst live able in the world, has only 54 parks when, ideally, it should have 92. That's only one side of the problem, though. Many of the existing parks are inaccessible to the citizens for recreational activities. According to the report, at least 10 parks in several parts of the city have been encroached on by powerful quarters. Parking lots, community centres, kitchen markets and mosques have replaced trees and shrubs that used to be a refuge to the city dwellers amidst the maddening chaos of the Dhaka City. And this has happened apparently with the acquiescence of the city corporation itself. Many of the major parks remain a haven for illegal activities such as prostitution, drug peddling and gambling, not to mention the rampant smoking.

The overall maintenance of Dhaka city's urban parks is not satisfactory, lack of maintenance and safety is a common problem there. Many parks and open spaces appear to be unutilized or underutilized for this reason, sometimes some of them appear as dumping ground for garbage, In most cases, they lack of toilets, drinking water, lights, sittings, walkways, etc, the problems of security and antisocial activities are prevailing in many parks, some of them are identified as crime zones also (Iqbal et al. 2010).

Dhaka City was once known for its serenity, beautiful parks, clean roads and lush greenery have now been converted into brick and concrete jungle. In the old part of city there is only 5%

open space while in New Dhaka 12 % of land is green and open. The total amount of open spaces in greater Dhaka i s about 17% to 18% and the total stock of public open spaces is hardly over 5000 acres (Mowla 2011).

2.2.4 Research gap

Most of the research on the use and importance of urban parks has been conducted in North America, Europe, and Australia (Chiesura 2004; Salazar and Menendez 2007; McCormack et al. 2010; Edwards et al. 2015). There are also a growing number of studies from South East Asia (Liu et al. 2017; Oh and Jeong 2007; Liu et al. 2017; Wei 2017; Xiao et al. 2017). A knowledge gap exists in terms of distribution, access and effectiveness to urban parks in developing countries and specifically in Bangladesh. This study attempts to fill this gap by understanding the relationship between spatial distribution and utilization of urban parks in the Dhaka city as an example of developing countries.

2.3 Theoretical Background

The type and use of parks in this study have been informed by previous research which have proven their benefits to urban park studies. Some studies in particular have been used as primary inspirations for the methodology used in this study.

Brown (2008) in his 'A Theory of Urban Park Geography' described that two factors the size of park and distance from concentrated human habitation influence the diversity of park values. The theory posits that the diversity of human values for parks will increase with park size, while the diversity of park values will decrease further from concentrated areas of human habitation. The mix of park types in the appropriate locations that enhances park system value. The theory is simple to explain, but complex to operationalize and test. He used theories of park size and distance from resident, questionnaire survey, Arc GIS in his study.

Schipperijn et al. (2010) work on the use of urban green space and factors correlated with this use based on the socio-ecological model. Result of this study showed that almost half of the respondents did not use their nearest green space the most. Whether or not respondent used their nearest green space most depends primarily on the area size. Again distance to the area and some factors (old age, young children, poor health etc.) are likely to express a reduced mobility. This paper also proved that there is a relation between distance to green space and frequency of use.

Ahmed (2011) predict and analyze the future urban growth of Dhaka City. He used images analysis (fisher supervised classification) method to prepare the base maps with five land cover classes. To observe the change detection different spatial metrics have been also used for quantitative analysis. Again, Bhunia and Shit (2013) used NDVI analysis to identified spatio-temporal change of vegetation in west Bengal, India. Saleem and Ijaz (2014) measured park

utilization and accessibility of neighborhood parks of Faisalabad City, Pakistan used chi square and correlation and show visitor pattern by using buffer analysis.

In this research utilization of parks of Dhaka city is analyzed by two important environmental factors: distance and size of park and tried to find out accessibility by buffer analysis. Three fundamental models are used as the base of this research;

I. Brunn and Williams (1983) land use model of the colonial based city in South Asia,
II. McGee's (1967) land use model of the South-East Asian city and
III. Philbrick (1957) Areal Functional Organization model.

Areal functional organization model is most important for this research work. First in 1957, Philbrick described this model in functional area of Chicago. After that many scholars used this model to describe the functional area of different purpose. The introduction and application of these concepts to urban geography was done by Masai (1961) and to agricultural geography by Yamamoto and Asano (1968). Satio (1984) used this model in his paper to describe the dairy regions in Tokyo Metropolitan area. All researches mostly described in developed countries perspective. However, at the first time, present research described the areal functional organization model in context of developing countries parks system and also in urban geography.

Few studies (Nilufar 1997; Byomkesh et al. 2011; Rahman et al. 2011; Ansari 2008; Nilufar 2000; Iqbal et al. 2010; Mowla 2011; Alam 2012; Tabassum et al. 2013; Khan 2014; Neema et al. 2014; Mishu et al. 2014) have been conducted earlier on parks and green spaces of Dhaka city. But, no organized study has been performed yet to evaluate the typology of parks in Dhaka city considering multiple criteria and improving the service area of urban parks. Therefore, in this research an attempt has been taken to classify all parks of Dhaka city with respect to their characteristics and a model for distribution of parks in Dhaka city is propose, as an example of developing country. Again, influence of both physical and social environment of park's user is also examined in this research with proposed functional model of parks in Dhaka city.

2.4 Methodology

This study consists of three stages (Figure 2.1). Each stages focusing on different areas of research interest. The first stage is to identify the research problem, emphasize on the scope of the study and review the associated literature in order to conceptualize and narrow down the focus of the study.

In second, the investigation stage is guided by the theoretical framework formulated in the previous stage. In this stage a broad micro level case study is being conducted to analyze the context of the study area, current situation and interacting with the users.

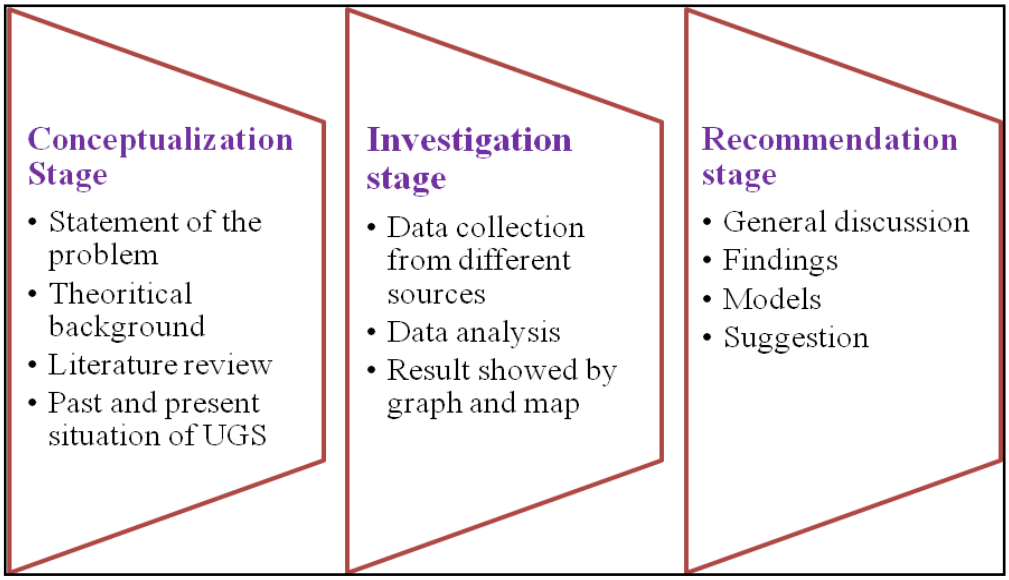

Figure 2.1 Three stages of this research

In the last stage recommendation is provided based upon the earlier findings to move towards a better urban life at large level. Again it would guide the planning and policy at the local level to achieve proper effectiveness and utilization of local resources. And at the same time this promotes some models for Dhaka city, Bangladesh in the context of developing countries.

Different levels of data collection at different stages have been adopted in this research. For example, observation and secondary data analyses were useful in drawing a general understanding of the domain, while primary data analysis of questionnaire responses led to a more in-depth analysis. Thus the research has tried to blend a mixture of quantitative and qualitative research methods depending on both primary and secondary data. Figure 2.2, illustrates the data collection methods used.

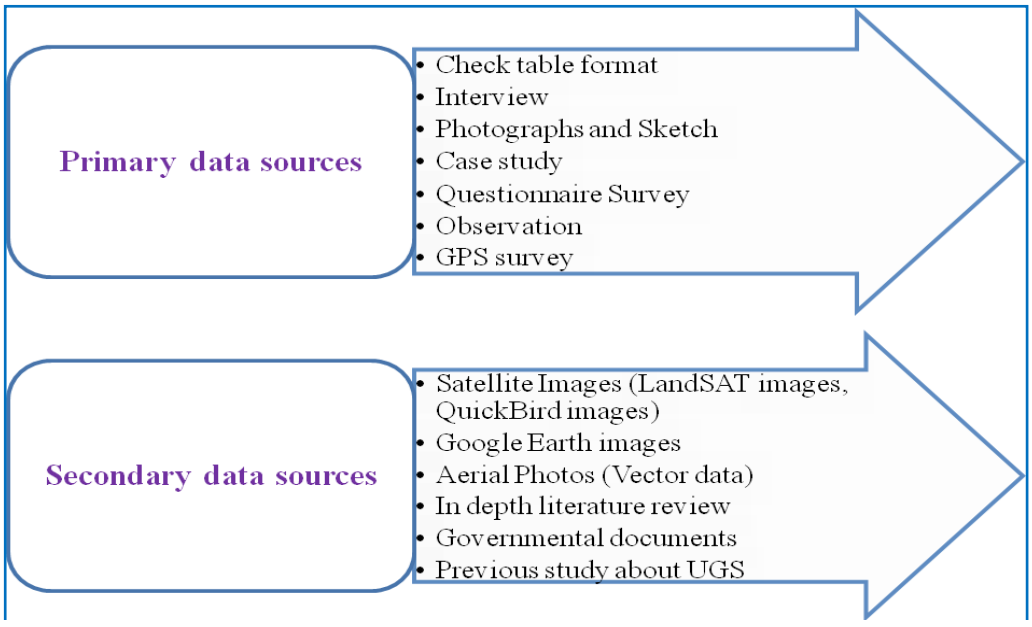

Figure 2.2 Methods of data collection used in this research

2.4.1 Primary data analysis:

Primary data are original observation collected by the researcher for the first time and analyzed for the research purpose, data regarding existing physical, environmental and ecological condition collected from field survey. As this research was based on primary data so following methods were used for the research purpose.

2.4.1.1 Selection of case study parks

In this study 'eight urban parks' have been selected for the purpose of case-study. Based on two important characters, these case studies parks selected. One is size of parks and another is urban structure of surrounding area. Location of parks also important for selection procedure. Brief discussion of parks are given below:

Case study- 1 (Uttara sector 7 park)

Symbol	:	For this research this park showed as S1.
Park size	:	3.58 acres
City Corporation	:	Dhaka North City Corporation (DNCC)
Location	:	New Dhaka and beside residential area.
Urban Structure	:	Planned urban area
Status of parks	:	Well maintained
Type of parks	:	Small size parks (Chapter 4)

Figure 2.3 Location of Uttara sector 7 park.
Source: Google Earth Map, 2017

Case study- 2 (Pantho Kunjo)

Symbol	:	For this research this park showed as S2.
Park size	:	3.0 acres
City Corporation	:	Dhaka South City Corporation (DSCC)
Location	:	Intersection zone of new and old Dhaka and beside commercial area.
Urban Structure	:	Mixed, planned and unplanned urban area.
Status of parks	:	Well vegetated area but lack of social environment.
Type of parks	:	Small size parks (Chapter 4)

Figure 2.4 Location of Pantho Kunjo park.
Source: Google Earth Map, 2017

Case study- 3 (Bahadur sha park)

Symbol	:	For this research this park showed as S3.
Park size	:	0.06 acres
City Corporation	:	Dhaka South City Corporation (DSCC)
Location	:	Old Dhaka and educational institutions around the park.
Urban Structure	:	Unplanned urban area
Status of parks	:	Poor maintained
Type of parks	:	Small size parks (Chapter 4)

Figure 2.5 Location of Bahadur sha park.
Source: Google Earth Map, 2017

Case study- 4 (Gulshan Lake park)

Symbol	:	For this research this park showed as M1.
Park size	:	9.57 acres
City Corporation	:	Dhaka North City Corporation (DNCC)
Location	:	New Dhaka and diplomatic zone area.
Urban Structure	:	Planned urban area
Status of parks	:	Well maintained and very well secured
Type of parks	:	Medium size parks (Chapter 4)

Figure 2.6 Location of Gulshan Lake park.
Source: Google Earth Map, 2017

Case study- 5 (Anwara park)

Symbol	:	For this research this park showed as M2
Park size	:	8 acres
City Corporation	:	Dhaka North City Corporation (DNCC)
Location	:	Intersection zone of new and old Dhaka; Private and government offices around the park.
Urban Structure	:	Mixed, planned and unplanned urban area.
Status of parks	:	Highest traffic zones, surrounding area diversified.
Type of parks	:	Medium size parks (Chapter 4)

Figure 2.7 Location of Anwara park.
Source: Google Earth Map, 2017

Case study- 6 (Osmani uddan park)

Symbol	:	For this research this park showed as M3.
Park size	:	22.10 acres
City Corporation	:	Dhaka South City Corporation (DSCC)
Location	:	Old Dhaka; South city corporation office and Secretary office zone.
Urban Structure	:	Unplanned urban area.
Status of parks	:	Historical memorial
Type of parks	:	Medium size parks (Chapter 4)

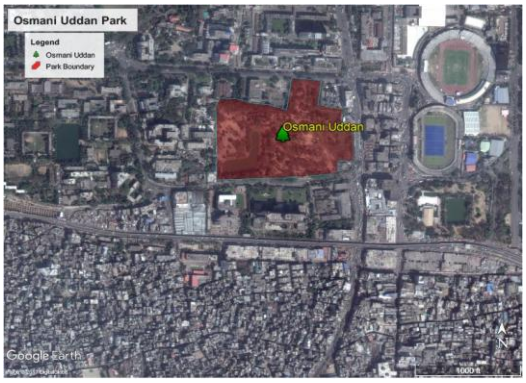

Figure 2.8 Location of Osmani uddan park.
Source: Google Earth Map, 2017

Case study- 7 (Dhanmondi Lake park)

Symbol	:	For this research this park showed as L
Park size	:	58 acres
City Corporation	:	Dhaka South City Corporation (DSCC)
Location	:	City center and diversified zone area (Private university, hospital, residential, political importance area)
Urban Structure	:	Mixed, planned and unplanned urban area
Status of parks	:	Design quality and well maintained
Type of parks	:	Large size parks (Chapter 4)

Figure 2.9 Location of Dhanmondi Lake park.
Source: Google Earth Map, 2017

Case study- 8 (Botanical Garden)

Symbol	:	For this research this park showed as EL.
Park size	:	210 acres
City Corporation	:	Dhaka North City Corporation (DNCC)
Location	:	City boundary and middle residential zone
Urban Structure	:	Newly planned urban area
Status of parks	:	Design quality and well maintained
Type of parks	:	Extra-large size parks (Chapter 4)

Figure 2.10 Location of Botanical Garden.
Source: Google Earth Map, 2017

2.4.1.2 Interview

Interview collected from following persons. For interview mainly focus on maintenance of parks, previous information about parks, future improvement (Appendix B).

Dhaka South City Corporation (DSCC)

- Farazi Shahabuddin Ahmed, Chief Engineer, Urban Planning Department, DSCC
- Jakir Hossain, BCS (Information) Chief Public Relation Officer Urban Planning Department, DSCC

Dhaka North City Corporation (DNCC)

- Farzana Bobi, Assistant Town Planner Urban Planning Department, DNCC.
- Tabassum Abdullah, Assistant Engineer Planning and Design Division
- Mohammad Abul Kashem, Executive Engineer (Civil) Nagar Bhaban, Dhaka North City Corporation.

Space Research and Remote Sensing Organization (SPARRSO)

- Z. M. Zahidul Islam, Member of SPARRSO

Limitations of the interview

- The interviewees were not treated as respondents to a questionnaire, but active participants in an unstructured/semi-structured interview. A checklist of issues was used as a basis for questions, not necessarily addressing all questions in each interview and sometimes departing from basic questions to pursue interesting, unexpected or new information, relevant to the study area and situation.
- In case of interview collection from city corporation office, respondents didn't cooperate.
- Lack of available and/or reliable data from different authority.

2.4.1.3 Photographs and Sketch

To examine visual quality of the park, a study has been carried out in Alanya County, Turkey using photographs (Ter 2012). He performed a study on Alaaddin Hill, a big tumulus place in the city of Konya which serves as an urban park, to determine what quality criteria are effective in assessment of Quality of urban parks. In this research by photographs tried to find out the present situation, quality of parks and also focus on differences of facilities of parks in Dhaka city. And by sketch, mainly focus on landscape and distribution of facilities inside the parks.

2.4.1.4 Check table format

In field work used the check table to identify different physical and cultural features. After collecting data prepared a list of features of parks.

Cultural Features: Gate, Bench, Table, Rain Shelter, Visitor's Shed, Artificial Waterfall, Vendor stall, Attraction, Sculpture, Orchid House, Net House, Snack corner, Toilet, Parking,

Watch tower, Food and Beverage, Building, Rest Zone, Masque/ Temple, Bridge, Electric Pole, Children Play Zone, Water Supply Station, Nursery area, Picnic Area, Cactus House, Research Centre, Dustbin, Artificial lake, Music facilities, Medical Facilities, Walking way, Drinking Water, Sports Field, Excise Area, Amphitheater.

Physical Features: Area, Shape, Wood Tree, Water body, Bamboo garden, Fruits Garden, Others.

2.4.1.5 Questionnaire survey

- The questionnaire method was chosen because it provides insights into people's beliefs, attitudes, values, and behavior (Sommer and Sommer 1991). The questionnaire was chosen because questionnaires can reduce the possibility of influence over participants based on his or her way of questioning (Sommer and Sommer 1991). In addition, the selection of questionnaire over interview was also based on the following advantages outlined by Mitra and Lankford (1999)
- They permit a person a considerable amount of time to think about an answer before responding. This means that the respondents do not have to answer immediately after the question is asked. They can answer at their leisure and at their own pace (Mitra and Lankford 1999).
- They provide greater measurement uniformity than interviews. Therefore, data can be more easily analyzed. The questionnaire allows participants to answer the exact same questions.
- Questionnaires are better suited to large random samples (Mitra and Lankford 1999). For this study, the sample population was large, as it was intended to measure a citywide opinion. Therefore, the questionnaire was the most appropriate method.

Questionnaire Design

The questionnaire is designed to meet research objectives and to answer research questions. Closed-ended and open-ended questions were used to measure people's characteristics toward urban parks in Dhaka city. According to Sommer and Sommer (1991), closed-ended questions are used when the researcher wants the participants to choose from a set of predetermined questions that have alternative answers. The researcher provides the alternatives. Researchers want confirmation of the answers in a specific scale for a measurement. On the other hand, open-ended questions give participants more freedom to answer the questions. The questionnaire was designed to be as simple as possible and variables were grouped within four factors: socio-economic status, transportation facilities (accessibility), park's inside facilities and trouble or problem. Other questions were based on the list of peoples' needs and preferred activities, related to the needs identified in the literature review.

Organization of the questionnaire

The questionnaires began with general questions about demographic characteristic. Demographic questions are considered easier to answer and putting them at the starting that participants feel free to answer than the difficult questions.

For this research, related questions were grouped together within the questionnaire. Questions 1 - 5 are about the transportation facilities used to come in the parks. Questions 6 - 10 are about visiting purposes and frequency of use of parks. Then 11 - 15 about parks inside facilities or availability. Questions 18 and 20 are open-ended questions for some suggestions about the park's environment. There, they are placed at the beginning of a set of related questions in order to avoid any contamination from the closed-ended questions. Question 16, 17, 21 and 22 focus on expenditure to visit parks. Questions 23 - 25 help to identify problems to use the parks. At the end, questions about feeling and comments about visiting parks condition.

The survey questionnaire was developed in two languages, Bangali and English, to make sure that all Bangladeshi understood it. Even though English is a principal language in Bangladesh, many Bangladeshi do not understand English very well.

Sample population

A detailed questionnaire survey of the whole population of the study area in an inadequate time frame is impossible. That is why the researcher has to take the advantages of sampling method. In this study eight case study parks were selected.

According to Patton (2002), “there are no rules for sample size in qualitative study”(pp. 244). At first decided to select 100 respondents from each parks. But in small and medium size parks visitors are common and repeated. So need to change the sample number.

For small size parks sample size 80, medium size parks sample size 90 and for large and extra-large parks sample size 100. Randomly sampling method used to select visitors.

Pre-Test

It is recommended that every research questionnaire be pre-tested by a group of people to assist the researcher with clarity. According to Sommer and Sommer (1991), “The impressive economy of the questionnaire is partially offset by the researcher’s inability to clarify the meaning of terms” (p. 138).

A pre-test was conducted on October 26, 2015. During this session, the participants were briefed with the purpose, layout, and content of the survey. The participants tried to answer the questionnaire and raised any possible problems that they faced in doing so. The pre-test participants found several problems pertaining to wording and typing errors, and felt that one question was unclear. The pre-test revealed no serious problems, and minor amendments were

made to the survey questions. The survey questionnaire later underwent a review by the researcher's committee members, and was finalized.

Data collection procedures

Data collection proceeded over a 4-day period for each parks (November 2015). four surveyors were involved in the first two days of the survey, and two surveyors were involved in the subsequent two days. The researcher's representative was present for all four days of the survey. Before surveying, all the surveyors were briefed on the survey procedure and survey question clarification. Two follow up briefings were made to the researcher's representative to address any questions that arose during the survey.

Limitations of the questionnaire

- Questionnaire were conducted at places, preferably at different site where local people gathered spontaneously. No formal invitation to the local people was made for participating at the group interview.
- Individual questionnaire were conducted with randomly selected persons.
- Both male and female respondents were considered and ignore children.
- Sometime visitors did not give the right information about parks.

2.4.1.6 Observation

A number of observations have been undertaken to characterize the existing urban parks in terms of present situation and nature of space use. It tries to identify the factors of the case study parks itself which influences the use, such as attractiveness, size, location, access, facilities, and management of the area; surrounding land use etc. In each sample area seven independent observations have been undertaken, each of which was for thirty minutes covering all the whole area during the peak hours of use. During the observations park's land type, vegetation coverage and condition, parks boundary also monitor. Besides, the nature of activities, the list of supporting services/facilities, their locations and service pattern has been determined.

2.4.1.7 GPS survey

GPS survey mainly used to identify the visitors distance from origin to parks. It's also main source to identify origin place of visitor. By collecting X, Y coordinate help identified the absolute location of visitor's origin place.

Figure 2.11 GPS survey
Source: Field survey, 2015

2.4.2 Secondary data analysis:

Secondary data are those which are collected by others and used by others. Secondary data are mostly published in newspapers,

periodicals, images, government documents, and journals. So, the following types of data were collected for the research work –

2.4.2.1 Satellite Images (Landsat images)

Satellite images (Landsat images) mainly used for detected the change of vegetation coverage in Dhaka metropolitan area. To prepare the base maps for analysis land cover change, Landsat satellite images (1972, 1989 and 2010) have been collected from the official website of USGS (U.S. Geological Survey). (Table 2.3) shows the details of the Landsat satellite images used for this research.

Table 2.3 Details of Landsat Satellite Images

Respective year	Date acquired (Day/Month/Year)	Sensor
1972	28-12-1972	Landsat 1 Multispectral Scanner (MSS)
1989	28-01-1989	Landsat 4-5 Thematic Mapper (TM)
2010	30-01-2010	Landsat 5 Thematic Mapper (TM)

Source: U.S. Department of the Interior, 2010

Landsat Path 137 Row 44 covers the whole study area. Map Projection of the collected satellite images is Universal Transverse Mercator (UTM) within Zone 46 N– Datum World Geodetic System (WGS) 84 and the pixel size is 30 meters (U.S. Department of the Interior 2010).

The surroundings area of DCC have also been included within the study area to know the past and present condition of land cover changes. The Band Combination used, for the base Landsat satellite images (Appendix A; Table 1), is 432 Red-Green-Blue (RGB). Map Projection used for DCC Boundary is Bangladesh Transverse Mercator (BTM) and datum is D_Everest_1830.

Reference Data

For the purpose of ground-truthing/ referencing, several base maps of Dhaka City (for the year of 1987, 1995 and 2001) have been collected from the Survey of Bangladesh (SoB). Again, for comparing the images some other reference satellite images (IRS image of 1996 and Landsat satellite image of 2003) have been collected from the Department of Urban and Regional Planning, Bangladesh University of Engineering and Technology (BUET), Dhaka, Bangladesh. Google Earth is another option to get some ideas about the recent land cover pattern of Dhaka city. These reference data have been used for preparing land cover maps. (The collected base maps are attached in Appendix A).

Composite Generation

Landsat TM records 7 spectral bands. For visual purpose any 3 bands are combined that are acting a False Color Composite (FCC). Using the basic colors red, green and blue (RGB) it is possible to prepare different FCC images (Eastman 2009). These FCC images are useful to distinguish between different cover types or ground objects like buildings, roads, and vegetation. The FCC of RGB= bands 4, 3 and 2 has been chosen for this research. This combination normally

makes urban areas appear blue, vegetation red, water bodies from dark blue to black, soils with no vegetation from white to brown (Geospatial Data Service Centre 2008).

Image Classification

Image classification refers to grouping image pixels into categories or classes to produce a thematic representation. Image classification comprehends various operations that can be applied to photographic or image data. These include image restoration, image pre-processing, enhancement, compression, spatial filtering and pattern recognition and so on (Canada Centre for Remote Sensing 2016). There are two basic methods of image classification: supervised and unsupervised. Supervised classification relies on the priori knowledge of the study area (Canada Centre for Remote Sensing 2016). Therefore, for this research, a supervised classification method has been used.

In case of supervised classification, the user develops statistical description for various known land cover types that is called signature development. Then a procedure is used to identify the similar pixels/signature for different land cover types for the whole image. The chosen colour composite is used for digitizing polygons around each training site for similar land cover. Then a unique identifier is assigned to each known land cover type (Eastman 2009). Moreover each type has been identified for making the land cover images. Four land cover types have been identified for this research (Table 2.4). The training sites developed for this research are based on the reference data and ancillary information collected from various sources as mentioned earlier. This is performed to make sure that the digital numbers (DNs) of different land cover types are acceptable prior to final classification (Ahmed 2011).

Table 2.4 Details of the Land Cover Types

Land Cover Type	Description
Built-up area	All residential, commercial and industrial areas, infrastructure.
Water body	River, permanent open water, lakes, ponds, canals and reservoirs.
Vegetation	Trees, shrub lands and semi natural vegetation, gardens, inner-city recreational areas, parks and playgrounds, grassland and vegetable lands.
Fallow land	Fallow land, earth and sand land in-fillings, construction sites, developed land, excavation sites, solid waste landfills, bare and exposed soils.

Source: Ahmed, 2011

Fisher classification

After developing signature files for all land cover classes the next step is to classify the images based on these signature files. This can be done by two ways: hard or soft classifiers. In case of hard classifications, each pixel is assigned in a way that has the most similar signature for a particular land cover type. On the other hand, soft classifications take into consideration the degree of membership of the pixel in all classes (Eastman 2009).

For this research, a hard classifier called "Fisher Classifier" has been chosen. Fisher classifier uses the concept of the linear discrimination analysis. Fisher Classifier performs well when there are very few areas of unknown classes and when the training sites are representative of their informational classes (Eastman 2009). This is why fisher classifier is appropriate for this particular research, because most areas for the classes are known. Finally all images are reclassified to produce the final version of land cover maps for different years.

Grid analysis

The new approach presented in this research for detail analysis of change detection by using "grid analysis". With the help of software, a grid mesh (fish net) over the area is created with a pre decided grid size. Grid size is to be decided based on the resolution of the satellite data and the unit ground area for which changes are to be monitored, say 500 m × 500 m (25 ha) or 1 km × 1 km (100 ha) with IRS P6 LISS III data. A grid should include sufficiently large number of pixels for providing robustness to the index value and at the same time its size should be such that the ground verification could be done in a practicable way (Ashutosh 2012).

QuickBird Images

In the past decade, with the development of new satellite sensors, a variety of high spatial resolution imageries, i.e., QuickBird, IKONOS and RapidEye, have been made possible. These satellite imageries provide rich landscape characteristics, detailed information about the size and shape of surface targets, as well as clear spatial relationships among the neighboring objects. This provides new opportunities for highly accurate and detailed land use/cover mapping at regional scales. However, it should be noted that, because of the narrow spatial coverage and high economic costs, these high spatial resolution imageries are generally utilized in mapping land use/cover for a specific small region, and hardly applied to large regions (Hu et al. 2013).

In this research, QuickBird images used for each case stud parks to identify the recent land use pattern inside the park and also neighborhood area (Appendix A; Figure 9-16). To know recent land use change, QuickBird satellite images (2010) have been collected from the Space Research and Remote Sensing Organization (SPARRSO), Dhaka, Bangladesh (Chapter 5).

Google Earth

More recently, the Google Earth (GE, hereafter) tool has developed quickly and has been widely used in many sectors. The high spatial resolution images released from GE, as a free and open data source, have provided great supports for the traditional land use/cover mapping. They have been either treated as ancillary data to collect the training or testing samples for land use/cover classification and validation or used as a visualization tool for land use/cover maps (Hu et al. 2013). However, very few studies have been undertaken to use GE images as the direct data

source for land use/cover mapping. If GE images can achieve relatively satisfactory classification, it may provide some opportunities for detailed land use/cover mapping by costing little.

In this research, Google Earth used for each case study parks to identify the natural and physical features inside and surroundings area of parks. Google earth mainly help for measurement of accuracy, boundary of parks.

Limitations of the Satellite images

- **Collection of Satellite Images**

To perform Spatio-temporal analysis, it is important to select the satellite images of the same time interval. Again the spatial resolution of the images is important. For this research purpose, Landsat satellite images have been chosen that are only commercially available but can be found in free public-domain. Another reason for choosing these images is that the time interval is found equal 20 years of interval (1972, 1989, and 2010). The main problem of working with Landsat images is low resolution. The spatial resolution of Landsat Image is 30 meter (Ahmed 2011).

QuickBird satellite images with higher resolution can be better option, but those images are commercial. So QuickBird image only used for case study parks land use analysis.

- **Seasonal Variation**

Another important point, while selecting satellite images, is seasonal variation. Seasonal variation is an important aspect for tropical countries like Bangladesh. The change in vegetation, wet land, low land and water body land cove types are evident due to different seasons. Therefore, in an ideal situation, satellite images of the same season are selected for this kind of research. But there exist some sorts of seasonal variation for Landsat satellite images collected for this research. The images collected for 1989 (January) and 2010 (January) are from the end of winter season. But the image of 1972 (December) is from full winter season. This kind of variation creates problems while preparing base maps for analysis.

- **Collection of Reference Data**

The next limitation regarding this research is the collection of reference data or maps. The reference data are necessary for ground truthing purpose of the base maps (1972, 1989 and 2010) that have been prepared from the Landsat satellite images. But reference maps of the respective years (1972, 1989 and 2010) are not available. Therefore the base maps of Dhaka city of the years 1987, 1995 and 2001, collected from Survey of Bangladesh (SoB), have been used for referencing purpose.

2.4.2.2 Aerial Photo

Historical aerial photographs have been used in numerous projects, but mostly as basis for manual digitization and visual human interpretation (Simpson et al. 1994 and Walde et al. 2009).

Digital processing of historical aerial photographs has successfully been applied to studies on large-scale areal phenomena such as vegetation dynamics (Kadmon and Harari-Kremer 1999 and Fensham and Fairfax 2002). However, there are no known studies reporting the successful use of historic grayscale aerial imagery for the automatic extraction of linear features or discrete objects such as buildings. However, changes in man-made structures, in particular buildings, are of interest when analyzing man-made impacts on the landscape, ecology, economy, and, for example, tourism (Lack and Bleisch 2010). The factors which thus far limited the use of historical aerial photographs for automated object and change detection include: the absence of multispectral or even color information, a limited radiometric resolution and a poor signal-to-noise ratio-compared to modern digital aerial or high-resolution satellite imagery.

To analysis land use change of case study parks, aerial photos (1984, 2000 and 2010) have been collected from the Space Research and Remote Sensing Organization (SPARRSO), Dhaka, Bangladesh. (Chapter 5)

Table 2.5: Eight primary characteristics used in manual interpretation of aerial photographs,

Characteristic	Definition	Use in manual interpretation
Tone/Color	Relative brightness or hue of pixels	Natural and anthropogenic feature identification
Size	Area (or number of pixels) of a feature or patch	Vegetation age and structure, habitat suitability, urban features/land use
Shape	Relative complexity of a feature/patch border or edge	Identification of natural (irregular shapes) and anthropogenic (geometric shapes) features
Texture	Frequency of change in tone among pixels; smoothness or roughness	Vegetation identification, biodiversity estimates, surface properties of a feature/patch
Pattern	Spatial arrangement and repetition of features or patches across an area	Land use, disturbance, habitat suitability, landscape structure
Shadow	Dark or "shadow" pixels caused by difference in elevation of a feature relative to surroundings	Feature identification and orientation
Site	Environmental conditions of the delineated feature/patch	Microclimate, species, local habitat suitability
Context	Conditions adjacent to, or surrounding, a feature or patch	Land use

Source: Adapted from Morgan et al., 2010

Limitations of the Aerial photos

- Aerial photography represents an important tool for mapping on local scale. But photos are not available of every years.
- Seasonal variation of aerial photos.
- Restricted and expensive.

2.4.2.3 In depth literature review

Literature collected to know the previous study and methodology. This also help to know the research gap.

A literature review performed on the basis of local, regional and international published relevant articles. The book Urban Forests and Trees edited by Konijnendijk et al 2005, articles from different issues of the Journal of Urban Forestry and Greening, Journal of Ecological Economics, Journal of Forest Policy and Economics, Journal of Trends in Ecology & Evolution, Journal of Landscape and Urban Planning and the Journal of Arboriculture, reports from FAO, UNEP, COST Action publication and others journals are the main source of literature for this purpose. Besides, other relevant literatures have been used collecting through the internet and library.

Limitations of the literature review

- Lack of available and/or reliable data from different sources.
- Lack of prior research studies on this topic.

2.4.2.4 Government documents

- Governmental Organizations
- Space Research and Remote Sensing Organization (SPARRSO), Dhaka, Bangladesh, QuickBird satellite images (Current Landuse)
- Rajdhani Unnayan Kartripakkha (RAJUK), (Urban Structure Plan)
- Bangladesh Bureau of Statistics (BBS),(Population data)
- Dhaka South City Corporation Bangladesh (DSCC)
- Dhaka North City Corporation Bangladesh (DNCC)
- Public Works Department (PWD), under the Ministry of Housing and Public Works
- Ministry of Law, Justice and Parliamentary Affairs (Website)

Reference Data

- Survey of Bangladesh (SoB)
- Department of Urban and Regional Planning, Bangladesh University of Engineering and Technology (BUET), Dhaka, Bangladesh
- Online Sources (Website)
- Official website of USGS (U.S. Geological Survey) , Landsat satellite images (1972, 1989 and 2010)

Limitations of the government documents

- Lack of available and/or reliable data from different organizations.
- Lack of available update management and restriction.
- Missing of some data.

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Chapter Two

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Chapter Three
Green Open Spaces and Urban Parks in Dhaka City

3.1 Introduction

The world's population crossed the 7 billion mark in 2011. According to UNFPA projections, within the next two decades the world's urban population will increase to almost 5 billion (UNFPA 2007). Between 2000 and 2030, urban populations in Asia and Africa are expected to double, and urban areas of the developing world will make up 81 per cent of urban humanity (UNFPA 2007). Most of these urban areas, including Dhaka, are already mega-cities (with more than 10 million people). Growing populations and urban centers are creating significant pressures on limited environmental resources in the mega-cities.

3.2 Dhaka city as a Study Area

Dhaka is the capital of the country located in a strategically central geographical position that accommodates about 10% of the nation's population. Dhaka is the most industrialized region accommodating the largest number of garment and knitwear factories which earn the highest amount of the foreign exchange for the country. About one third of the national urban population lives in Dhaka that also provides the highest number of jobs. The city produces more than one third of the nation's GDP. In the year 1990 Dhaka was ranked as the 24th largest mega city in the world. According to World Urbanization Prospects 2014 published by the United Nations, the population of Dhaka is now the 11th largest megacity. It also forecasts that Dhaka will be the 6th largest megacity of the world with a population of 27.37 million in 2030 (Dhaka Structure Plan: 2016-2035, 2015).

The location of Dhaka city is 23°41′ north latitude to 23°53′ north latitude and 90°21′ east longitude to 90°28′ east longitude. Tongi and Ashulia thana are in the north of Dhaka city, Keranigonj and Dohar in the south, Savar and Keranigonj in the west and Narayananj in the east (Figure 3.1).

Dhaka is the capital city of Bangladesh and is located in the central part of the country. The area of Dhaka mega city is 1,353 km^2 of which DCC occupies 276 km^2 (BBS 2001).

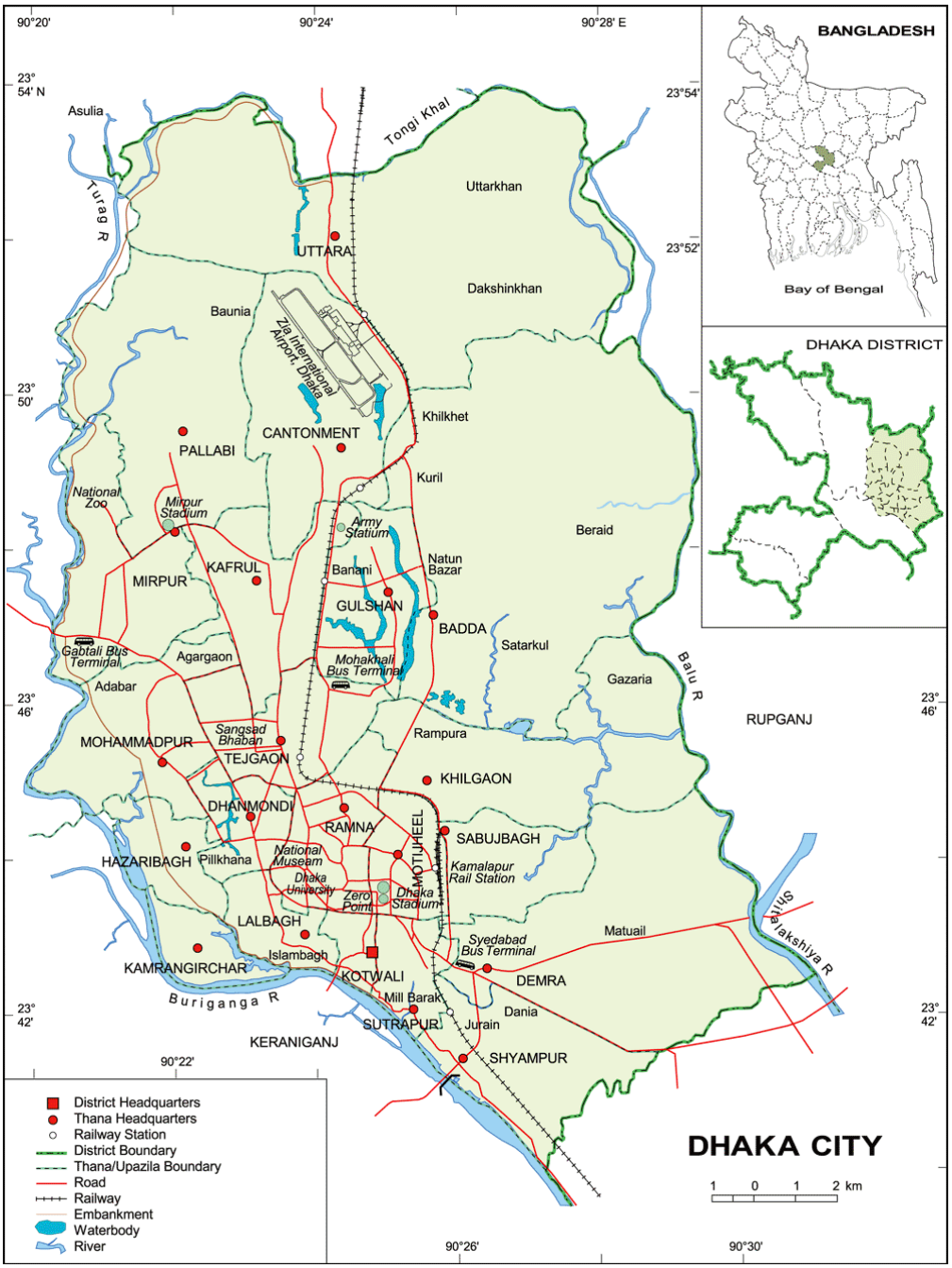


Figure 3.1 Location of the study area
Source: www. dhakadailyphoto.blogspot.com/2007/06/maps-dha...

3.2.1 Historical expansion of Dhaka city

Dhaka, the capital of Bangladesh, is one of the major mega- cities of South Asia. The city is located on the bank of the Buriganga River. Including metropolitan area, Dhaka has a population of over 15 million, making it the largest city in Bangladesh. It is the 9th largest city in the world and also fall among the most densely populated cities in the world. (Figure 3.2) shows the growth and expansion of Dhaka city under five major subsequent periods. Growth and expansion of Dhaka city in the scale of time under five major periods (Neema et al. 2013):

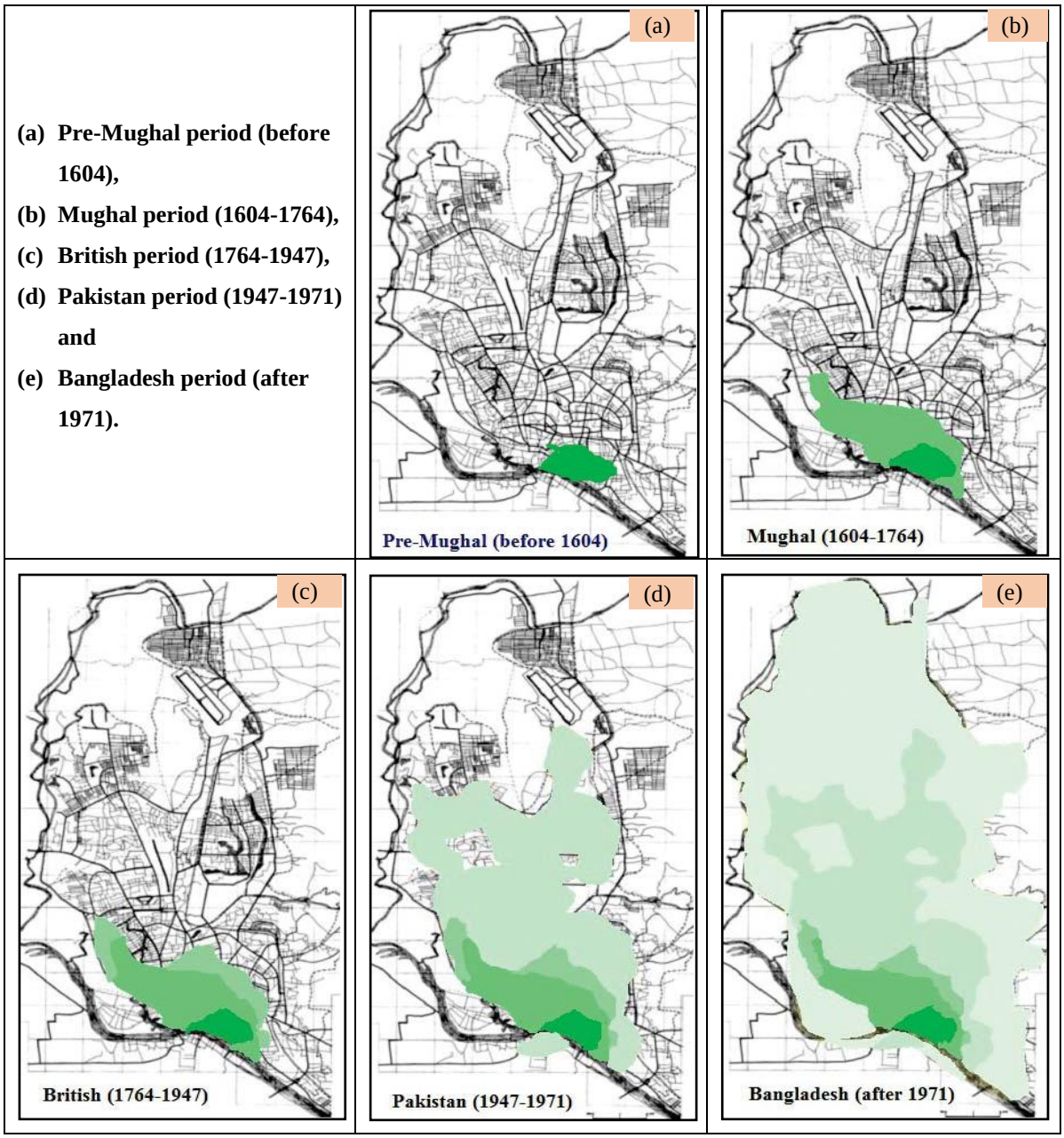


Figure 3.2 Urban expansion of Dhaka City

Source: Neema et al., 2013

Before the merciless urbanization in last three decades, Dhaka was considered as a very fine city with shaded and leafy streets, boats plied in the heart of the city, clean air, promenaded people on the banks of the river, playing children on open fields, and a sense of community among its citizens. Unfortunately, the environment and living condition of the city are deteriorating due to unplanned urbanization, deforestation and haphazard development activity in the city (Neema and Ohgai 2010; Neema et al. 2008).

Since its establishment, Dhaka has grown mostly without adequate planning interventions; substantially organic in nature. The patterns of areal expansion and the urban form of Dhaka have been largely dominated by the physical configuration of the landscape in and around the city,

particularly the river system and the height of land in relation to flood level (Dhaka Structure Plan: 2016-2035, 2015) .

There are two dominant general patterns in the historical evolution of urban (Nilufar 2010): old Dhaka or the historic core, and new Dhaka or northern expansion. The latter is actually post-colonial development, an effect of modernization, still spontaneous and organic in the nature. Besides these two dominant factors, five distinct and mutually exclusive spatial patterns are found simultaneously existing in an explicit composition.

3.2.2 Physical setting and Climate

Dhaka is considerably high above the water of surrounding rivers in ordinary seasons of inundation. The elevation of Greater Dhaka lies between 2 to 13 m above mean sea level (msl). Most of the urbanized area lies at the elevation of 6 to 8 m above msl (Tawhid 2004) which is flat and close to sea level. The natural drainage system in the greater Dhaka city comprises of several retention areas and khals (channels), which are linked to the surrounding rivers. There are more than 40 drainage channels (khals) in Dhaka including main and branch channels (Tawhid 2004).

Moist soils characterize the whole Dhaka city land for which Dhaka is susceptible to flooding during the monsoon seasons owing to heavy rainfall and cyclones. The main vegetation type is tropical in nature. Dhaka's increasing growth and primacy is partly explained by its geographic location. Being centrally located enjoys good accessibility with rail, road, water and air connections with all major towns and cities of Bangladesh (Islam 2001).

Dhaka experiences a hot, wet and humid tropical climate. The city is within the monsoon climate zone, with an annual average temperature of 25 °C and monthly means varying between 18 °C in January and 29 °C in August. Nearly 80% of the annual average rainfall of 1,854 millimeters occurs between May and September. The city also experiences tornado, thunderstorms and cyclone during the pre-monsoon season (Ansari 2008).

3.2.3 Geology

Dhaka is situated at the southern tip of a Pleistocene terrace, the Madhupur tract. Two characteristic geological units cover the city and surroundings, viz Madhupur Clay of the Pleistocene age and alluvial deposits of recent age. The Madhupur Clay is the oldest sediment exposed in and around the city area having characteristic topography and drainage. The major geomorphic units of the city are: the high land or the Dhaka terrace, the low lands or floodplains, depressions and abandoned channels. Low lying swamps and marshes located in and around the city are other major topographic features. The subsurface sedimentary sequence, up to the explored depth of 300m, shows three distinct entities: one is the Madhupur Clay of the Pleistocene age, characterized by reddish plastic clay with silt and very fine sand particles. This

Madhupur Clay unconformable overlies the dupi tila formation of the Plio-Pleistocene age, composed of medium to coarse yellowish brown sand and occasional gravel. The incised channels and depressions within the city are floored by recent alluvial floodplain deposits and are further subdivided into Lowland Alluvium and Highland Alluvium. (Banglapedia 2012).

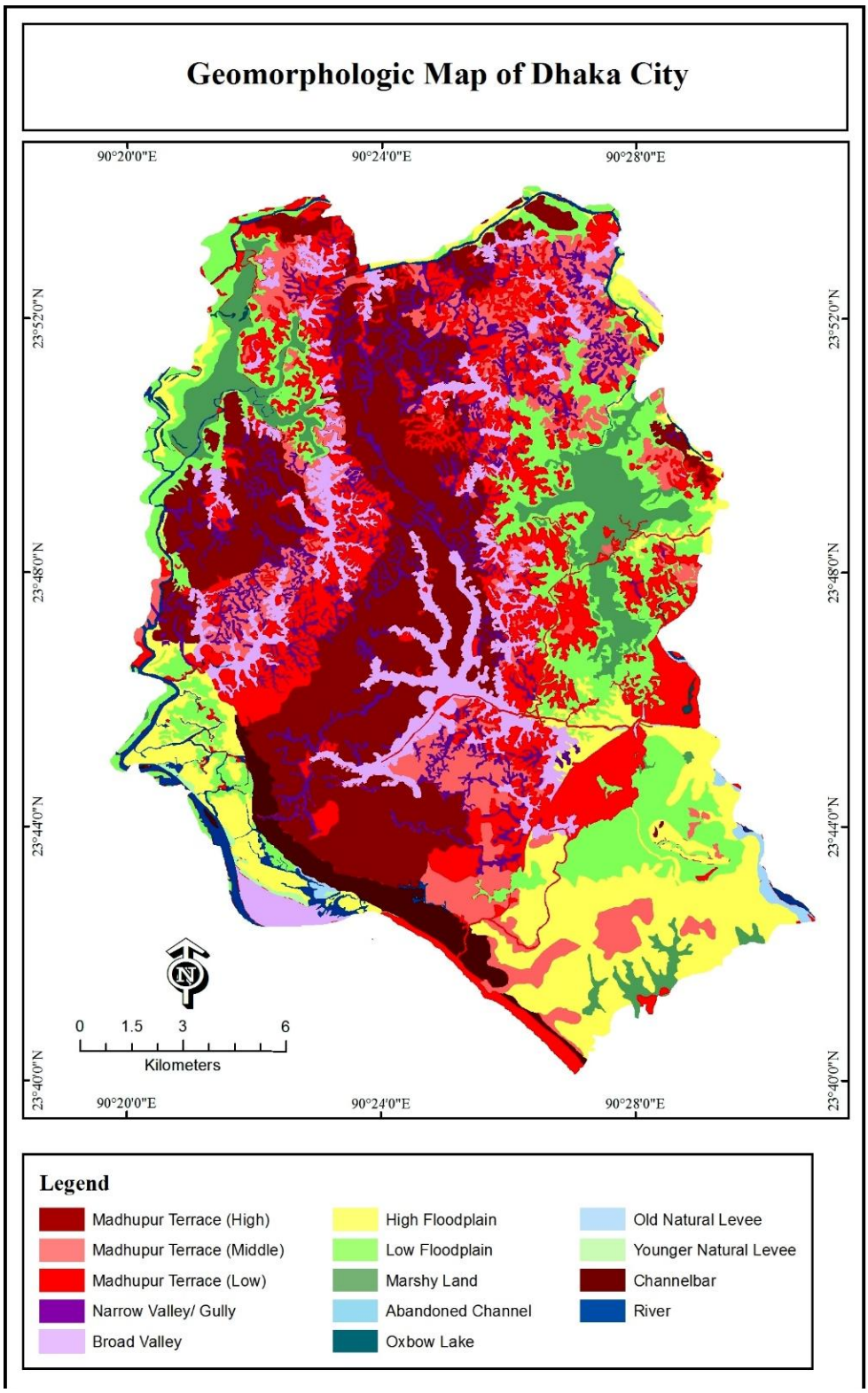


Figure 3.3 Geomorphic map of Dhaka city
Source: Adapted from Geological Survey of Bangladesh, 2015

3.2.4 Demographic character

According to United Nation Population Fund (UNFPA) the total population of Dhaka mega city is now over 12.3 million of which population of DCC is about 8.4 million. The population is growing by an estimated 4.2% per annum, one of the highest rates amongst Asian cities (Ansari 2008). The continuing growth reflects ongoing migration from rural areas to the Dhaka urban region, which accounted for 60% of the city's growth. The city's population is being also growing with the expansion of city boundaries. The population density of DCC is 19,286 per km^2 which is more than double of the mega city average of 7,918 per km^2 (BBS 2001).

Table 3.1 Historical expansion of Dhaka city

Year	Periods	Population	Area (sq.km.)
1608	Pre-mughal	30,000	2
1700	Mughal period	900,000	40
1800	British period	200,000	45
1867	British period	51,636	10
1881	British period	80,358	20
1891	British period	83,358	20
1901	British period	104,385	20
1931	British period	161,922	20
1941	British period	239,728	25
1951	Pakistan period	411279	85
1961	Pakistan period	718766	125
1974	Bangladesh period	2068353	336
1981	Bangladesh Period	3440147	510
1991	Bangladesh period	6887459	1353
2001	Bangladesh period	10712206	1530
2011	Bangladesh period	15123293	-

Source: Taylor, Sketch of the Topography and Statistics of Dacca (Calcutta: Military Orphan Press 1840); Bangladesh Bureau of Statistics, Bangladesh National Population Census Report - 1974 (Dhaka: Ministry of Planning 1977); Bangladesh Population Census 1991 Urban Area Report (Dhaka: Ministry of Planning 1997); Population Census 2001 Preliminary Report (Dhaka: Ministry of Planning 2001).

3.2.5 Land use

Dhaka carries a very long history dating back from the 1600 to present times. But the present city started to develop in a more planned way after 1947 when it gained regional and political importance (Chowdhury 1998). Previously, commercial and residential areas were situated side by side, mostly concentrated beside the narrow roads, old Dhaka still presents this situation with a mixture commercial, residential and small industries. After preparation of the Master Plan of the city in 1958, the commercial centers of the city was moved to Motijheel and a high residential area was developed at Dhanmondi. Housing colonies for government employees, universities, parks, commercial and industrial zones, lakes and other public facilities were developed gradually to meet the demands of the expanding city (Tawhid 2004). Again, result of rapid urban growth of Dhaka city, adjacent peri-urban and rural lands are being converted to built-up areas and land use changed hastily.

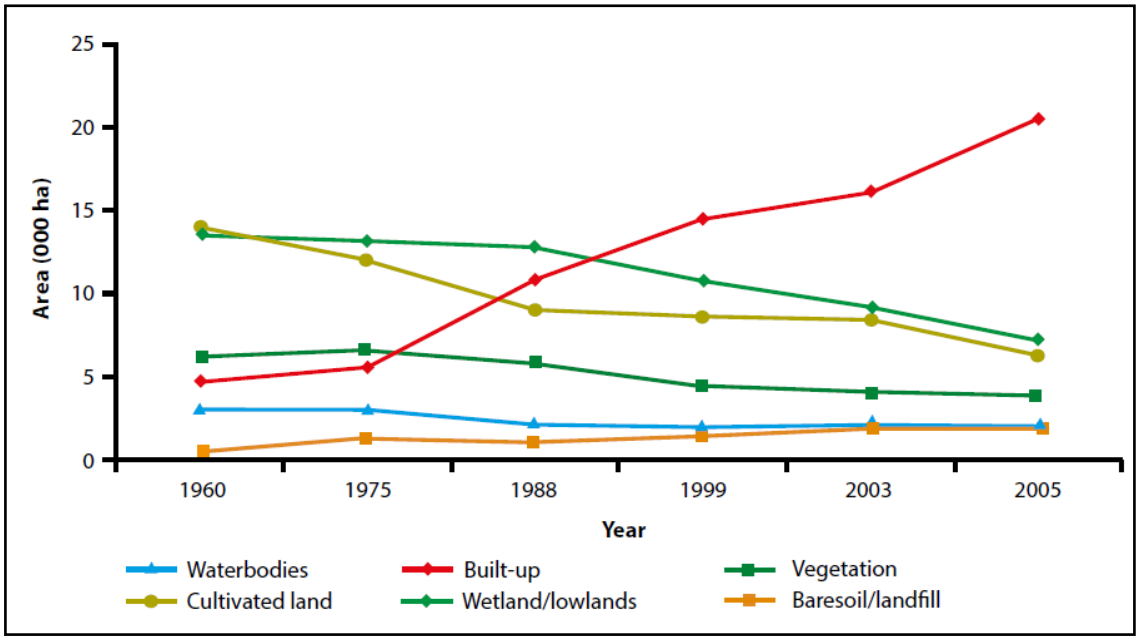


Figure 3.4 Temporal pattern of land use/cover change for Dhaka

Source: Rahman et al., 2015

In (Figure 3.4), spatial patterns of land use/cover change in the Dhaka study area for 1975, 1988, 1999 and 2005 reveal that low lying areas, cultivated lands and vegetation were the dominant cover in 1975 and the direction of urban development (collectively termed as 'built-up') confined to the north of the city. However by 1988, built-up land cover replaced cultivated land of the then fringe zone. The trajectory of urban development extended to further north and north-west between 1975 and 1988, when road transportation from Dhaka to the hinterland was provided by constructing bridges on the rivers (Islam 1996).

3.3 Open spaces in Dhaka city

Based on the nature of the land and the type of use, Nilufar (1999) ordered all the public open spaces within Dhaka City under the following (Table 3.2) four categories:

Table 3.2 Type of open space in Dhaka city

Type of open space	Criteria	Example	Area
Urban parks	Large open spaces	Ramna park, Chandrima udyan, Osmani udyan, Sohrawardy udyan	5-8 acres
Urban recreational areas	Open spaces developed and assigned for more or less organized outdoor recreational activities	Stadiums and tennis Complex at metropolitan scale, Armanitola play field at locale scale	2-9 acres
Urban development open spaces	Urban plazas/parks of various size in commercial and institutional areas	Pantha kunja, Anowara udyan, Gulistan park	2-8 acres
Functional open spaces	Functional in nature	Azimpur Graveyard, Islambagh Eidgah Math	-

Source: Nilufar, 1999

Generally, the green areas within the Dhaka city and its periphery are broadly part of the open space (Figure 3.5). According to the statistics of Taylor (Sustainable Development Networking Programme Bangladesh Department) 2005, the open space in Dhaka city is accounted only 21.573 % of its total area. As agriculture is the most dominant activity in Bangladesh, it comprises the highest proportion of open spaces that was about 12.12%. That's why agriculture is not a part of green resources of Dhaka city. Thus, green resources in point of view of UPFG (Urban and Peri-Urban Forestry and Greening) in Dhaka city comprise:

- Trees along the streets, paved paths in commercial and residential areas, car parks etc.
- Parks inside the town used for recreational purposes and generally consisting of different areas
- Public and private Garden, graveyard, nursery, zoo, spots fields etc.
- Other types of green areas may be within public or private areas.
- Larger green areas or National Parks outside the city but within the periphery, with some recreational use, mainly visited during holidays and weekends.
- Woodlots, social or community forest areas in peri-urban.

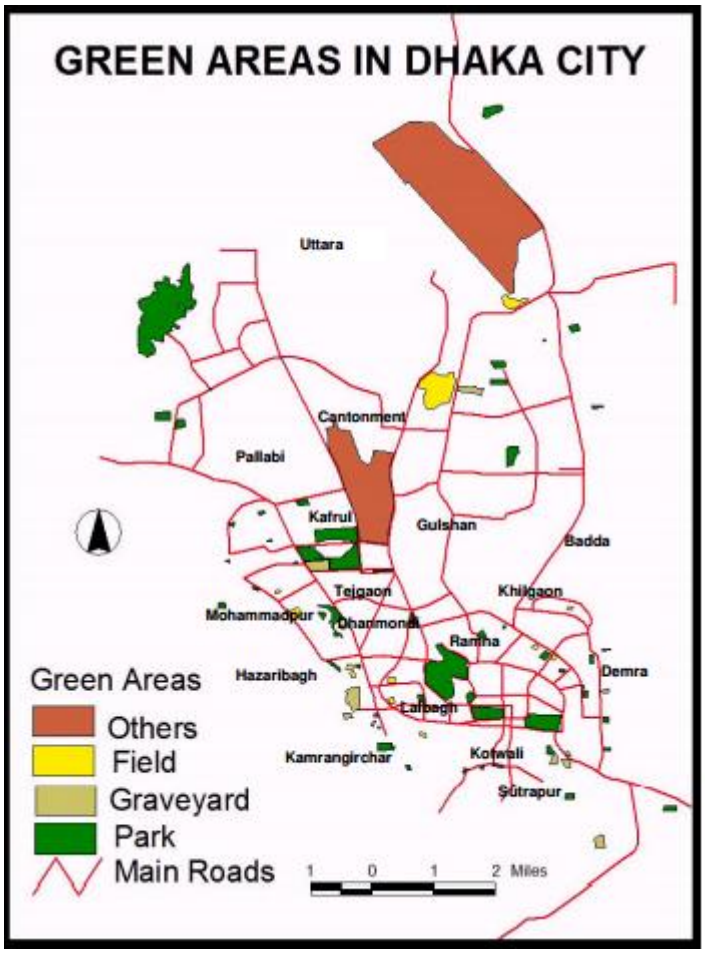


Figure 3.5 Green areas in Dhaka city

Source: Ansari, 2008

Therefore, green resources can be defined as trees or tree stands within the legal boundaries of DCC (Dhaka City Corporation) with the purpose of providing amenities for the population; namely shelter, recreation, landscaping, beauty etc. and additionally, both public and privately own large green areas, woodlots, social or community forest areas in the peri-urban areas of DCC for recreation and mostly timber, fuel wood and other products purposes (Ansari 2008).

3.4 Methodology

Luck and Wu (2002) recognized that urbanization is one of the most important driving forces behind land-use and land-cover changes in Jinan City (China). Kong and Nakagoshi (2006) reported that the driving forces are the policies that affect the development and management of urban green spaces. The causes of these changes in green spaces in the study area were also identified.

Again Byomkesh et al. (2011) estimated that based on spatiotemporal green space dynamics, the green spaces of Greater Dhaka are rapidly decreasing. Estimates of green spaces using satellite images from 1975 to 2005 revealed that the rate of change in green spaces was consistently high, and in the last 30 years a total loss of 8617 ha was observed in comparison to the base year of 1975. Two type data were used in this chapter as secondary data source. First, it was used of satellite images for detected the change of vegetation coverage. To prepare the base maps for analysis purpose Landsat satellite images (1972, 1989 and 2010) have been collected from the official website of USGS (U.S. Geological Survey). (Table 3.3) shows the details of the Landsat satellite images used for analysis.

Table 3.3 Details of Landsat satellite image**.**

Respective year	Date acquired (Day/Month/Year)	Sensor
1972	28-12-1972	Landsat 1 Multispectral Scanner (MSS)
1989	28-01-1989	Landsat 4-5 Thematic Mapper (TM)
2010	30-01-2010	Landsat 5 Thematic Mapper (TM)

Source: U.S. Department of the Interior, 2010

For analysis it needs to change all images for FCC (False Color Composite). These FCC images are useful to distinguish between different cover types or ground objects like buildings, roads, and vegetation. After supervised classification of these images (Ahmed 2011), for identifying the change of land cover of Dhaka city grid analysis were used. Again, NDVI analysis also completed by using these three images.

Grid analysis

Size of unit area of observation i.e. a grid in this methodology may be chosen considering the objectives of monitoring and the pixel size of the satellite data being used. Each grid is identifiable by a unique Id. The size has an implication on field inspection, the grid size should be such that it allows field inspection of the identified grid practicable in a reasonable time. A fishnet of 1.25 km

×1.25 km grid size for the whole area was created with the help of GIS software. The whole area comprised 20 × 23 = 460 grids. That means total area of the image is, 460 × 1.25= 575 sq. km. The unit area of change detection in this case becomes a square polygon of 1.25 km ×1.25 km which is identifiable by a unique Id. After drawing grid in all images, percentage of different land cover measured in each grid. The highest percentage land cover dominated the particular grid. Its helpful to measure the change of each grid in different year (Chapter 2).

Normalized Difference Vegetation Index (NDVI)

Green and vigorous vegetation reflects lesser amount of solar radiation in the visible wavelength (Channel3) contrasted to those in near-infrared spectrum (Channel4). The Normalized Difference Vegetation Index (NDVI) is defined by (Rouse et al. 1973) and Tucker (1979) as: NDVI = (Channel4 – Channel3) / (Channel4 + Channel3). Four NDVI continuous images, for all dates, resulted from this step with float data type (continuous real numbers). Each image at each date was recoded to only two values: 0 and 1. Zero for the nonvegetated land and one for vegetated land. The healthy and intense vegetation demonstrate a large and positive NDVI. In compare,

DIF [1972, 1989] =NDVI [1972] – NDVI [1989]

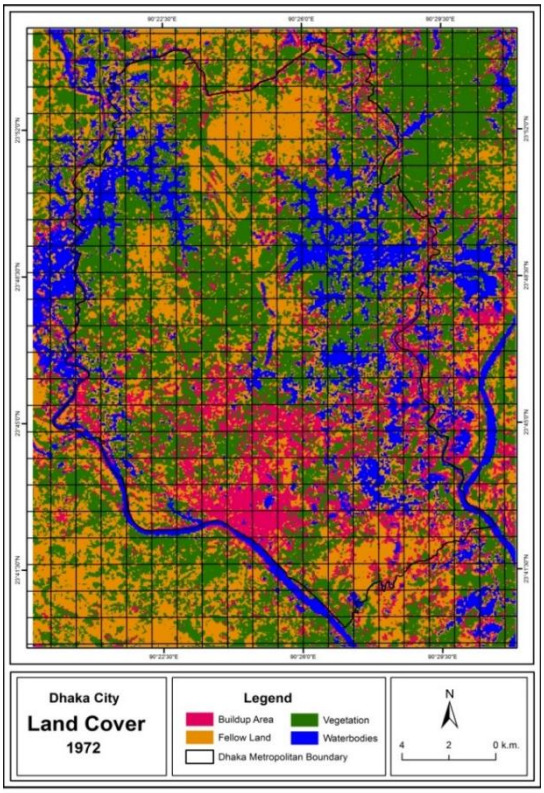
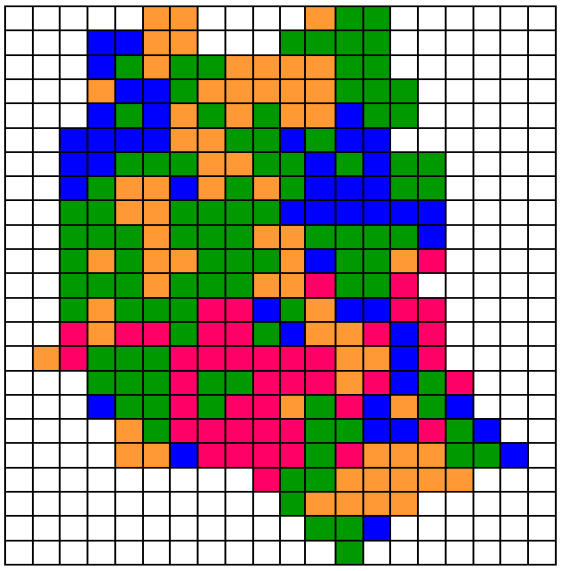
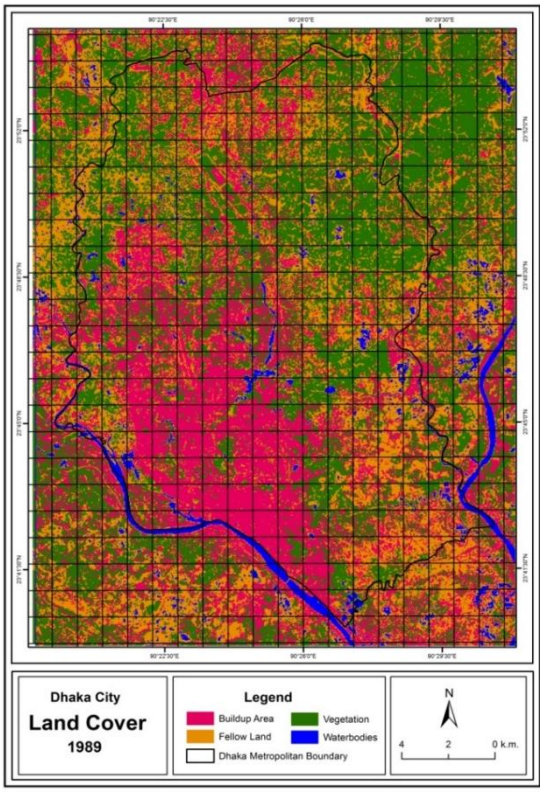
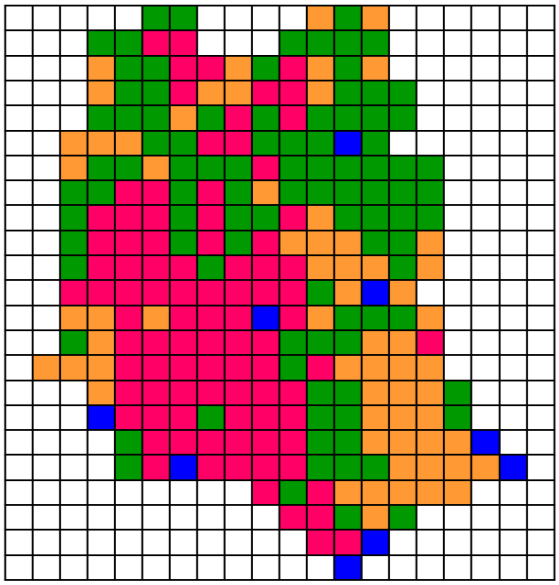
DIF [1989, 2010] =NDVI [1989] – NDVI [2010]

Secondly, it was used past and present information about parks, Dhaka City Corporation data based, literature on parks of Dhaka city to identify the distribution of parks in Dhaka city.

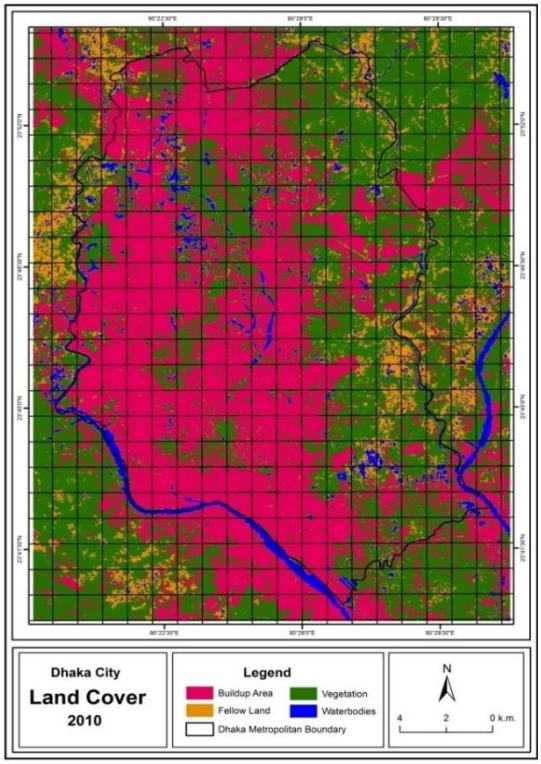
3.5 Spatial Analysis

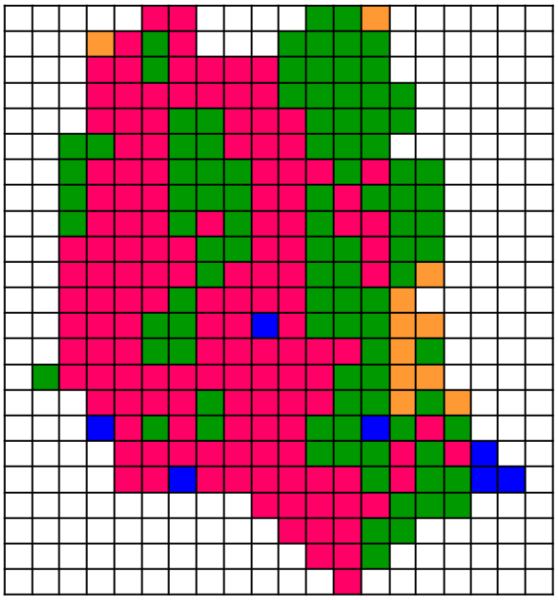
The extraction of green spaces along with other land-cover classes from multi-temporal satellite data provided valuable information on the change of green spaces in Dhaka city during 1972–2010 (Table 3.4). This table clearly depicts how green spaces are disappearing in the study area over the course of time. Grid analysis showed a sizeable reduction in green spaces in the last 40 years. After analysis of change type (Table 3.5), it was found that most of the grid was transferred into built-up area than other land cover. On the other hand, in the eastern part of the city newly vegetated area (fellow land to vegetation) was also found. But overall city land covers intensively changed and the whole city was turned into buildup area.

Table 3.4 Spatial and temporal changes of land cover of Dhaka City

Spatial and temporal changes of land cover of Dhaka City, 1972	
	 Grid analysis, Dhaka city (1972)
Spatial and temporal changes of land cover of Dhaka City, 1989	
	 Grid analysis, Dhaka city (1989)

Spatial and temporal changes of land cover of Dhaka City, 2010





Grid analysis, Dhaka city (2010)

Symbols	Major information	Multi-temporal satellite data
	Built-up area	All residential, commercial and industrial areas, infrastructure.
	Water body	River, permanent open water, lakes, ponds, canals and reservoirs
	Vegetation	Trees, shrub lands and semi natural vegetation, gardens, inner-city recreational areas, parks and playgrounds, grassland and vegetable lands.
	Fallow land	Fallow land, earth and sand land in-fillings, construction sites, developed land, excavation sites, solid waste landfills, bare and exposed soils.

Table 3.5 Changes of land cover in Dhaka city by grid analysis

Land cover 1972	Land cover 1989	Land cover 2010	Grid number
Fellow land	Buildup Area	Buildup Area	18
Vegetation	Buildup Area	Buildup Area	30
Fellow land	Fellow Land	Buildup Area	27
Vegetation	Vegetation	Buildup Area	20
Water body	Vegetation	Buildup Area	15
Buildup area	Buildup Area	Buildup Area	28
Fallow land	Vegetation	Vegetation	11
Vegetation	Vegetation	Vegetation	24
Vegetation	Fallow Land	Vegetation	18
Fellow land	Fellow Land	Vegetation	15
Others			54
Total			260

3.5.1 NDVI analysis

The Normalized Difference Vegetation Index (NDVI) is a numerical indicator that uses the visible and near-infrared bands of the electromagnetic spectrum, and is adopted to analyze remote sensing measurements and assess whether the target being observed contains live green vegetation or not.

NDVI has found a wide application in vegetative studies as it has been used to estimate crop yields, pasture performance, and rangeland carrying capacities among others.

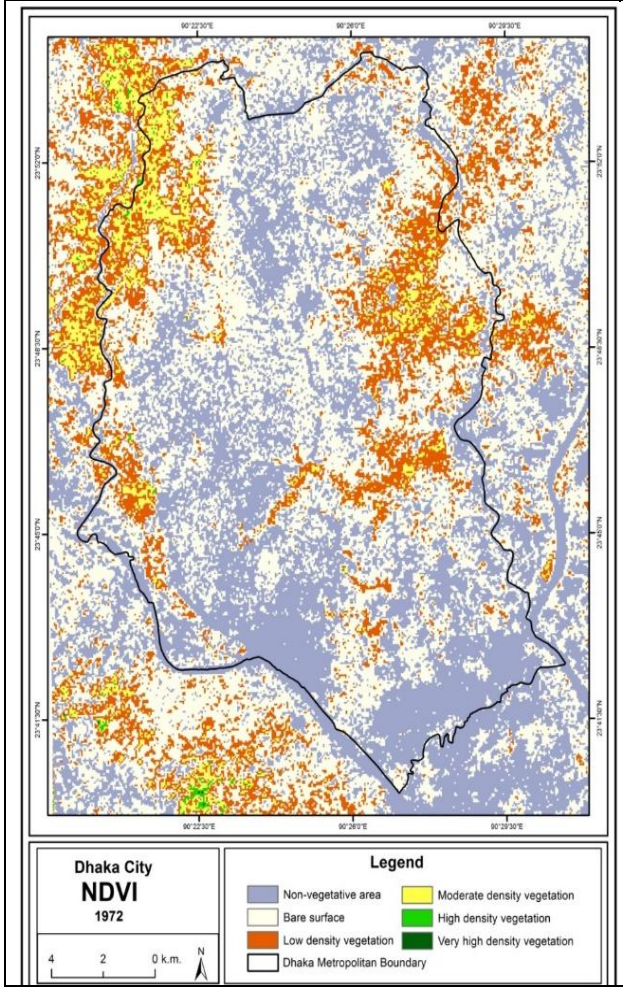
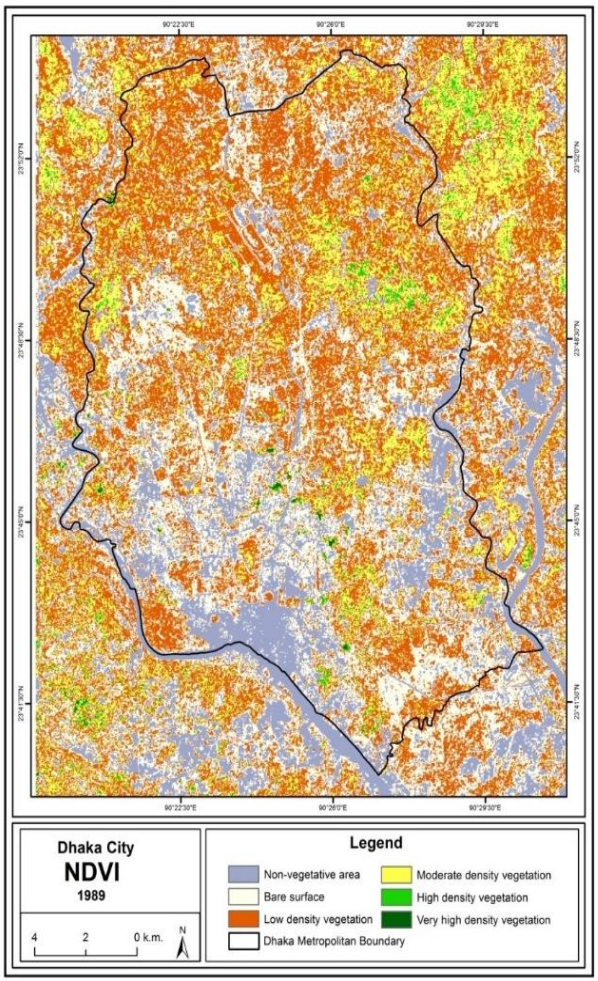
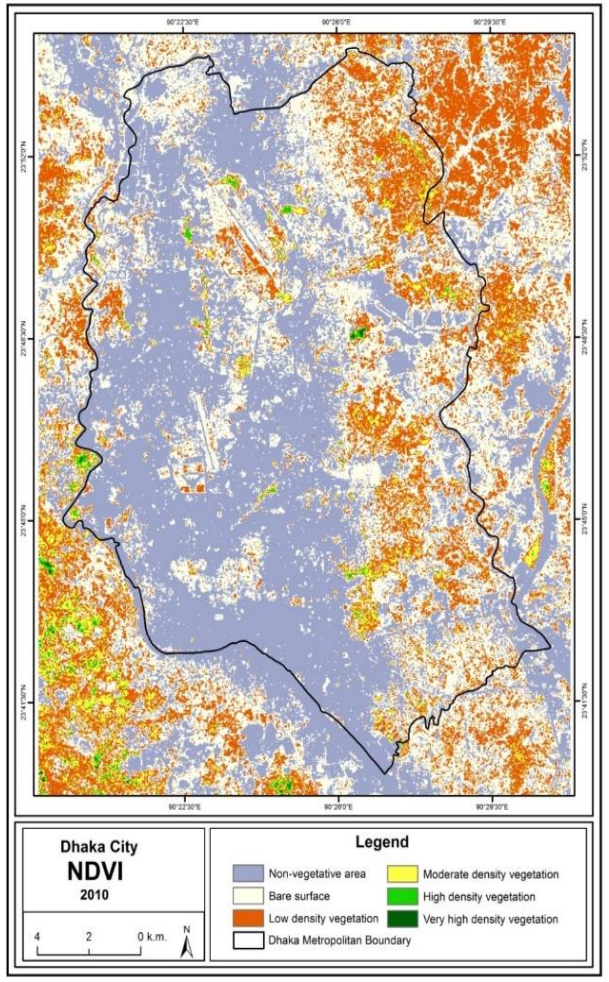
It is often directly related to other ground parameters such as percent of ground cover, photosynthetic activity of the plant, surface water, leaf area index and the amount of biomass. NDVI was first used in 1973 by (Rouse et al. 1973) from the Remote Sensing Centre of Texas A&M University. The NDVI algorithm subtracts the red reflectance values from the near-infrared and divides it by the sum of near-infrared and red bands.

$$NDVI= (NIR-RED) / (NIR+RED)$$

This formulation allows us to cope with the fact that two identical patches of vegetation could have different values if one were, for example in bright sunshine, and another under a cloudy sky. The bright pixels would all have larger values, and therefore a larger absolute difference between the bands. This is avoided by dividing by the sum of the reflectance.

Theoretically, NDVI values are represented as a ratio ranging in value from -1 to 1 but in practice extreme negative values represent water, values around zero represent bare soil and values over 6 represent dense green vegetation.

Table 3.6 Temporal coverage of vegetation during the period from 1972 to 2010

Temporal coverage of vegetation during, 1972	Temporal coverage of vegetation during, 1989	Temporal coverage of vegetation during, 2010
		

NDVI images was created using Landsat MSS and TM data for each image at each date (1972, 1989 and 2010) using band 3 (R) and band 4 (NIR) and used in the analysis of variation in NDVI. Vegetation index and difference images were generated for the 20 years study period (Table 3.6). Results showed that the vegetation index map derived by NDVI transformation within each computational group were dissimilar in terms of spatial distributional pattern and statistical characteristics. The mean NDVI value of the study area is gradually increasing during the period 1989 but again decrease in 2010 (Table 3.6). Again from land cover data found that in 1972 large area covered by fallow land and water bodies and in 2010 land cover changed into built up area. So in these two years non vegetated area is high.

(Table 3.7) explain the NDVI continuous images and the area coverage for the NDVI classes by square kilometer and percentage on different dates, respectively. Results showed that in 1972, non-vegetated area 39% (118.173 sq. Km) and low density vegetation 13% (38.7225 sq. Km). Again, in 1983 showed opposite relation, non-vegetated area decrease 16% (48.2011 sq. Km) and low density vegetation increase 38% (116.609 sq. Km). Moreover, in 2010 got reverse like previous (year 1972), non-vegetated area high increase 51% (155.5262 sq. Km) and low density vegetation decrease 13% (38.84341 sq. Km). However, very less percent of area covered with the high density vegetation and very high density vegetation zone in the study area.

Table 3.7 Surface characteristics of vegetation through NDVI

Surface Characteristics	NDVI Value	1972		1983		2010	
		Area (sq. Km)	%	Area (sq. Km)	%	Area (sq. Km)	%
Non vegetated area	< 0.00	118.173	39%	48.2011	16%	155.5262	51%
Bare surface	0.01 - 0.10	136.437	45%	98.6963	32%	102.5877	34%
Low density vegetation	0.10 - 0.20	38.7225	13%	116.609	38%	38.84341	13%
Moderate density vegetation	0.20 - 0.30	10.6593	4%	37.2798	12%	6.793753	2%
High density vegetation	0.30 - 0.40	0.227844	0%	3.34442	1%	0.995609	0%
Very high density vegetation	0.40 - 0.50	0.00	0%	0.280449	0%	0.066176	0%
Total		304.219644	100%	304.411069	100%	304.812848	100%

Table 3.8 show the incessant vegetation coverage transform images using the outputs of NDVI analysis at two different dates and the differences between the areas which changed from one land cover class to another by areas, respectively. The results showed that in 1972 to 1983, non-vegetated area of 69.9719 sq. Km and bare surface 37.7407 sq. Km were decreased; while in 1983 to 2010, 107.325 sq. Km non vegetated area and 3.8914 sq. Km bare surface areas were increased. However, the overall analysis during the period between 1972 and 1983 showed all types of density vegetation increased. But 1983 – 2010, there was decreased in trend of all types of vegetated area. In 1972 most of land covered by water bodies and bare surface, but in 1989 all vegetated area

increased, it may be due to the development of new settlement and agricultural land and as a result of reclamation process. Moreover, after 20 years 2010, land cover vastly changed into build up area. As a result, amount of vegetated area again decrease.

Table 3.8 Change detection of vegetation through NDVI during the period from 1972 – 2010

Surface Characteristics	1972 - 1983 Area (sq. Km)	1983 - 2010 Area (sq. Km)
Non vegetated area	69.9719 ↓	- 107.325 ↑
Bare surface	37.7407 ↓	- 3.8914 ↑
Low density vegetation	- 77.8865 ↑	77.76559 ↓
Moderate density vegetation	- 26.6205 ↑	30.48605 ↓
High density vegetation	- 3.11658 ↑	2.348811 ↓
Very high density vegetation	- 0.28045 ↑	0.214273 ↓

↑ = Increasing in trend;
↓ = Decreasing in trend

3.6 Distribution of parks in Dhaka city

The stock of green open spaces and parks in a city is important for the present and future of its urban life. To have a right picture of the present use and also to prepare future proposals it seems essential to have the facts and figures regarding the existing stock of green spaces. However, with multiplicity of controlling agencies, such figures are not readily available for Dhaka. Traditionally, the maintenance and control of parks of Dhaka have been shared by different authorities.

Previously open spaces and parks of Dhaka control by Public Works Department and RAJUK [previous DIT]. Being influenced by a political decision, at present, most of the open spaces and parks in local areas are handed over to the Dhaka City Corporation [DCC] authority as they collect tax from the citizens. The Arbory Culture Department of PWD only takes care of the large green areas of Dhaka. Beside these, other governmental agencies are responsible for their respective open areas like Zoo, Stadiums, Botanical Gardens etc.; and several open spaces are under the authority of different institutions. As a result, in absence of any central control or legal binding such figures rarely determined and reported for Dhaka City. Although PWD has a list of their open spaces; it has been found that Dhaka City Corporation [DCC] has no complete list of the open spaces under their authority (Nilufar, 1999). Besides, the stock of open spaces under other agencies and different institutions still remains uncovered. DMDP Structure Plan claims that at the city or metropolitan scale, Dhaka has a fair representation of recreational open spaces, both for active and passive recreation, though arguably not enough. [Dhaka Structure Plan, Vol.-I, 84: 1995]

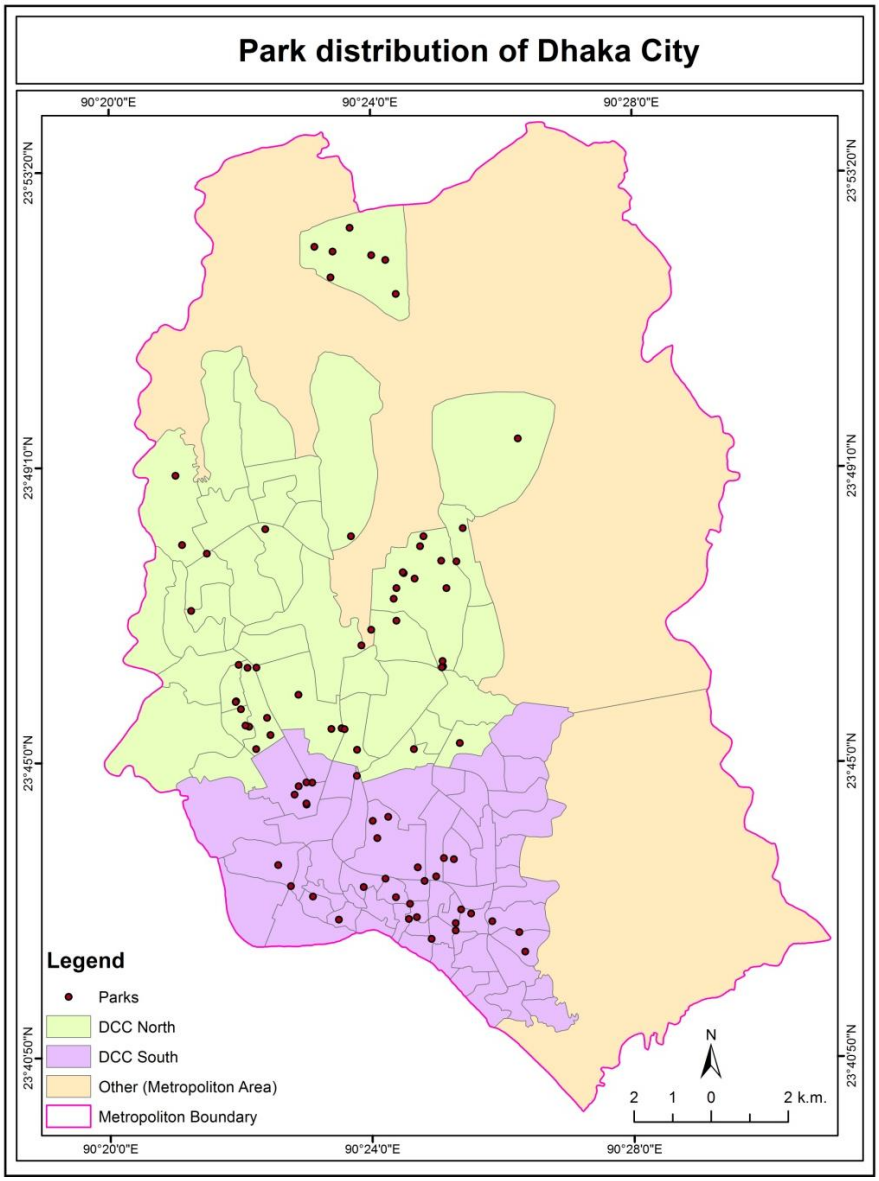


Figure 3.6 Distribution of parks in Dhaka city

Till now there is no clear list of parks of Dhaka city. From GPS survey, data from city corporation offices and website, local zonal offices[6], Google earth and also Nilufer (1999), in this research tried to prepare a complete list of parks in Dhaka city. Distribution of parks of Dhaka city are shown in Figure 3.6.

Mainly four authorities managed the urban parks of Dhaka city. The number of parks with managing authorities are given below (Table 3.9):

Table 3.9 List of parks in Dhaka city

Parks under the authority	Number of parks
Dhaka South City Corporation [DSCC]	31
Dhaka North City Corporation [DNCC]	52
Public Works Department [PWD]	4
Ministry of Environment and Forest [MoE&F]	2
Total	**89**

Source: Field survey, 2015; City Corporation website; Google Earth; Nilufer, 1999

3.6.1 Dhaka South City Corporation [DSCC]

Dhaka became the capital of Bangladesh with the independence in the year 1971. City area was divided into 50 wards and election of Ward Commissioners was held in 1977 with the introduction of "Pourashava Ordinance, 1977". The corporation was statute with the introduction of Dhaka Municipal Corporation Ordinance, 1983, repealing the application of Pourashava Ordinance, 1977. Later, number of wards was increased to 75 and Administrators/Mayors were appointed by the Govt. till 1994. In 1990, Dhaka Municipal Corporation was renamed as Dhaka City Corporation and was divided in to 10 zones.[7]

In 1993, the Government with a view to democratize the city corporation, made drastic amendment in Ordinance, 1983 and repealing the application of pourashava that the Mayor and the Commissioners will be elected by direct election on the basis of adult franchise. The City area is divided into 90 wards to represent one Commissioner, elected directly, form each ward. There are 18 reserved seats exclusively for women Commissioners who are elected by the Mayor and the Commissioners.[7]

Dhaka always expansion on the north ways. So for the necessary of well management and control, the Local Govt. (City Corporation) Act 2009, (Amendment-2011), Dhaka City Corporation has divided as Dhaka South City Corporation (DSCC) and Dhaka North City Corporation (DNCC). As a result, the parks which mainly located the southern part of the city control by DSCC.[6]

Table 3.10 List of Parks under the Dhaka South City Corporation [DSCC]

No.	Name of Parks	Location	Area	GPS Location
1	Jatrabari chourasta Park	East Jatrabari, Ward-48, DSCC Zone-5.	1.2 acres	N= 23°42'38.54" E= 90°26'4.66"
2	Dhanmondi Park	Mirpur Road, Dhanmondi Ward-15, DSCC Zone-1	0.81 Acres	N= 23°45'0.84" E= 90°22'42.68"
3	Kala Bagan Local Park	KalaBaghan,Mirpur Road, Ward-17, DSCC Zone-1	0.75 Acres	N= 23°44'45.50" E= 90°22'55.14"
4	Dhanmondi local park	Dhanmondi ,Road 4 Ward-15, DSCC Zone-1	1.32 Acres	N= 23°44'27.93" E= 90°22'49.63"
5	Bahadur Sah Park	Lakshi Bazar, Ward-42, DSCC Zone-4.	0.06 acres	N= 23°42'32.60" E= 90°24'44.29"
6	Saidabad Park	Saidabad, Ward-48, DSCC Zone-5.	0.0450 acres	N= 23°42'47.81" E= 90°25'39.84"
7	Samibagh Park	Samibagh, Ward-39, DSCC Zone-5.	1.35 acres	N= 23°42'54.87" E= 90°25'29.24"
8	Gulisthan Park (Sahid Motiur)	DIT Avenue, Ward-9, DSCC Zone-2.	3.5 acres	N= 23°43'26.82" E= 90°24'50.62"
9	Sirajud Doula Park	Zindabahar, Nayabazar, Ward-32, DSCC Zone-4.	0.85 acres	N= 23°42'49.85" E= 90°24'23.01"
10	Jogonnath Sah Road Park	Jogonnath Saha Road, Ward-24, DSCC Zone-3.	0.63 acres	N=N23°43'9.13" E= 90°22'55.42"
11	Hazaribagh Park	Nilombor Saha Road, Ward-22, DSCC Zone-3.	2 acres	N= 23°43'36.39" E= 90°22'24.32"

[6] See more in http://www.dhakasouthcity.gov.bd/park/index.html

No.	Name of Parks	Location	Area	GPS Location
12	kolabagan Lake Circus Park	Mirpur Road, Ward-17, DSCC Zone-1.	3.7175 acres	N= 23°44'59.09" E= 90°22'43.35"
13	Najirabazar Park	Majed sardar Road, Ward-33, DSCC Zone-4.	0.22 acres	N= 23°43'8.38" E= 90°24'11.49"
14	Malitola Park	Malitola, Ward-35, DSCC Zone-4.	0.33 acres	N= 23°42'51.40" E= 90°24'30.73"
15	Bongshal Triangle Park	Bongshal Old Chourasta ,Ward-35, DSCC Zone-4	0.03 acres	N= 23°43'2.74" E= 90°24'24.48"
16	Narinda Sishu Park	Narinda, Ward-41, DSCC Zone-5.	0.33 acres	N= 23°42'40.00" E= 90°25'6.31"
17	Narinda Sishu Park	Narinda, Ward-41, DSCC Zone-5.	0.1798 acres	N= 23°42'46.40" E= 90°25'6.23"
18	Bashir Uddin Sardar Park	Water wax Road Ward-29, DSCC Zone-3.	0.20 acres	N= 23°42'49.41" E= 90°23'19.16"
19	Outfall Staff quarter Sishu Park	Outfall, Ward-50, DSCC Zone-5.	0.33 acres	N= 23°42'21.89" E= 90°26'10.01"
20	Motijheel Park	Motijheel, Ward-9, DSCC Zone-2.	0.33 acres	N= 23°43'40.42" E= 90°25'4.85"
21	Dhanmondi 3 no gate park	Dhanmondi. Road-3, Ward-15, DSCC Zone-1.	0.8484 acres	N= 23°44'26.96" E= 90°22'49.78"
22	Hazaribagh Kasaitola Park	Gojmahal, Ward-14, DSCC Zone-3.	0.4269 acres	N= 23°43'18.05" E= 90°22'35.24"
23	Phulbaria Park (As a bus stand)	Fulbaria, Ward-34, DSCC Zone-4.	0.0698 acres	N= 23°43'21.99" E= 90°24'37.81"
24	Bokshibazar Park	Girza Urdu Road, Bakshibazar, Ward-27, DSCC Zone-3.	0.278 acres	N= 23°43'17.12" E= 90°23'42.04"
25	Nimtola Park	Nimtoly, Ward-20, DSCC Zone-1.	0.0391 acres	N=23°43'24.06" E= 90°24'2.05"
26	Motijheel Park Shilpo area	Motijheel, Ward-13, DSCC Zone-2	0.44 acres	N= 23°43'41.33" E= 90°24'55.53"
27	Motijheel Park Shilpo area	Motijheel park Ward-9, DSCC Zone-2	0.25 acres	N= 23°43'40.46" E= 90°25'4.78"
28	Dhanmondi Park	Mirpur Road, Ward-15, Zone-1.	4.4982 acres	N= 23°44'30.32" E= 90°22'38.76"
29	OsmaniUddayan	Phonix Road, Ward-20, Zone-1.	22.10 acres	N= 23°43'34.76" E= 90°24'31.82"
30	Central Sishu Park	Sahbagh, Ward-20, Zone-1.	15acres	N= 23°44'12.44" E= 90°23'52.47"
31	Dhanmondi Lake Park	Dhanmondi lake,Road 6A	58 acres	N= 23°44'42.44" E= 90°22'38.12"

Source: Field survey, 2015; City Corporation website; Google Earth; Nilufer, 1999

3.6.2 Dhaka North City Corporation [DNCC]

DNCC is the new part of City Corporation. This part of the city corporation is more planned and well managed. Large number of urban parks are located in here. Each city corporation had individual department to manage and control the parks[7].

Table 3.11 List of Parks under the Dhaka North City Corporation [DNCC]

No.	Name of Parks	Location	Area	GPS Location
1	Banani Sishu Park	Blk-D, Banani R/A, Ward-19, DNCC Zone-3.	1.14 acres	N= 23°47'21.53" E= 90°24'10.25"
2	Banani Park	Blk-C, Banani R/A,	0.9060 acres	N= 23°46'41.73"

[7] See more in http://www.dncc.gov.bd/

No.	Name of Parks	Location	Area	GPS Location
		Ward-19, DNCC Zone-3.		E= 90°23'40.56"
3	Banani Sishu Park	Blk-G, Banani R/A, Ward-19, DNCC Zone-3.	0.5670 acres	N= 23°47'30.13" E= 90°24'12.82"
4	Banani Sishu Park	Blk-F, Banani R/A, Ward-19, DNCC Zone-3.	1.23 acres	N= 23°47'43.05" E= 90°24'19.71"
5	Banani Lake Park	Adjacent to Banani Lake, Ward-19, DNCC Zone-3.	2.75 acres	N= 23°46'25.83" E= 90°24'55.23"
6	Kamal Ataturk Avenue Park	Kamal Ataturk Avenue, Ward-19, DNCC Zone-3.	0.6 acres	N= 23°47'38.11" E= 90°24'29.51"
7	Baridhara Park	Vatara, Baridhara, Ward-18, DNCC Zone-3.	2.2679 acres	N= 23°48'20.75" E= 90°25'13.84"
8	Baridhara Nursery Park	Vatara, Ward-18, DNCC Zone-3.	2.7089 acres	N= 23°47'53.59" E= 90°25'6.54"
9	Gulshan Taltola Park	Opposite of Gulshan Shooting Club, Ward-19, DNCC Zone-3.	3 acres	N= 23°46'25.92" E= 90°24'55.50"
10	Nababgonj Park	Nababgonj 2nd Lane, Ward-19, DNCC Zone-3.	0.5 acres	N= 23°47'11.28" E= 90°21'4.41"
11	Shyamoli Park	Mohammedpur Ring Road, Ward-32, DNCC Zone-5.	3.57 acres	N= 23°46'23.07" E= 90°21'56.03"
12	Sahid Makil Park	Mohammedpur , Ward-31, DNCC Zone-5	1.98 acres	N= 23°45'34.05" E= 90°21'53.92"
13	Shia Mosque Park	Mohammedpur Ward-31, DNCC Zone-5.	1.25 acres	N= 23°46'25.45" E= 90°21'47.86"
14	Iqbal Road Field Park	Iqbal Road, Ward-32, DNCC Zone-5.	1.6070 acres	N= 23°45'40.10" E= 90°22'13.17"
15	Shyamoli Sishu Park	Shyamoli, Ward-28, DNCC Zone-5.	1.5 acres	N= 23°46'23.61" E= 90°22'4.14"
16	Kawran Bazar Park	Kawran Bazar, Ward-26, DNCC Zone-5.	0.52 acres	N= 23°45'13.81" E= 90°23'36.03"
17	Firm gate Trikon Park	Firmgate, Ward-26, DNCC Zone-5.	0.05 acres	N= 23°45'26.42" E= 90°23'24.66"
18	Pantho Kunja Park	Kawran Bazar, Ward-26, Zone-5.	3.0 acres	N= 23°44'51.94" E= 90°23'36.16"
19	Pallabi Sishu Park	Senpara Porbota, Ward-4, DNCC Zone-2.	0.70 acres	N= 23°48'6.56" E= 90°20'56.56"
20	Tree Uddayan	Senpara Porbota, Ward-4, DNCC Zone-2.	0.33 acres	N= 23°48'20.28" E= 90°22'12.66"
21	Khilgaon Sishu Park	Khilgaon Rehabilitation Area Ward-23, DNCC Zone-3.	0.65 acres	N= 23°45'18.86" E= 90°25'10.56"
22	Mirpur 1 no Round about Park	Mirpur 1 no round Ward-8, DNCC Zone-2.	0.05 acres	N= 23°47'59.72" E= 90°21'19.05"
23	Wonderland Park	Gulshan, Ward-19, DNCC Zone-3.	2.5 acres	N= 23°47'30.04" E= 90°24'58.58"
24	Ser sahsuri Lane Park	Ser Shah suri Road, Ward-31, DNCC Zone-5.	1.875 acres	N= 23°45'47.96" E= 90°21'49.93"
25	Udoyjol Field45	Iqbal Road, Ward-32, DNCC Zone-5.	1.229 acres	N= 23°45'42.21" E= 90°22'5.38"
26	Mohammedpur Tajmohol Road Park	Tajmohol Road, Ward-29, DNCC Zone-5	0.785 acres	N= 23°45'54.77" E= 90°21'46.31"
27	Lalmatia D Block Park	Lalmatia, Ward-32, DNCC Zone-5.	1.184 acres	N= 23°45'14.03" E= 90°22'3.82"
28	Uttara Sector 11 Park	Uttara Sector 11 ,Ward-1, DNCC Zone-1	1.50 acres	N= 23°52'35.45" E= 90°23'30.78"
29	Uttara Sector 12 Park	Uttara Sector 12,Ward-1 , DNCC Zone-1	1.17 Acres	N= 23°52'19.38" E= 90°22'58.23"
30	Uttara Sector 7 Park	Uttara Sector 7 Ward-1 , DNCC Zone-1	3.58 Acres	N= 23°52'12.27" E= 90°23'50.36"

No.	Name of Parks	Location	Area	GPS Location
31	Uttara Sector 5 Park	Uttara Sector 5 Ward-1 , DNCC Zone-1	0.58 Acres	N= 23°52'8.18" E= 90°24'3.37"
32	Uttara Sector 5 Park	Uttara Sector 7 Ward-1 , DNCC Zone-1	1.49 Acres	N= 23°51'45.81" E= 90°23'7.77"
33	Vishal Litu Park	Gulshan North Ave,Road No-69 Ward-19, DNCC Zone-3	0.80 Acres	N= 23°48'14.11" E= 90°24'37.64"
34	Banani club Field	Banani Road No-18 Ward-19, DNCC Zone-3	1.12 Acres	N= 23°47'42.76" E= 90°24'19.52"
35	Dr.Fozle Rabbi Park	Bir Uttaam Mir shawkat sarak,Nicketon Ward-19, DNCC Zone-3	3.90 Acres	N= 23°46'25.54" E= 90°24'54.47"
36	Mohakhali DOHS Park	Park Road ,Mohakhali Ward-16, DNCC Zone-4	2.93 Acres	N= 23°46'54.90" E= 90°23'49.40"
37	Children and Women Park	Mohakhali DOHS, Road No-32 Ward-16, DNCC Zone-4	0.05 Acres	N= 23°46'41.76" E= 90°23'40.39"
38	Shere Bangla Nagar Park	Indira Road,Framgate Ward-27, DNCC Zone -5	2.67 Acres	N= 23°45'30.98" E= 90°23'12.73"
39	Farmgate Park	Khamarbari Road,farmgate Ward-27,DNCC Zone-5	2.43 Acres	N= 23°45'31.52" E= 90°23'22.13"
40	Childrens' Park	Mirpur-1 Avenue2 Ward-11,DNCC Zone-4	0.40 acres	N= 23°48'7.10" E= 90°20'56.19"
41	Tajmahal Park	Tajmahal Road,mohammadpur Ward-29,DNCC Zone-5	1.55 Acres	N= 23°45'54.57" E= 90°21'45.48"
42	Town Hall Park	Asad Avenue,Ward-31,DNCC Zone-5	0.68acres	N= 23°45'33.18" E= 90°21'57.30"
43	Noyatola	Noyatola Road, Ward-35,DNCC Zone-3	0.22 Acres	N= 23°45'13.65" E= 90°24'28.47"
44	Gulshan Park	Gulshan, Ward-19, DNCC Zone-3.	8.97 acres	N= 23°48'5.36" E= 90°24'35.77"
45	Gulshan Central Park	Gulshan, Ward-19, DNCC Zone-3.	7.6160 acres	N= 23°46'25.54" E= 90°24'54.47"
46	Uttara Sector 13 Park	Uttara Sector 13 Ward-1, DNCC Zone-1.	4.09 acres	N= 23°52'18.05" E= 90°23'14.40"
47	Uttara Sector 4 Park	Uttara Sector 4 Ward-1, DNCC Zone-1.	6.31 acres	N= 23°51'40.04" E= 90°24'13.78"
48	Safwan Park	Boshondara,Block-F Ward-17, DNCC Zone-1.	7.46 acres	N= 23°49'37.37" E= 90°26'6.76"
49	Gulshan Lake Park	Gulshan-2, Gulshan North Ave Ward-19, DNCC Zone-3.	9.57 acres	N= 23°48'5.24" E= 90°24'33.95"
50	Gulshan Tank Park	Gulshan-2,Road No-86 Ward-20, DNCC Zone-3.	9.30 acres	N= 23°47'53.67" E= 90°24'53.84"
51	Baridhara Lake Side RAJUK Park	United Nations Road,Baridhara Ward-18, DNCC Zone-3.	4.50 acres	N= 23°47'53.45" E= 90°25'6.24"
52	T and T Playground park	Banani Road No-8 Ward-20, DNCC Zone-3.	4.8 acres	N= 23°47'2.30" E= 90°24'12.59"

Source: Field survey, 2015; City Corporation website; Google Earth; Nilufer, 1999

3.6.3 Public Works Department [PWD]

The responsibility of maintenance of important Parks and Lakes lies with PWD. Standing at the heart of Dhaka City, a dedicated office of PWD is working round the clock to maintain the natural beauty of Ramna Park which is the home of hundreds and thousands of different flora and fauna. The Sohrowardi Uddyan is another historic park in Dhaka which is maintained by PWD[8].

[8] See more in http://pwd.gov.bd/about/environment

Table 3.12 List of Parks under the Public Works Department [PWD]

No.	Name of Parks	Location	Area	GPS Location
1	Anowara Uddayan	Near Framgate	8 acres	N= 23°45'30.86" E= 90°23'16.04"
2	Sohrawardi Uddayan	(DSCC) Ward-20, Zone-1.	55 acres	N= 23°44'2.60" E= 90°23'50.76"
3	Ramna Park [including Nursery]	(DSCC) Ward-20, Zone-1.	58 acres	N= 23°44'13.78" E= 90°24'5.73"
4	Chandrima Uddayan	(DNCC) Ward-27, Zone-5.	77 acres	N= 23°45'57.10" E= 90°22'45.23"

Source: Field survey, 2015; City Corporation website; Google Earth; Nilufer, 1999

3.6.4 Ministry of Environment and Forest [MoEF]

The Botanical garden provided learning and recreational facilities adjacent to the Dhaka Zoo. It is divided into 57 sections and is managed by Forest Department under Ministry of Environment and Forests, Government of Bangladesh. Another famous park of Dhaka city is Baldha garden. It has huge and rare collection of flora. The Baldha garden is now managed as a satellite unit of the National Botanical Garden by the Department of Forestry[9].

Table 3.13 List of Parks under the Ministry of Environment and Forest [MoEF]

No.	Name of Parks	Location	Area	GPS Location
1	Baldha Garden	Wari (DSCC) Ward-39, Zone-5.	3.15 acres	N= 23°43'0.95" E= 90°25'9.12"
2	Botanical Garden	Mirpur (DNCC) Ward-8, Zone-2.	210 acres	N= 23°49'16.52" E= 90°20'57.95"

Source: Field survey, 2015; City Corporation website; Google Earth; Nilufer, 1999

3.7 The regulation of Public Parks in Bangladesh

This act may be called the Public Parks Act, 1904.

It may be applied to any public park or garden in Bangladesh by order of the Government published in the official Gazette. Dhaka city park regulations developed in 9th March, 1904. After liberation war, update in 1973 (Act No. VIII of 1973). According this act, government make rules for the management and preservation of parks. All parks management by "Superintendent", Superintendent means the person in executive charge of a park. In old Dhaka parks, moat of the parks are managed by Dhaka South City Corporation (DSCC). In new Dhaka managed by Dhaka North City Corporation (DNCC). This superintendents selected by the local government. Furthermore, Public Works Department (PWD) and Ministry of Environment and Forest (MoEF) take care of large green spaces and urban parks, such as, Botanical Gardens, Zoo, Baldha Garden etc. This regulations mentioned the using restriction of parks and also some prohibit or regulate for park users.

[9] See more in http://www.moef.gov.bd/

Rules to use of parks:

- The Government may make rules for the management, and preservation of any park, and for regulating the use thereof by the public.
- In particular, and without prejudice to the generality of the foregoing power such rules may,
  - (a) regulate the admission of persons, horses and ponies, and carriages, palanquins and other conveyances, into the park, and prescribed fees to be paid therefore;
  - (b) prohibit or regulate the bringing of dogs, motor-cars, bicycles or tricycles into the park;
  - (c) prohibit the doing of all or any of the following things, by persons other than employees of the park, that is to say, plucking or gathering anything growing in the park, breaking trees, branches or plants cutting names or marks on trees, disfiguring buildings, furniture or monuments, removing or disfiguring labels or marks attached to trees or plants;
  - (d) prohibit the purchase of any produce of the park otherwise than from the superintendent or some other authorized person;
  - (e) prohibit shooting, bird-nesting, the catching of butterflies, or any act of cruelty;
  - (f) prohibit or regulate fishing or boating and prescribe fees to be paid by persons obtaining permission to fish or to use boats;
  - (g) prohibit bathing, or the pollution of water by any other means;
  - (h) prohibit the grazing of horses or ponies;
  - (i) prohibit the teasing or annoying of animals or birds kept in the park;
  - (j) prohibit the commission of any nuisance, or the molestation or annoyance of any person resorting to the park.
- In making any rule under this section, the Government may direct that a breach thereof shall be punishable with fine which may extend to one hundred Taka.
- The power to make rules under this section is subject to the condition that they shall be made after previous publication.
- All rules made under this section shall be punished in the official Gazette[10].

Park regulation of Dhaka city have some limitation. The regulation of parks is old one and its need to update and change some rules based on developed countries parks regulation.

[10] See more in http://bdlaws.minlaw.gov.bd/print_sections_all.php?id=84

3.8 Past and present of Ramna park, as a case study park

Before starting this PhD research work, a micro scale analysis was done one important park of Dhaka city. The result of analysis given below:

Ramna Park (Bengali: রমনা উদ্যান Rômna Uddan) is a large park and recreation area situated at the heart of Dhaka, the capital city of Bangladesh. This park is one of the most beautiful areas in Dhaka with lots of trees and a lake near its center.

Ramna is one of the oldest parks of Dhaka representing our cultural heritage. The history of Ramna starts about 1610 AD during Mughal rule, when the city of Dhaka was founded. But after transferring the capital from Dhaka to Mursidabad, Ramna became a forest. In 1825, the Magistrate of Dhaka Charles Doch started cleaning the forest to develop the city. In 1908, under the supervision of one of the best landscape gardener, keeper of the Royal Botanic Gardens, London and designer named Proudlock, R. L. started to form Ramna Park. It took 20 years to finish the whole work and in 1952 the park got its present shape[11].

Still, the greenery of Ramna Park is working as the lungs of the mechanized Dhaka city. It is the main and one of the few places for Dhaka to rest under the green shades of trees and breathe fresh air. The park awakes in the early morning when joggers and health enthusiasts from all walks of life gather there to keep their body and mind fit and healthy.

At present two organizations, namely, Arboury Culture and the Directorate of Public Works jointly share the responsibility of supervision and maintenance of Ramna Park and Nursery.

The specific objectives of this research were: to identify the present park's landscape features and facilities; and to examine the spatio-temporal changes of green cover of Ramna Park for the period of 2001 to 2014. For identifying the present park's landscape and features, GPS survey and photographs were used. The spatial changes of the green cover for the different years of Ramna Parks were calculated by preparing maps for the year of 2001, 2007 and 2014 taking 2001 as reference year. Maps were prepared with the help of Google earth Image for those years using ArcGIS (10.1) and then were analyzed and calculated the areal extension or reduction of green spaces along with other features of the studied park.

A detail scenario of Ramna Park given below (Table 3.14):

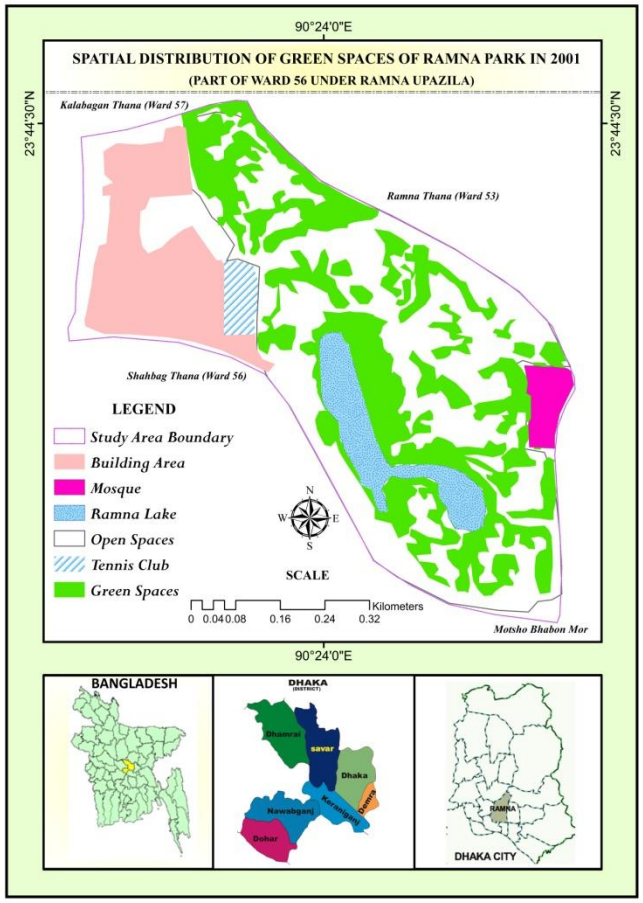
[11] See more in http://www.thedailystar.net/star-weekend/spotlight/dhakas-green-heart-1264543

Table 3.14 Present Scenario of Ramna Park

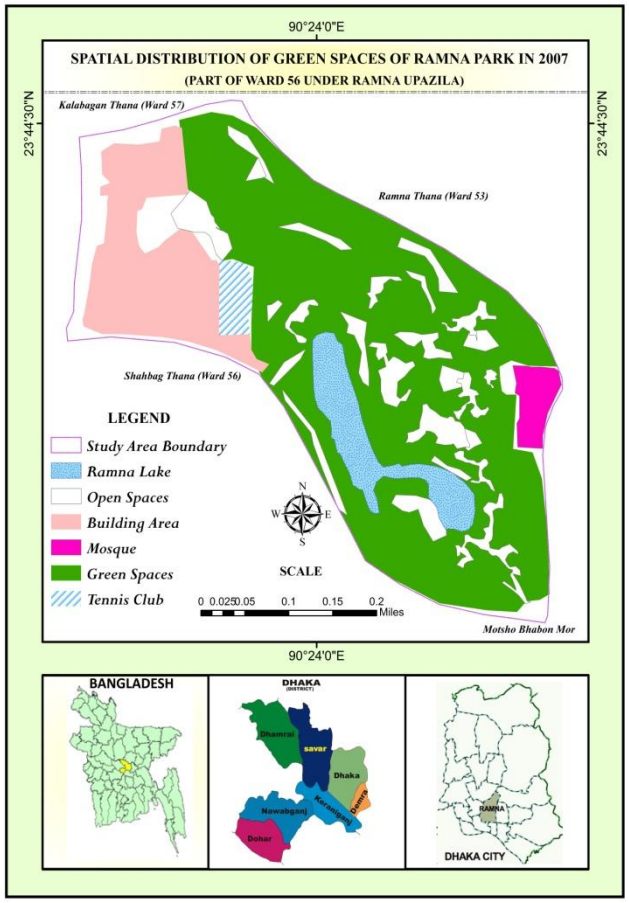
Parameters	General Information
Area:	Ramna Park = 68.50 acre and Ramna Lake = 8.76 acre Word no 56 (part) = 102.08 acre (0.45 sq. km)
Footway: **Length 3.60 Km** **Area 2.25 Km**	From Star gate to Arunodoy gate : 900 Meter From Arunodoy gate to Sheraton gate : 300 Meter From Sheraton gate to Astachal gate : 450 Meter From Astachal gate to Baishaki gate : 300 Meter From Astachal gate to Arunodoy gate : 750 Meter From Sheraton gate to Star gate : 1.25 km
Infrastructure:	There are a lot of nice places named *Kusumchaya, Prabhati, Kichukkhon, Hijol, Shiuli* and *Akashmoni*. Some look like small cottages built of wood. Besides cottages there are also benches made for them. The benches are located around the lake and the side of Footway. There is also located toilet and a water tank that looks like a Lotus.
Different Facilities	□ Jogging □ Sanitation □ Economic □ Recreation □ Resting place □ Exercise □ Cultural program □ Boating
Different Features	

Source: Field survey, 2014

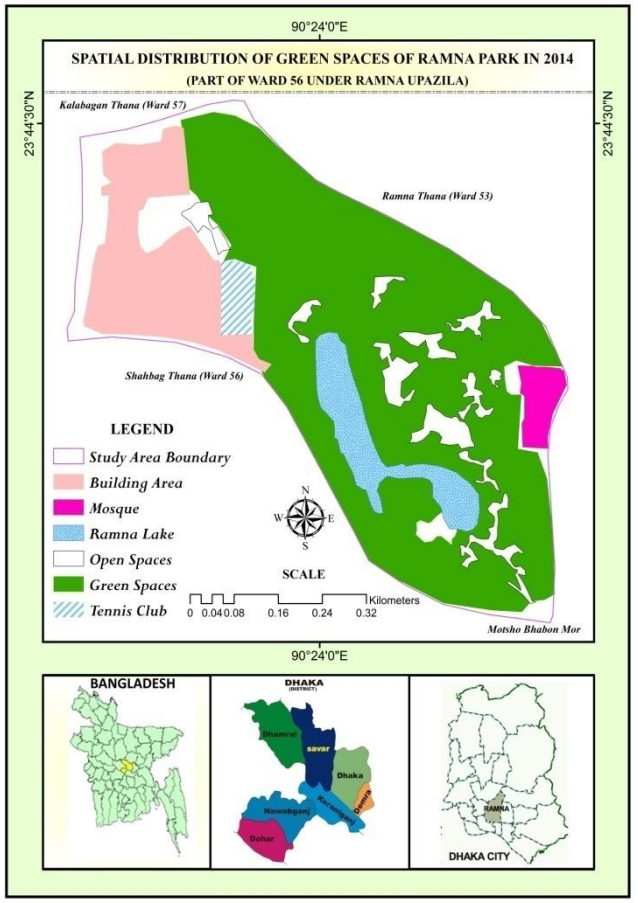
Table 3.15 Spatial distribution of different features of Ramna park in 2001, 2007, 2014



Ramna park in 2001



Ramna park in 2007



Ramna park in 2014

The area of Ramna Park is 68.50 acres. However, though the park is fenced by brick wall, the green areas within the park area are changing day by day. To understand the past condition of green areas, this study analyzed the spatial change of green areas with other features. From table 3.15 showed that green space gradually increased and open space decreased inside the park. Other buildup area was in unchanged condition. From a formal interview with a park official, it was found that the authority attempted continuously to increase green space proportionately inside the park area. Authority claimed that they maintain at least 50 percent of park area as green space and some parts of the park were retain by other organizations like, the Dhaka club and Raman Tennis Club. Ramna is the place where Dhaka, as a city, started to function and still it is preserving the city's natural harmony. So, renovation measures must be taken to maintain this park as well as this heritage site, but it has to be conducted in such a manner that the place's historic significance and natural beauty remain unaltered and unaffected.[12]

In Dhaka rapid growth of urban population has caused the huge encroachment of green space due to increasing demand on land for housing and other urbanization need. As a result, built-up area increases very rapidly within last 40 years. And most of the land covers transfer into built-up area. These changes influence urban environment both socially and naturally. So it's essential to know the past situation and predict the future condition of UGS in Dhaka city.

[12] See more in BBS Census, 2011, DCC 2012, LGED Data Base, 2013, Google Earth, 2014

References
Chapter Three

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Chapter Four
Typology and Characteristics of Urban Parks: Dhaka City as a Case Study

4.1 History of parks in urban area

Urban parks are the oldest features in the city. According to Springgate (2002), parks are peaceful, tranquil, beautiful spaces to which people are intrinsically attracted. Historically, urban parks emerged from public spaces that were used as a grazing land in cities or towns. Evidence from Western Europe in the 17th century and New England towns in the United States shows that inhabitants set aside lands near their towns, cities, or villages for the common use of their citizens. The citizens used these areas, or "commons" to graze livestock, and hold the animals before selling them or using them in the village or town (Newton 1971 and Jellicoe et al. 1975). Over time, these grazing lands became important spaces in the city as people started to use them for other purposes.

In the western world, the modern concept of the urban park started in the early 19th century, during the Industrial Revolution. At this early stage, urban parks were important features that could improve the quality of urban life, which declined during the rapid industrialization of this time. Parks became places to escape from the stresses of chaotic industrial cities. The idea swept the United States, England, and mainland Europe. Cities in Sweden, Denmark, and Holland started to develop urban parks to improve the quality of their cities (Jellicoe et al. 1975).

In addition to rapid industrialization, mass urban migration was another factor that stimulated the growth of urban parks. Crowded urban spaces, due to an influx of people massively degraded the quality of urban life. Parks served as places of recreation and leisure. In the late 19th century, urban parks started to be developed at public expense (Yuen 1996), when the social reform of the working population in Britain paved the way for early legislation providing open spaces in cities and towns. Since the 19th century, urban parks have transformed American and European cities. They have not only enhanced and beautified the urban environment, but also have become "important structural components in the shaping of urban form" (Yuen 1996, p. 955).

During the colonization period in the late 19th century, Europeans introduced the concept of the urban park to Asia. The early 20th century, cities like Manila, Hong Kong, Shanghai, Singapore, and Kuala Lumpur already had their own urban parks. However, during colonization, landscapes were managed and shaped according to the needs of the colonial governments (Maulan 2002). They managed land to maximize their benefits. In the case of open spaces in the city, colonial officers built urban parks to cater to the recreation and leisure needs of their families, their citizens, and local affluent people, such as royal family members. In other words, colonial governments did

not seek to develop public parks, but rather private sanctuaries (Yuen 1996). After World War II, when countries such as Singapore, Malaysia, Indonesia, China, and the Philippines gained their independence, the need for urban parks became greater as their cities expanded and urban population rapidly grew (Yuen 1996). People needed better urban spaces for health and recreation, and there was an outcry for better town and city planning. Governments in most of the countries in the East started to develop new parks or redevelop old ones to accommodate these needs (Maulan 2002).

4.2 Urban parks and city sustainability

The urban environment is characterized by an intense use of the available space, where the preservation of open green spaces is of special ecological importance (Roessner 2001). Urban parks and green space is an indispensable element of urban quality of life. Green areas are environmental and sometimes historic-ecological assets of great importance for any city. The importance of urban green has been clearly recognized in urban architecture (MacHarg 1971).

For a healthy city we need a proportional balance between open and built up areas. Open green spaces acts like lungs besides being used as active recreational and leisure areas for its citizens. Green spaces have a direct impact on the urban environment and general physical, mental and social health of the urban dwellers. Parks contribute to physical health by providing opportunities for exercise, jogging walking. Parks contribute to mental health by providing restorative effects of nature (Forsyth 2007).

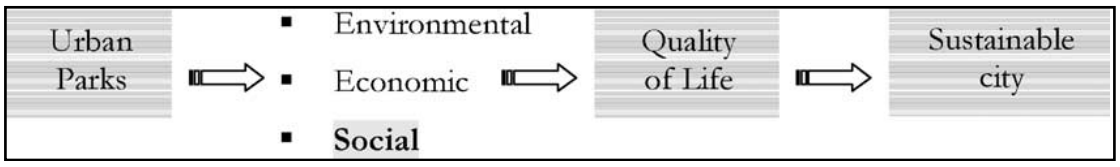


Figure 4.1 Urban parks and city sustainability

Source: Chiesura, 2003

Again, some cities have been developing their own sustainability indicators, to try and measure quality of life issues in a meaningful way. Beside environmental criteria (water and energy saving, waste recycling, transportation, etc.), quality of life issues are central to all the various definitions of a sustainable city. Aspects such as “amount of public green spaces per inhabitant”, “public parks” and “recreation areas” are often mentioned as important factors to make the city livable, pleasant and attractive for its citizens. It is strongly believed that developing more sustainable cities is not just about improving the abiotic and biotic aspects of urban life, it is also about the social aspects of city life, that is—among others—about people’s satisfaction, experiences and perceptions of the quality of their everyday environments (Chiesura 2003).

4.3 Typology of parks

The definition of park may depend upon the perspective of the person identifying it. A park can be defined by its relationship to human or by its relationship to nature. In 1966, Charles Abrams defined park as an open area, usually landscape or left in its natural state, intended for outdoor recreation and the general enjoyment of nature (Abrams 1967). At the same time according to Rutledge parks were seen as natural area that served as passive retreats and recreation area that was focused on athletics and active facilities (District of Saanich 2016).

The typology of parks is an important first step in focusing the planning, development and management efforts vital to balancing public recreation opportunities and resource integrity statewide. Through parks type, the dominant character and principal values of an area are defined, and use and management policies are established. A typology system allows the programming, orderly development, and use of these lands based upon these management policies. Standardization of the classification system assures uniform implementation of these policies on a statewide basis. This will result in consistent management of our natural, recreational and heritage resources.[13]

The parks are mainly classified into three ways: a) according to their character; b) according to their purpose; and c) according to their size. All of them based on size it is more popular than the other classifications. Moreover physical size of parks also describe detail characteristics of parks and easy to identify the service level of the urban area.

According to NRPA in USA, parks were classified into eight types based on their size (NRPA 2014). Again Rangwala 1974 classified parks based on the size into five types (Rangwala et al. 2003). In 1984, according to Time-Saver Standard for Residential Development by Chiara J. D., the parks were classified into six types by size (Chiara and Koppelman 1975) (Appendix 1). All these classification are not suitable for all countries. Parks size, location, urban structure etc. influence the classification of parks.

4.4 Urban parks in Dhaka city

Due to rapid urbanization the city is growing immensely and rapidly expanding than other city centers in the country. The ongoing development activities are creating constant pressure to squeezing all open spaces out of the urban fabric (Nilufer 1999).

Lack of variety of activities is phenomenal in Dhaka's urban parks, but the use of the urban parks is significant and diversified. Seasonal and occasional events, even 1arge scale festivals are also seen to take place in parks (Iqbal et al. 2010).

[13] See more in https://parksandrecreation.idaho.gov/sites/default/files/uploads/documents/Procedures/Development/2005%20Park%20Class%20Sys%20Doc.pdf

Most of the areas of Dhaka city are so unplanned that there is very little scope for creating a new park or open space to meet the needs of the growing population. In this case, it is inevitable that the existing parks need to be improved or developed. But unfortunately till now no initiatives have been taken to improve the parks of Dhaka city (Alam 2012). If the prevailing conditions remain unchanged then Dhaka will definitely collapse (Hasan 2012).

Nilufer (1999) tried to classify Dhaka city (recreational area) parks based on open space hierarchy by Greater London Council, GLC. All the four types of GLC standards fall under the category of Urban Recreational Areas of the former group. According to GLC standards classification of parks are as follows: Metropolitan Park, District Park, Local Park, 'Mini' Park She also mentioned that none of the western standards are comparable to the case of Dhaka.

Tabassum et al. (2011) mentioned there is no typological classification of parks in Dhaka city according to different international standard, not even of our own. Therefore the development of parks has not been followed any standard planning/ design criteria at any physical level. Because of the absence of any central controlling agencies there is also no complete list of open space found in city. At present it seems urgent to identify and quantify the available stock of open spaces in the city. However such a venture needs enormous resources. Therefore she tried to find out the limitation and also investigated the current situations of parks under DCC control.

Khan (2014) used space syntax is a method for describing and analyzing the relationships between social structure and spatial structure of Dhaka city parks.

Accordingly, there is no clear typology and characteristics of parks in Dhaka city which is also applied for others developing countries.

For this chapter tried to analyzed first hypothesis of the research work.

Hypothesis 1: Environmental factors (size and distance) of parks positively influence the use of parks in Dhaka city.

To prove the hypothesis specifically, sought to answer two questions: (1) Are environmental factors such as size and distance related to the use of the urban parks? (2) How are different types of parks associated with the characteristics of park users?

4.5 Previous study about park's size and distance

In many studies, accessibility is used as a measure of a park's ability to provide services, and distance to a park is considered as an important component of accessibility (Wen et al. 2013; Rossi et al. 2015). For example, Nicholls and Shafer (2001) evaluated equity and accessibility of local parks by analyzing fixed buffer zones. Although distance can be used to reflect the area of a park that provides services, it is often difficult to identify the appropriate distance at which park services become inaccessible. Moreover, recreational services of parks are not isotropic and homogeneous,

but change with increasing distance. Some studies investigated distance decay effects and found a weakening of recreational services with increasing distance (Peschardt et al. 2012; Hooper 2015).

Most studies have demonstrated an understanding of the spatial physical factors influencing park access and use (McCormack et al. 2010; Kaczynski et al. 2016). For example, van Herzele and Wiedemann (2003) found that the sense of space, the natural environment, the degree of quietness, and available park facilities were the most important factors affecting park use, while Erkip (1997) indicated that distance to the park was the key factor in determining park accessibility. Some other studies emphasized that the importance of such spatial-physical factors could be offset by socio-demographic factors (Moore et al. 2008; Macintyre et al. 2008; Lee 2016). For example, Byrne and Wolch (2009) found that people may not visit nearby parks for cultural reasons. To fill this gap of knowledge, both physical and non-physical dimensions have been considered in recent studies (Lindsey et al. 2001; Wang et al. 2013). For example, Wang et al. (2015) found that both physical and social variables, such as proximity to the park and a pleasant walking experience, were statistically significant to perceived park accessibility in Brisbane, Australia.

4.6 Typology of parks in Dhaka city

From government organization (DNCC and DSCC) collected the data of size of parks. Most of the parks of Dhaka city's parks size lower than 10 acres. Only few parks size are within 10 to 100 acres. Only one park size is 210 acres.

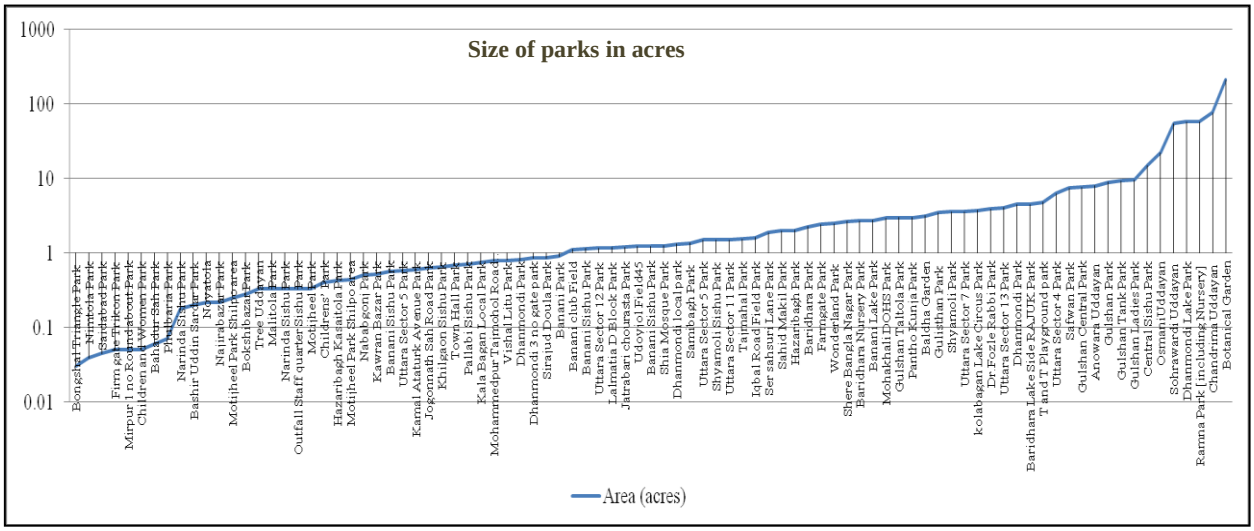


Figure 4.2 Size of parks (acres) in Dhaka city
Source: Field survey, 2015; City Corporation website; Google Earth; Nilufer, 1999

After study International Park's classification (Appendix 1), based on physical size, the parks of Dhaka city were classified into four types (Table 3.2).

Table 4.1 Classification of parks in Dhaka City

Type of park	Size	Number of parks
Small	0 - 4 acres or 0 - 0.016 km^2	71
Medium	5 - 40 acres or 0.0202 - 0.162 km^2	13
Large	> 40 acres or 0.162 km^2	4
Extra large	200 acres + or 0.809 km^2+	1

Most of the parks of Dhaka city under the small size parks are scattered distributed. There are thirteen numbers of medium size parks which mostly distributed in north part of city and four large size parks in city center area. Again only one extra-large park is situated in the city boundary.

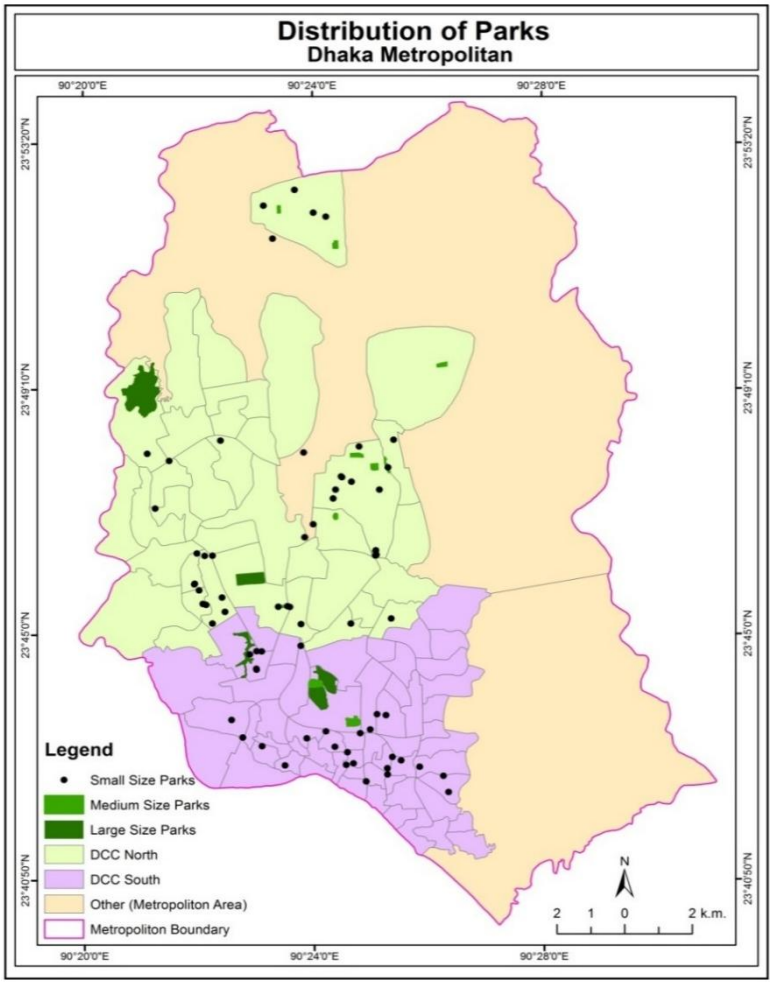


Figure 4.3 Different size of parks in Dhaka city

4.7 Methodology

From the previous study, it has become obvious there is no typological classification of parks in the city according to different international standard, not even of ours. Therefore the development of parks has not been followed any standard planning/ design criteria at any physical level (Tabassum and Suchana 2011). Because of the absence of any central controlling agencies there is also no complete list of open space and park found in city. At present it seems urgent to identify and quantify the available stock of parks in the city.

After classified eight case study parks were selected from each region of Dhaka Metropolitan area. Table shows the location of case study parks with their name (detail description of case study parks in chapter 2).

Table 4.2 Name of case study parks

Park Location	Small size park	Medium size park	Large size park	Extra-large size park
Southern part of City	Bahadur sha, **S3**	Osmani Uddan, **M3**	**City center** Dhanmondi lake, **L**	**City boundary** Botanical garden, **EL**
Middle part of City	Pantho kunjo, **S2**	Anwara, **M2**		
Northern part of City	Uttara sector 7, **S1**	Gulshan Lake, **M1**		

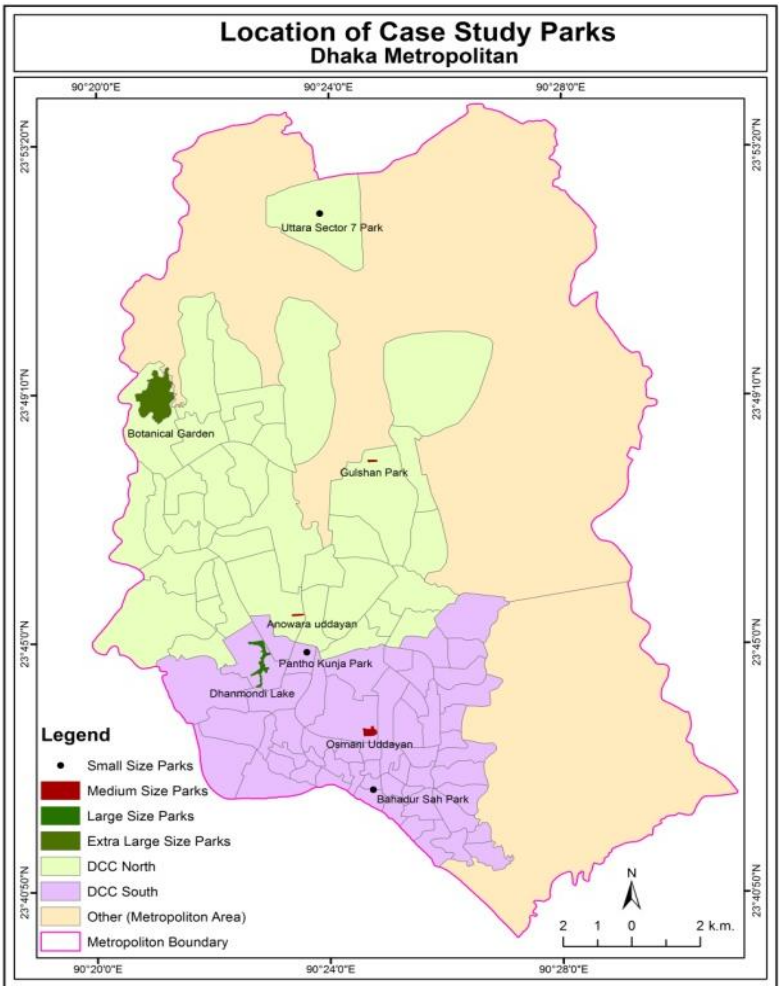


Figure 4.4 Location of case study parks

Questionnaire data analysis –

For analysis characteristics of parks, questionnaire survey of parks visitors and field observations were carried out as primary data sources. The sample was selected randomly from each parks visitors and sample size was for small size parks 80, medium size parks 90, large and extra-large parks 100. This survey was done from October to November in 2015 (Chapter 2). Questionnaire data analyzed by frequency and cross table using SPSS.

Service area analysis –

For identifying service area, first compared with case study parks with NRPA American standard. By using GPS, measured visitors distance from park to home. Service area calculating by average distance of park visitors. After analysis, draw the service area of case study parks by using GIS.

Techniques used in GIS for draw service area given below,

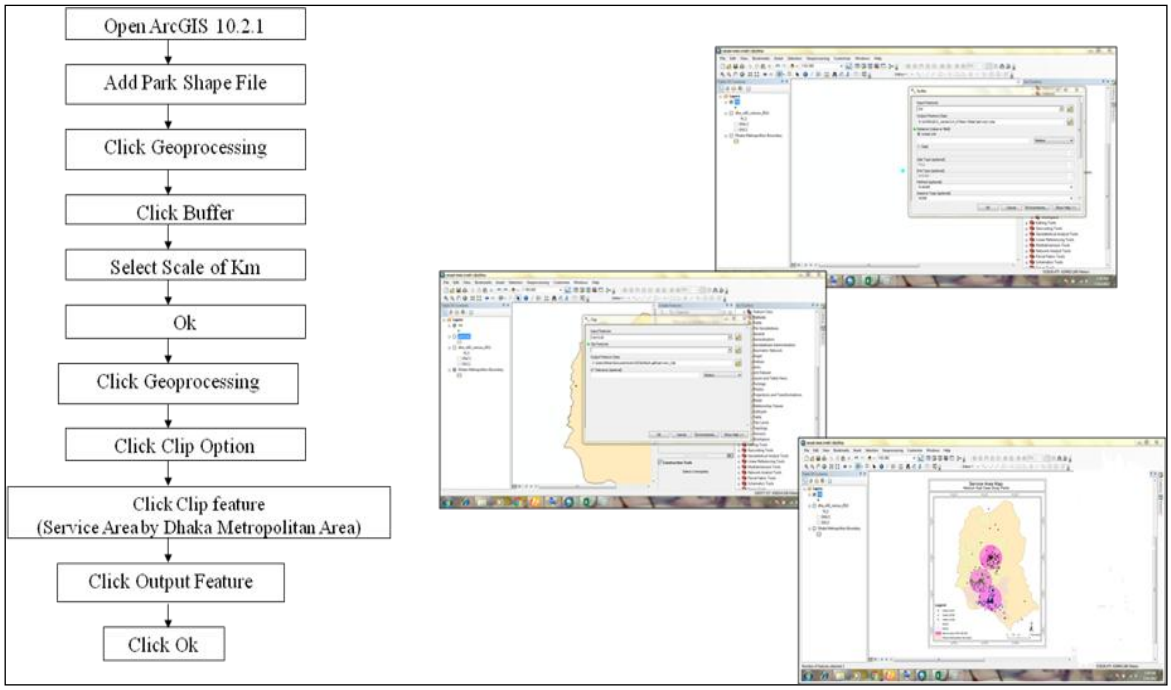


Figure 4.5 Techniques used in GIS for draw service area

Accessibility –

- Visitors point (resident)
- Buffer zone (Saleem and Ijaz 2014; Neema et al. 2014; Nicholls and Shafer 2001)

Techniques used in GIS for draw buffer zone given below,

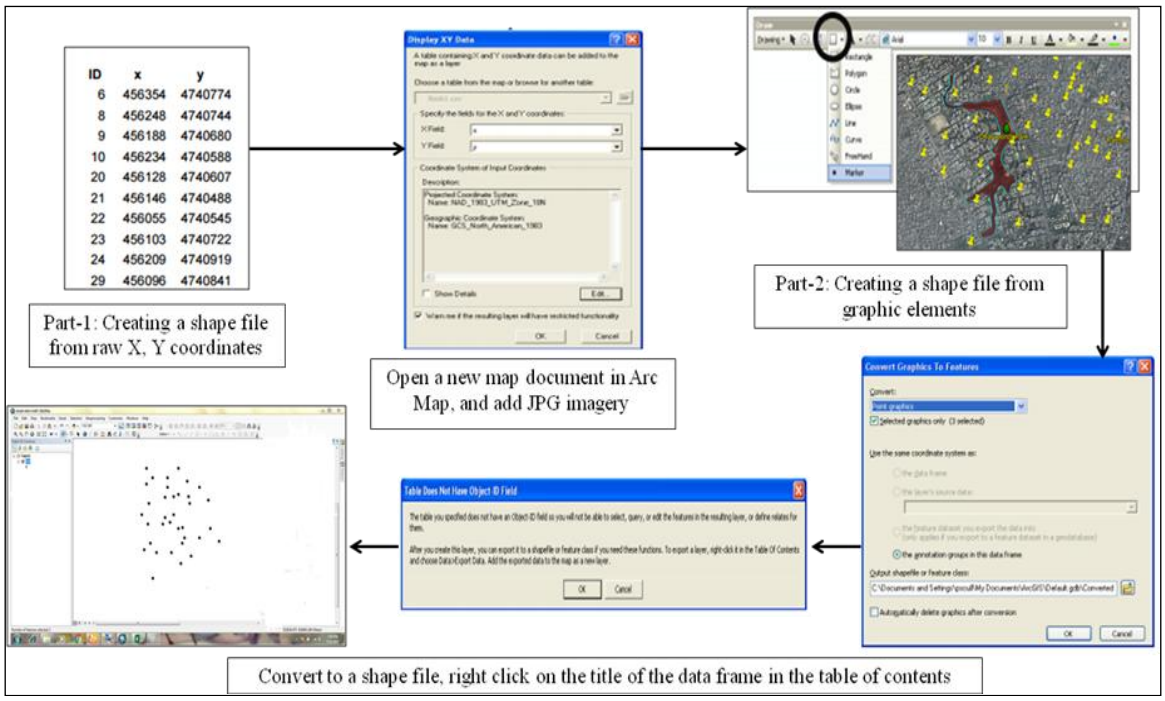


Figure 4.6 Techniques used in GIS for draw buffer zone to measure accessibility

Land use of case study parks –

- Land use identified by Quick bird images (eight case study parks, year 2010) (Appendix A). Visualization tool for land use/cover maps (Hu et al. 2013)
- Features identification and digitization.
- Parks shape identified

GIS has been used as a tool for mapping and represents present situation of different size parks of Dhaka city. Arc View GIS 3.3, Arc GIS 10.2, Erdas Imagine and other cartographic techniques were used.

4.8 Urban Parks and their Service Area

Basically the service area of an urban green space covers the range of action where its potential users live and tends to border to the farthest user that has the availability to move to this space. This differs with the type of urban green space and the attractiveness and accessibility conditions. It is related to the measurement network depending on the attribute and criteria in question and has a more realist approach compared to buffer approach (linear distance) because have account the multiple limitations that influences the network dynamics. The concept can also be applied to a public equipment or service that has a territorial expression (Figueiredo 2016).

For an urban park, it is very essential to identify the service area. Service area of a park means the particular range of area where population can be used the park facilities. It mainly depends on the size and the accessibility of the parks. In this research it used the buffer approach of each park to show the service area.

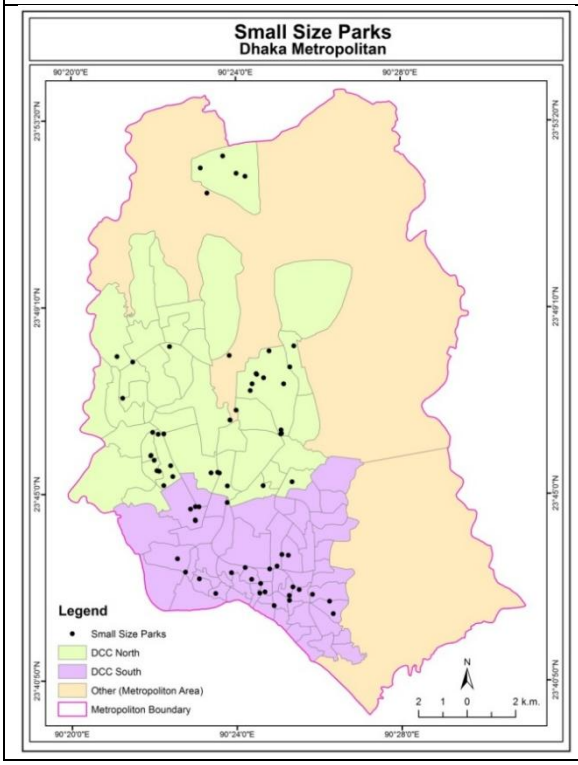
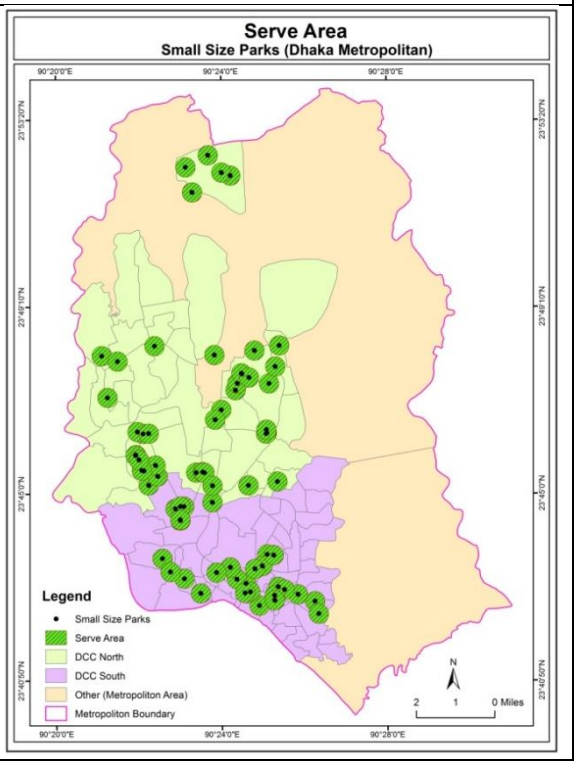
Table 4.3 According to (NRPA 2014) range of service area of different size parks

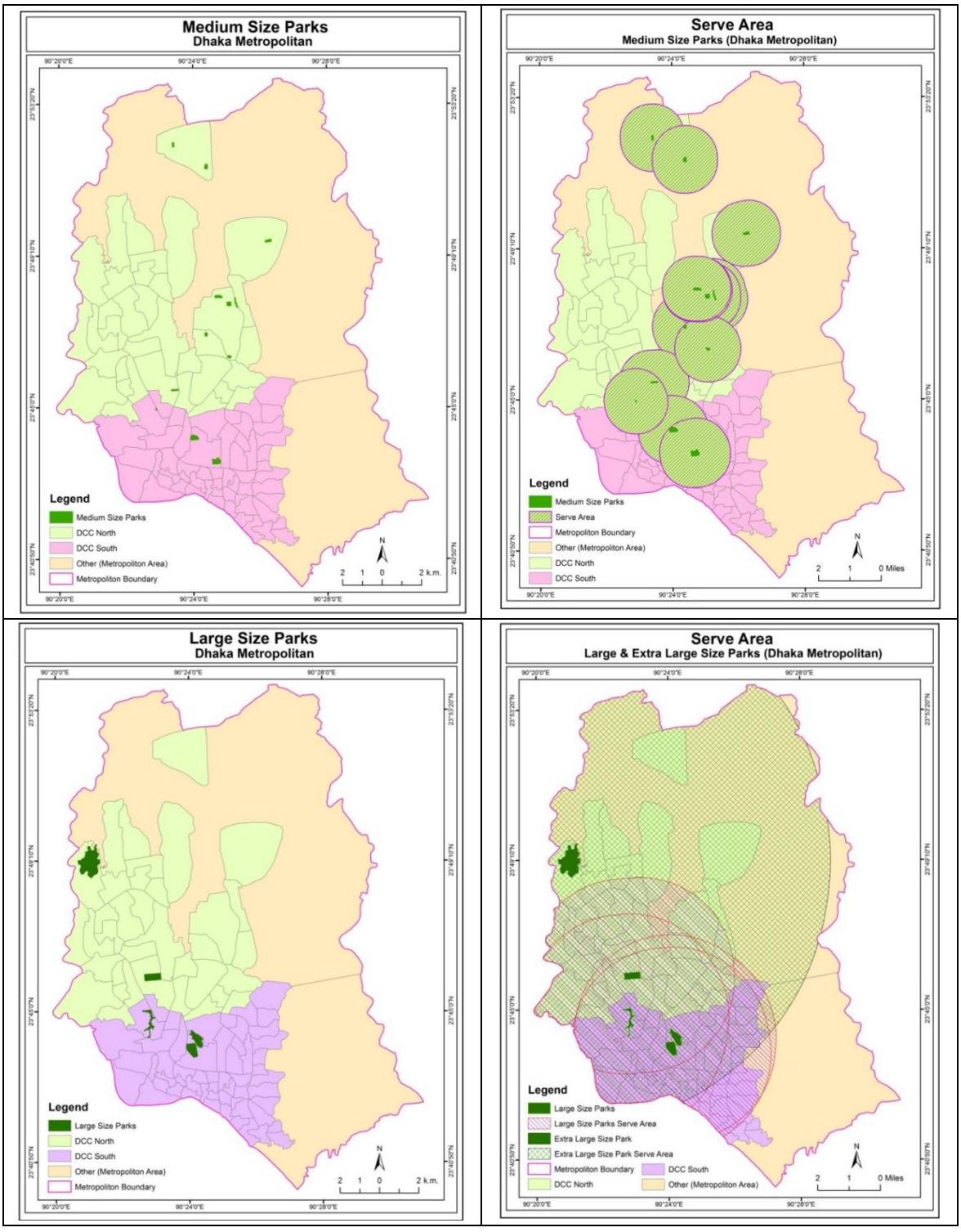
Park Types	Size (acres)	Serve area (radius in miles/km)
Mini Park	< 1	$^1/_4$ mile / 0.402 km
Neighborhood Park/Playground	1 - 15	1 mile / 1.609 km
Community Park	16 - 99	3 miles / 4.828 km
Regional / Metropolitan Park	100 - 499	serve the entire city
Regional Park Reserve	> 500	serve those areas within a one-hour driving distance
Special Use Area	no specific standards	-
Linear Park	no specific standards	-
Conservancy	no specific standards	-

Source: NRPA, 2014

The maps on the following (Table 4.4) illustrate the service areas for small, medium, large and extra-large parks of Dhaka city based on NRPA standard. Service areas are consistent with the guidelines established by the NRPA (Table 4.3). The special use parks and facilities do not have defined service areas as they are considered to offer amenities and services that appeal to the entire resident population of the urban area. In some cases, the actual service area of any park may be larger if the park includes amenities of regional appeal. Smaller service areas are also possible where major roadways act as barriers to park access. For illustration purposes, these roadway barriers are not shown.

Table 4.4 Service area of parks in Dhaka city according NRPA America Standard

Parks type based on size	Parks service area
	



NRPA define park service area based on international standard. But this data are not suitable for all courtiers special in developing countries. In developing county's city mainly developed in unplanned way. And for pressure of over population and different land use, it's possible to encroach the park area. Again, number and size of park also influence the service area. So it's necessary to find out the real picture of service area of parks in Dhaka city.

For measured the actual service area of parks of Dhaka city, in this research used distance (origin to parks) data of visitors of eight case study parks. Distance of visitors measured by GPS and average distance $\bar{X}$ calculated for measuring service area.

$$\bar{x} = \frac{1}{N}\sum_{i=1}^{N} x_i$$

Here,

Average distance of visitors for each parks, $\bar{X}$:

$\sum$, represents the summation

x, represents distance from home to park

N, represents number of visitors

Average distance of different size parks are given below:

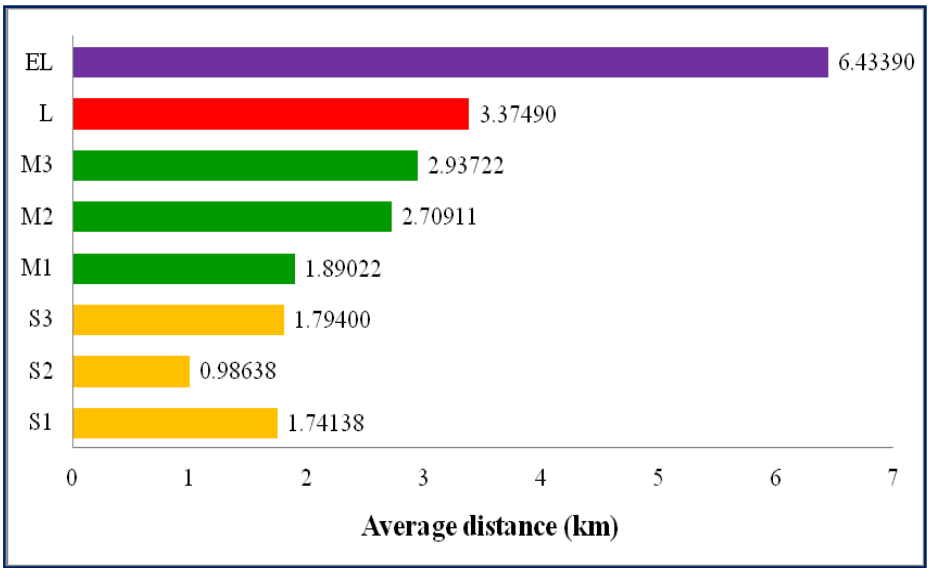


Figure 4.7 Visitors average distance of different size parks

Source: Field work, 2015

For calculating service area of parks in Dhaka city, again calculated average all distance values base on the size of parks. Service area of different size of parks in Dhaka city are given below,

Table 4.5 Service area of different size parks in Dhaka city

Service area	Distance (Km)
Small size parks, $\bar{X}_S$	1.507
Medium size parks, $\bar{X}_M$	2.512
Large size parks, $\bar{X}_L$	3.375
Extra-large size park, $\bar{X}_{EL}$	6.434

Based on visitor pattern of different size parks, after calculating average distance for each park, service area of parks in Dhaka city can be define by below model (Figure 4.8).

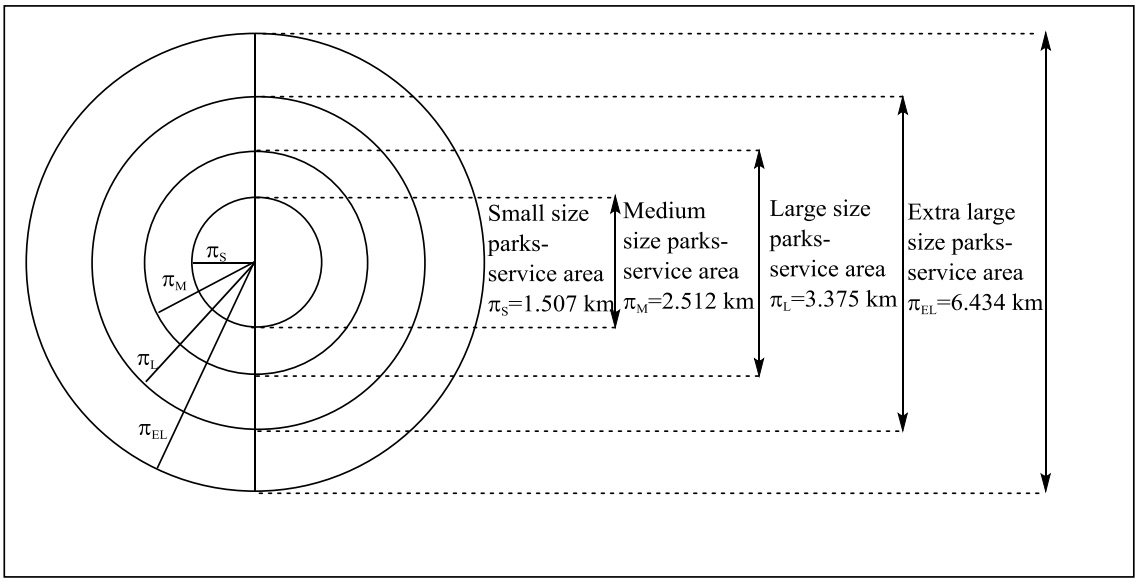
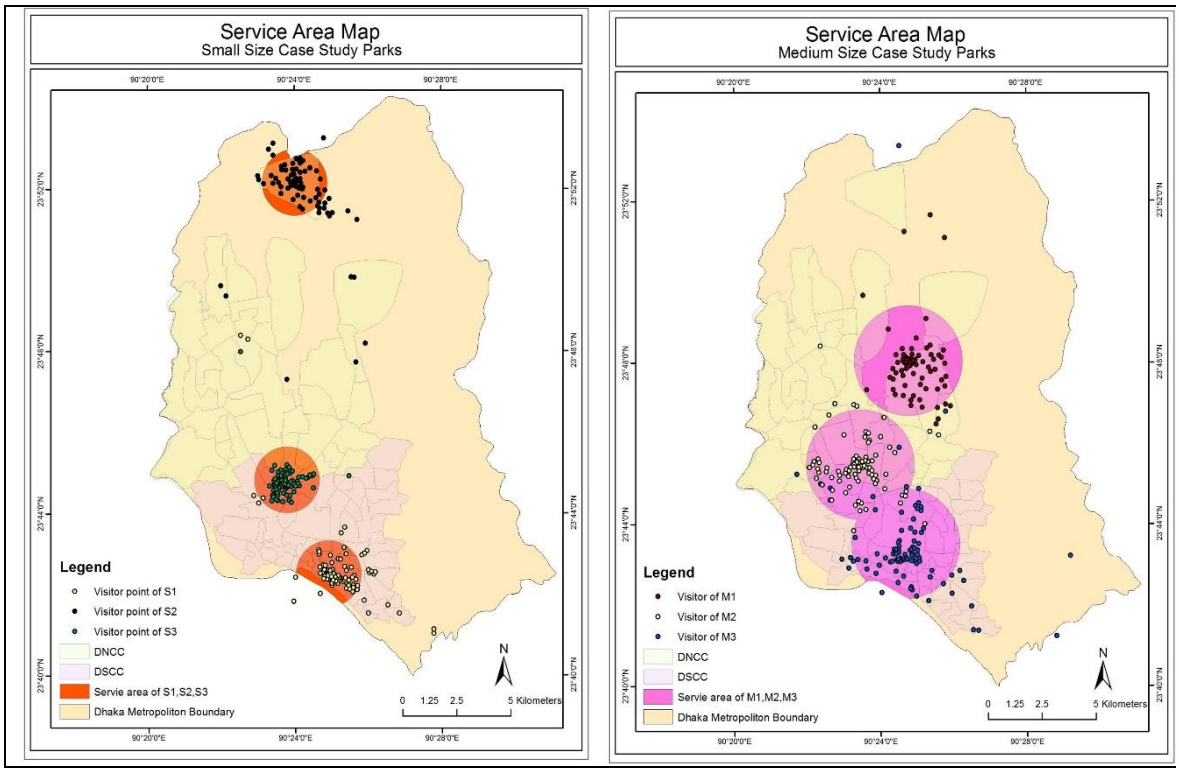
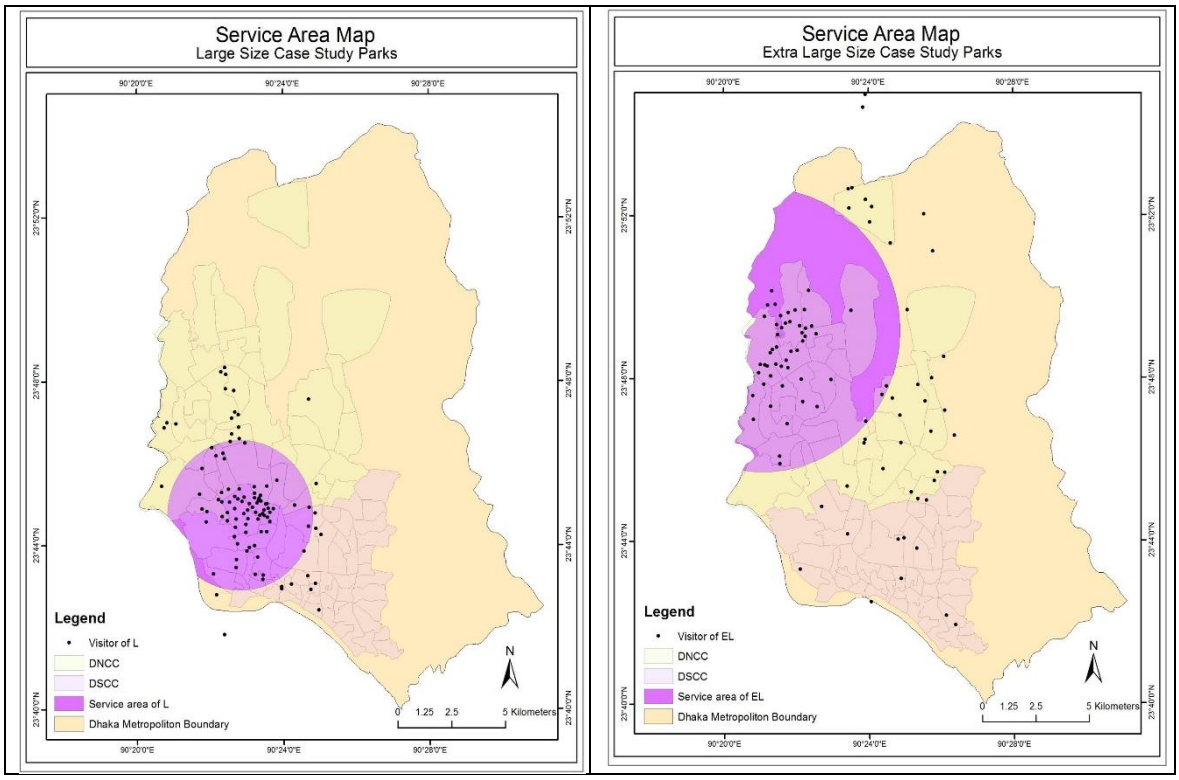


Figure 4.8 Model of service area of different size parks in Dhaka city

That means, it's showed that service area of parks of Dhaka city different from international standard. The maps on the following (Table 4.6) show the service areas for small, medium, large and extra-large case study parks of Dhaka city based on field survey.

Table 4.6 Service area of case study parks in Dhaka city





Source: Field work, 2015

4.9 Accessibility of Parks in Dhaka city

Measuring accessibility to urban parks is a commanding tool to analyze individual mobility patterns of visitors. Parks plays a multi-purpose role in urban areas that provides social, economic and environmental benefits (Saleem, et al. 2014). The major focus of the analysis is to study parks / green spaces in urban areas, including through the measure of parks accessibility and the relative area and the number of parks in communities (Potestio et al. 2009). Measuring accessibility to urban parks is the potential tool to examine individual mobility patterns (Reyes et al. 2014).

Park equity studies use accessibility measures to determine whether the distribution of parks benefit some people more than others. Accessibility measures must therefore determine who benefits and why. While the goal of equity analysis is clear, the methods applied in measuring park accessibility vary. Many methods have been set forth, with no clear standard of which type of method should be applied to measuring accessibility to parks specifically, and how the application to other industries vary. An important issue remaining largely unexplored is how variation in the measurement of access can affect the results of spatial equity (Talen, 1997; Talen, 1998).

For the research, the following parameters were investigated to check the accessibility of urban parks in Dhaka city:

1. Distance
2. Time

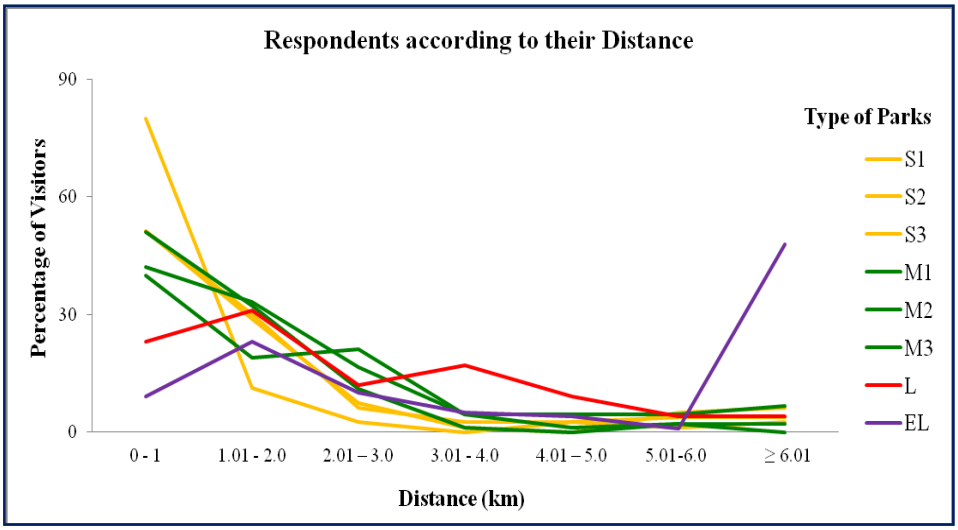


Figure 4.9 Respondents According to their Distance from Destination to Parks

Source: Field work, 2015

From figure 4.9 showed that distance has affected by the size of parks and the number of visitors. Small size of parks (S1, S2 and S3), large number of visitors come from within 1 km. In medium size parks (M1, M2, M3), most of the visitors come from near distance 1 - 3 km. In the large park (L) a large number visitors come from distance 2 - 4 km. And only one extra-large park which situated city boundary and far away from city center, most of the visitors come from more than 6 km. For short distance people always choice small size park and for large size park people come from different part of the city.

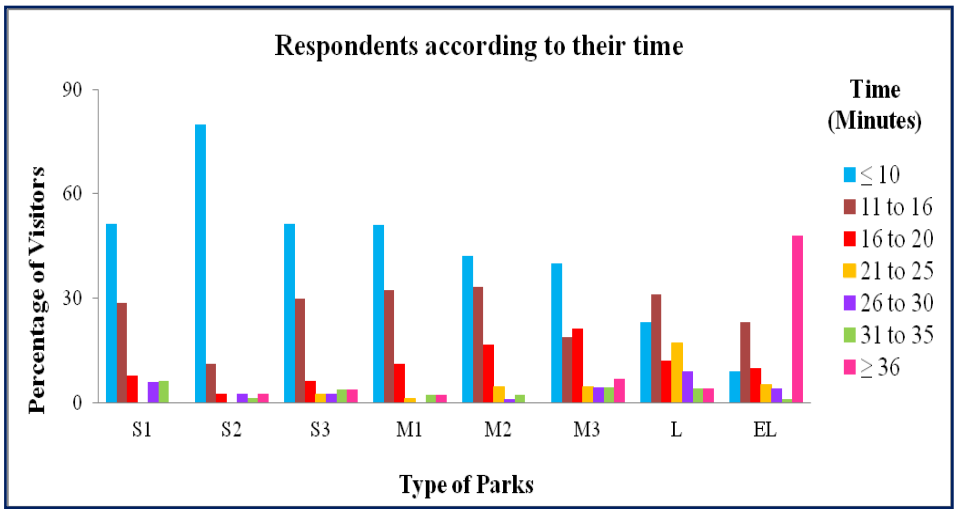


Figure 4.10 Respondents According to their Distance from Destination to Parks

Source: Field work, 2015

Note: Ignore visitor's different types of local vehicles[14], without traffic jam and other obstacles.

Time is another important parameter to measure accessibility of parks. From figure 4.10 found that time has affected by the size of parks and the number of visitors. Small size of parks (S1, S2 and S3), large number of visitors need less than 10 minutes. In medium size parks (M1, M2, M3),

[14] Rickshaw, CNG Auto rickshaws (4 Stroke), Bus, Motor car, Auto tempo, Motorcycle and Others.

more than half of the visitor come from near distance within 15 minutes. Again in large park (L) people come from different time range. Because this particular park situated in city center and famous for various program. So in here visitors come to attend program from diverse places. And only one extra-large park which situated city boundary and far away from city center, most of the visitor need more than half an hour. In small and medium size parks, people needs shot time and accessibility is high. On the other hand extra-large size parks because of distance people needs more time to visit.

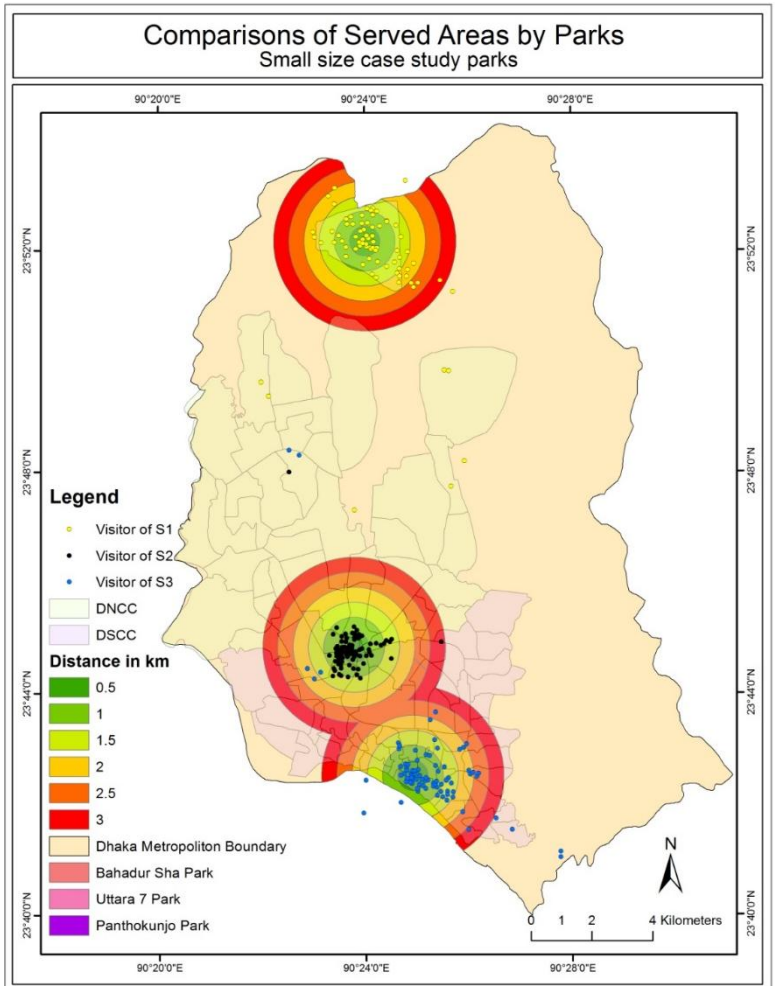


Figure 4.11 Comparisons of served areas by small size case study parks

Source: Field work, 2015

In figure 4.11 concentric buffers demonstrate the association between distance (km) and spatial accessibility of visitors towards small size case study parks. Buffers were taken at the distance of 0.5 km. The comparison of these three parks indicates that small size parks of Dhaka city serve its neighborhood areas. Most of the visitor visit the parks for different activates e.g. walk, play sports and games, for entertainment and meeting friends etc. And people also visit these parks for daily purpose.

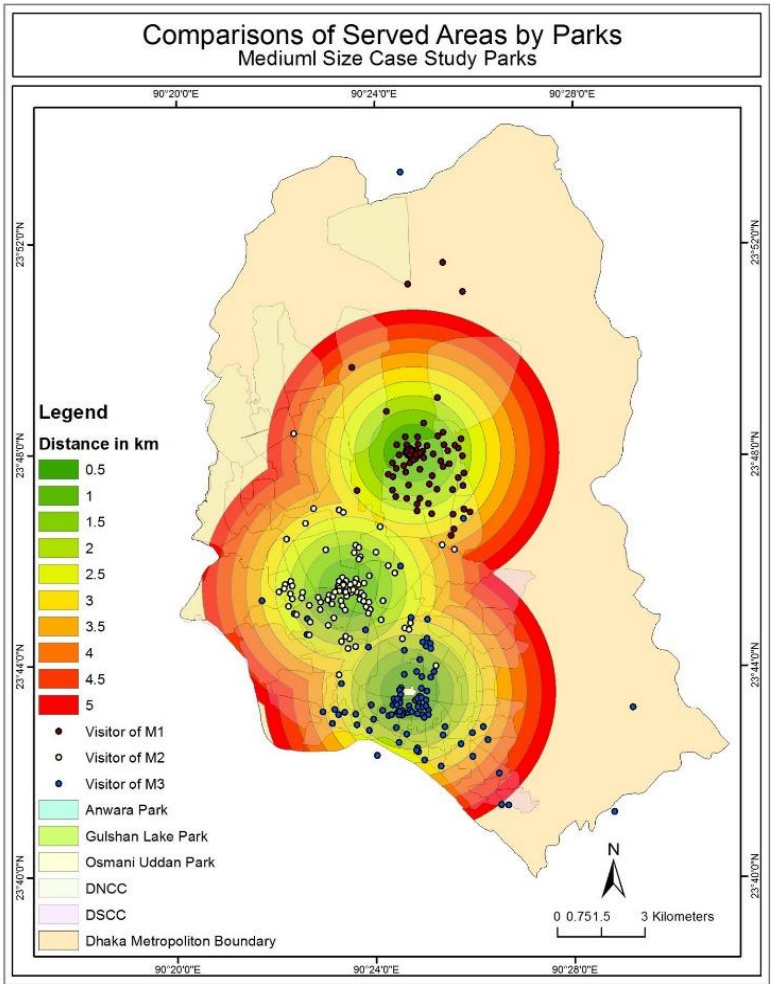


Figure 4.12 Comparisons of served areas by medium size case study parks

Source: Field work, 2015

In figure 4.12 concentric buffers reveal the association between distance (km) and spatial accessibility of visitors towards medium size case study parks. Buffers were taken at the distance of 0.5 km. In this parks most of the people come from 1 - 2 km distance. Again, some people (residence near the parks) also come from below 1 km use the park as neighborhood park. Surrounding area of park also an important factor to use of park. Example, Osmani uddan (M3) park, situated opposite of South City Corporation Office. People come from all part and also outer part of the city for that City Corporation Office and they wait or take rest inside the park. So visitor pattern is different from other parks. In medium size parks people mainly visit daily to weekly.

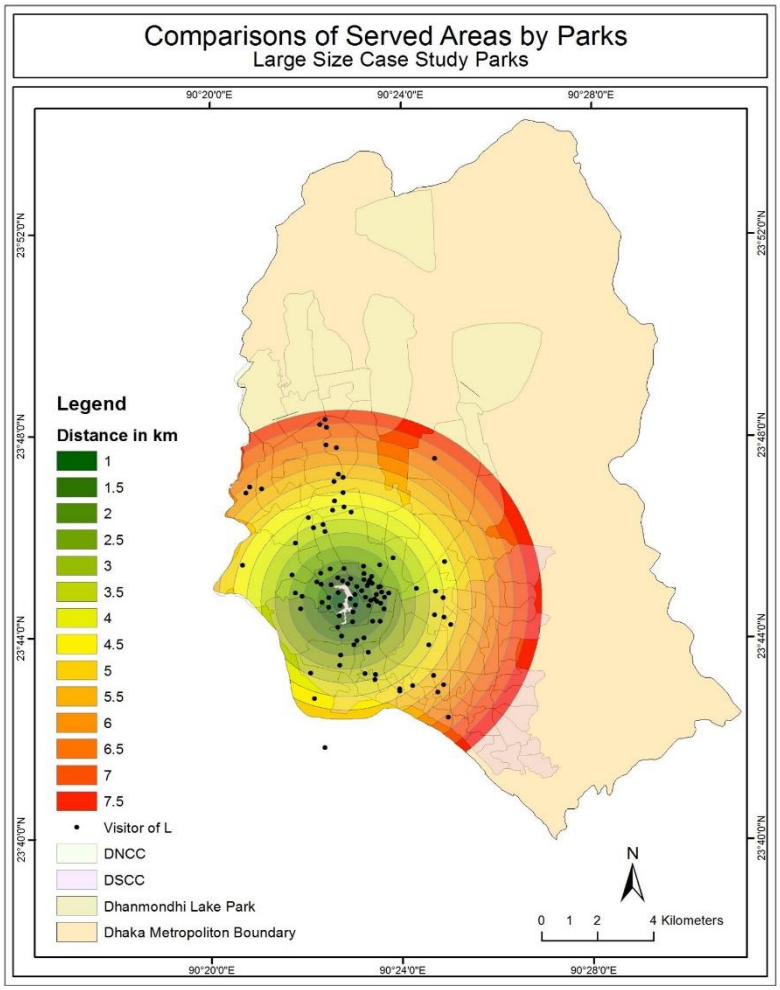


Figure 4.13 Comparisons of served areas by large size case study park

Source: Field work, 2015

In figure 4.13 concentric buffers show the association between distance (km) and spatial accessibility of visitors towards large size case study park of Dhaka city. Buffers were taken at the distance of 0.5 km. In Dhaka city there are four large size parks and all are situated in center of the city. Moreover in large size park famous for different invents and program. Inside the park different facilities also available. People mainly visit monthly to attend all these program. Again like medium size parks, also in Dhanmondi lake (L) park's some people (residence near the parks) also come and use the park as neighborhood park.

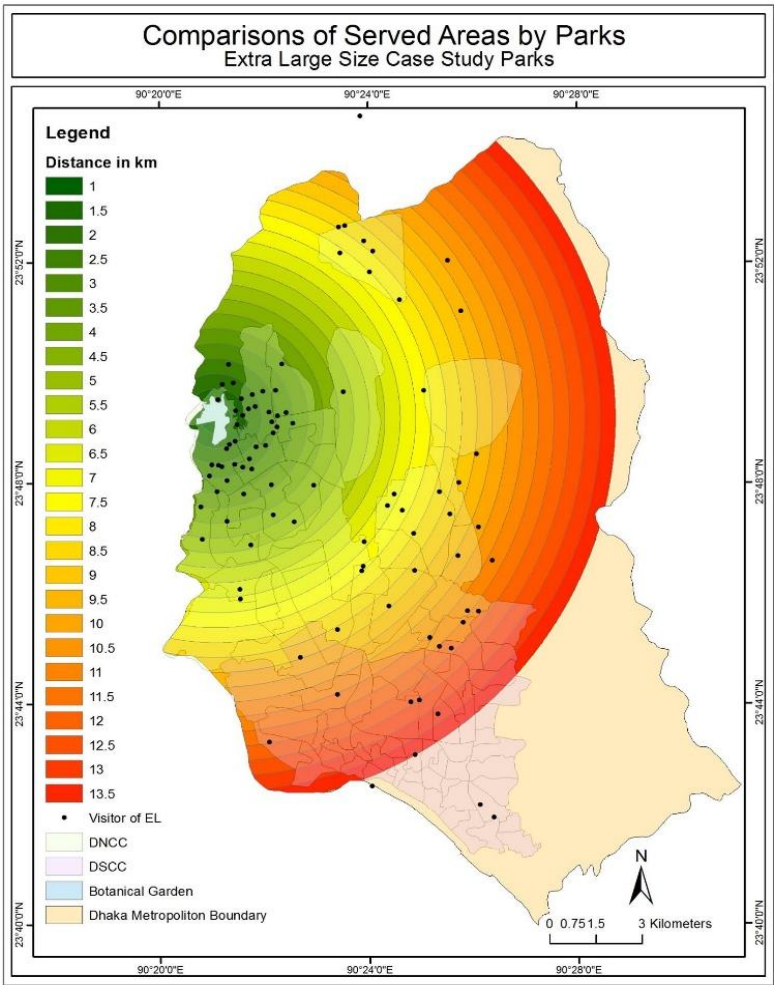


Figure 4.14 Comparisons of served areas by extra-large size case study park

Source: Field work, 2015

In figure 4.14 concentric buffers demonstrate the association between distance (km) and spatial accessibility of visitors towards extra-large size case study park. Buffers were taken at the distance of 0.5 km. In Dhaka city there are only one extra-large park which situated in the city boundary. Most of the visitor visit this parks at weekends or at special events e.g. study tour, picnic, family outing and play sports and games etc. Inside the park (Botanical garden) there are different facilities and well managed. People mainly visit this park once a year and stay whole day long. Because of far from city center people do not visit the park willingly.

4.10 Transport system of Parks visitors in Dhaka city

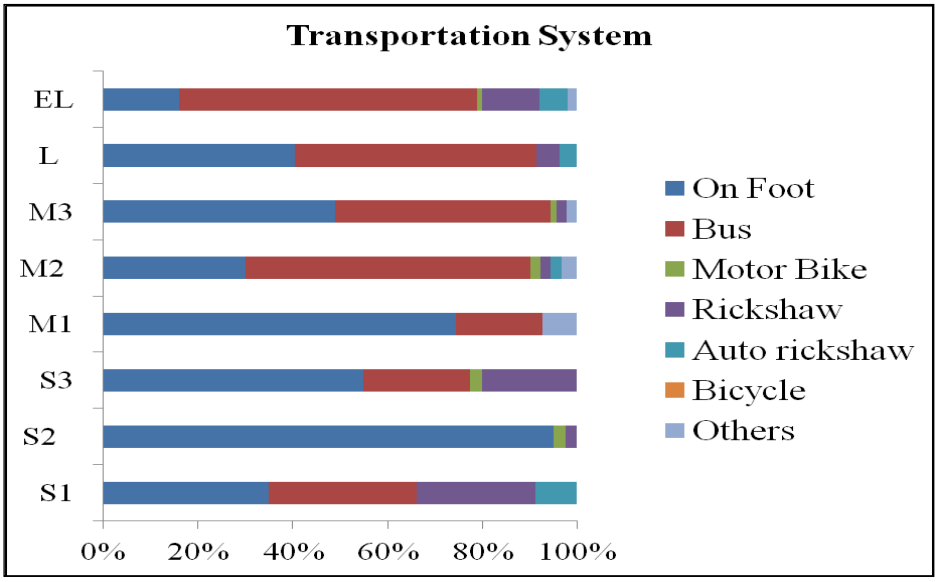


Figure 4.15 Type of Transport system

Source: Field work, 2015

From (Figure 4.15), most of the respondent visit park on foot. Mainly in small size parks people visited from near place and they prefer on foot. In medium size parks people also visited by bus and rickshaw from their home. In large and extra-large park people mainly depend on bus.

4.11 Frequency of use of parks visitors in Dhaka city

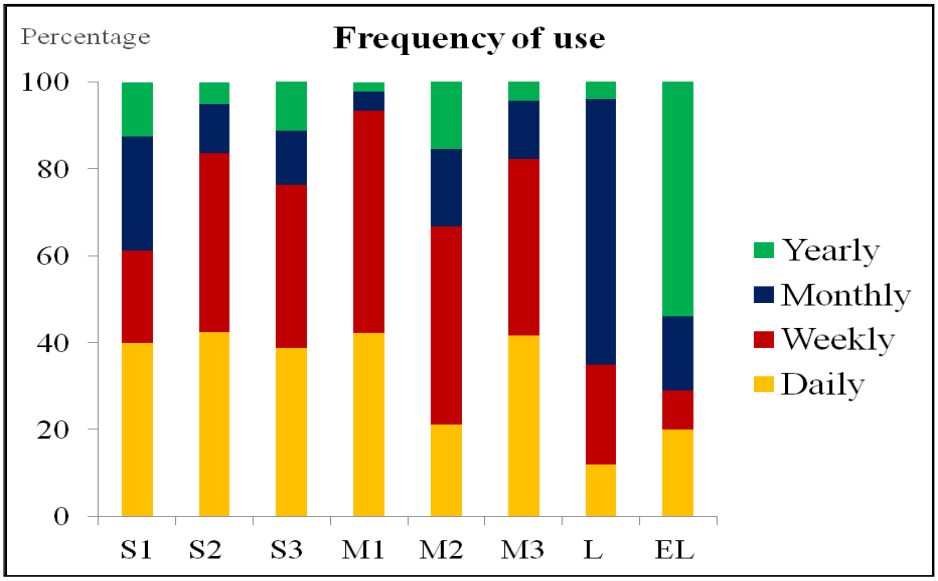


Figure 4.16 Frequency of use

Source: Field work, 2015

Figure 4.16 showed the frequency of use of parks. Small size parks people visited daily and medium size parks visited daily to weekly. In large parks who lived near, visited park's daily purpose but other visited monthly. In extra-large park which situated city boundary, because of far distance people visited yearly.

4.12 Purposes of visiting of parks in Dhaka city

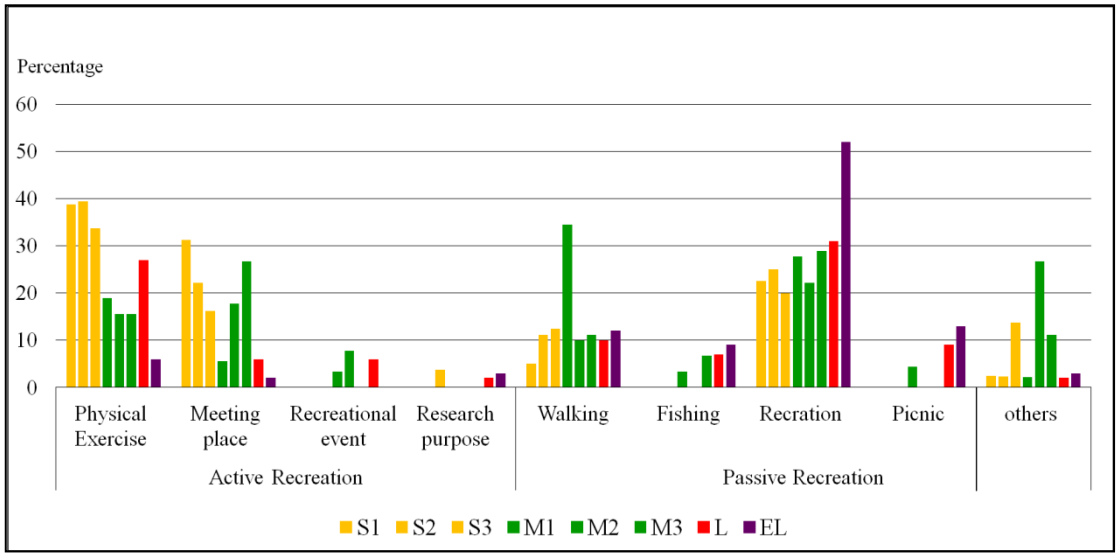


Figure 4.17 Purposes of visit of parks

Source: Field work, 2015

Figure 4.17 described the purpose of visit of parks. Purpose of visit of parks mainly depend on the physical size and condition of surrounding area of parks. In small size parks people visited for meeting place, physical exercise and recreation purpose. So in small size parks mainly active recreation, sometimes passive. Again, in medium size parks, people who lived near park come for recreation and walking and some people also come physical exercise. In large and extra-large parks people visited for recreation and picnic purpose. In large and extra-large parks mainly passive recreation and outdoor activates. In small parks people stayed short time for daily refreshment and in large park they enjoyed whole day inside the park.

4.13 Land use of case study parks

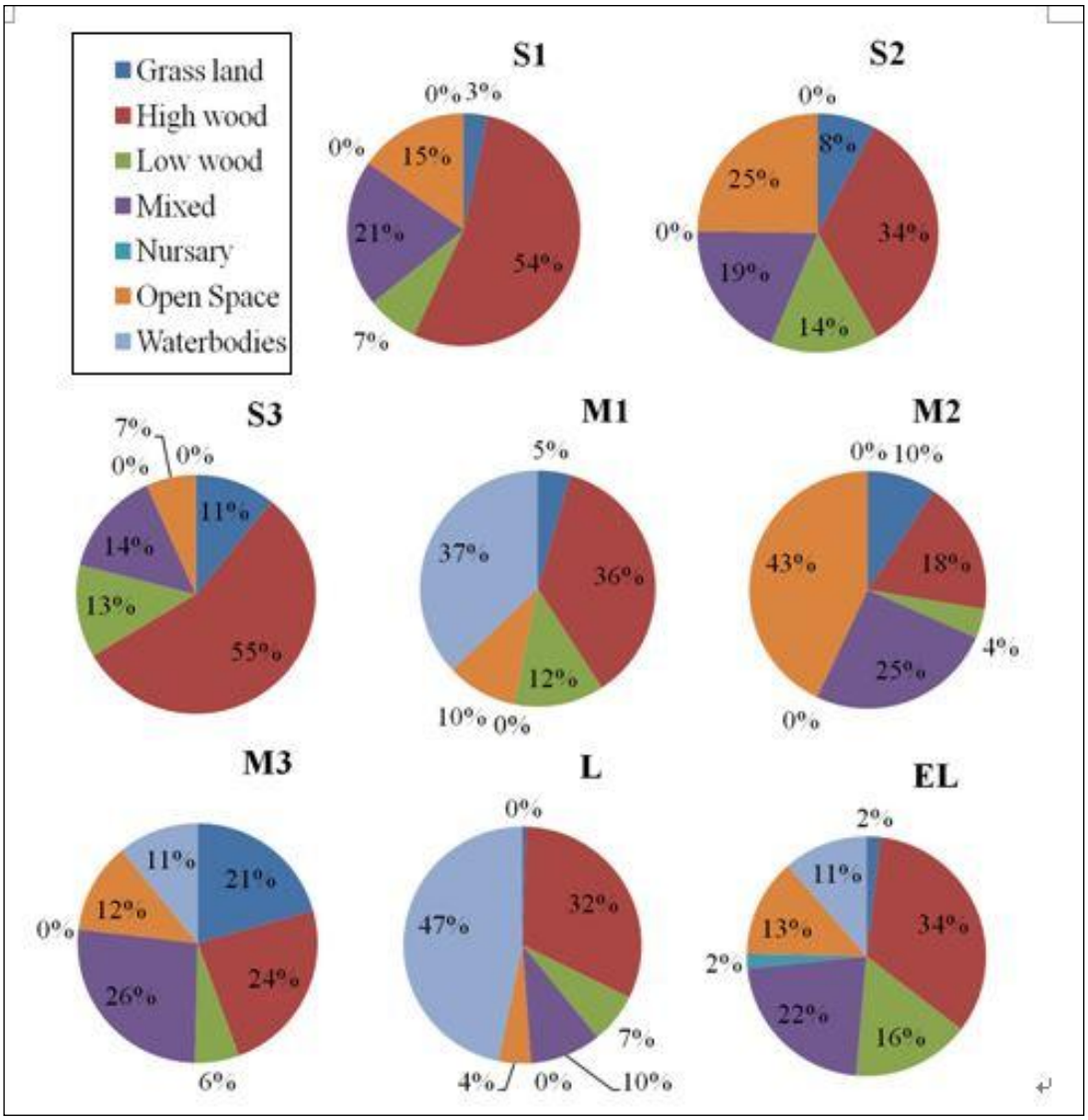


Figure 4.18 land use of case study of parks
Source: Quick Bird images 2010; Field observation, 2015

Quick Bird images and field observation help to identified land use of case study parks. After identified features, by digitizing area measure to analysis the land use.

In small size parks most of the area covered by high wood. In medium size parks mainly control by high wood and mixed wood. But in M1 a large area covered by water bodies, because it's a lake based park. Again, in Large size park also found a large water bodies as it's a lake based park. Moreover, in extra-large park found different types of land use.

4.14 Regional characteristics of parks in Dhaka city

After analysis of questionnaire data, field observation, check table, satellite images, previous information about park (Appendix A), based on these four categories of parks, regional characteristics of parks of Dhaka city are also identified (Table 4.7).

Table 4.7 Regional characteristics of parks in Dhaka city

Factors	Small size park	Medium size park	Large size park	Extra-large size park
Area (Acres)	Less than 4	4-40	Greater than 40	200 +
Shape	Round or Square	Rectangular	Irregular	Irregular
Radius of serve area	1.507 km	2.512 km	3.375 km	6.434 km
Located	Beside the residential area	Beside the institutional or commercial area	City center	City boundary
Vegetated area	High and mixed wood	High wood and Grass land	High, low and mixed wood	High, low, mixed wood and also Nursery
Non-vegetated area	Open Space	Open space, sometime water bodies	Open space and water bodies	Open space and water bodies
Recreation activities	Mainly Active, sometime Passive	Active and Passive	Mainly Passive, sometime Active	Outdoor
Purposes of visitor	Physical exercise	Physical exercise and leisure period	Cultural programme, Festivals, various occasion	Picnic, site seeing, whole day spending
Frequency of use	Daily	Daily to weekly	Monthly	Yearly
Transport facilities	Walking	Walking, private vehicles, auto rickshaw	Vehicle (Private and hiring)	Bus, Vehicle (Private and hiring)

Small size parks of Dhaka city mainly are situated beside the residential area, medium size parks beside the commercial area, large size parks placed at city center and only one extra-large size park found outer range of city area. Small parks mainly use as daily purpose. Medium parks use as daily and weekly. Again in large parks people mainly visited monthly or occasionally and in extra-large size park visit yearly. Moreover, small and medium size parks used for active and passive recreation more than other. Again large size parks are used in various national occasion (Example: traditional fair, Bangla happy New Year programs) more than the recreational purposes (Iqbal et al. 2010). In extra-large size parks people visited at all day long for outdoor activities.

Urban parks are very essential element for meeting the recreational need in the urban population. In the Dhaka city it is almost impossible to create a new park for high land price and inadequate land. Hence it should be taken care of the existing parks but existing green spaces face various weaknesses in management due to lack of awareness, maintenance and management. For this reason, there is need for effective management of existing parks.

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Chapter Five
Regional Difference of Urban Parks in Dhaka, Bangladesh, as an Example of Developing Countries

5.1 Morphological difference of developing cities

The morphology of third world developing cities often reflects dualism of urban form, the traditional or pre-colonial and the modern (Herbert and Thomas 1997). The first type predominantly built up with narrow streets and congested patterns with few open spaces and functional areas. The second type is modern city, in contrast, allocated a more spacious layout and geometry (Ferdous 2012). According to Conzen (2004), the diversity of morphology in South Asian cities arises from the diversity of historical development, functional types and different combinations of morphological characteristics. Most of cities of the developing countries mainly formed base on this two characters of urban structure.

5.2 Historical expansion and regional differentiation of Dhaka city

Dhaka reached its present status through a series of dynamic changes it underwent during different phases of history. The phases and consequent changes over the years have shaped Dhaka to its present structure. There are two dominant general patterns in the historical evolution of urban (Nilufar 2010): old Dhaka or the historic core and new Dhaka or northern expansion. The latter is actually post-colonial development, an effect of modernization, still spontaneous and organic in the nature. Besides these two dominant factors, five distinct and mutually exclusive spatial patterns are found simultaneously existing in an explicit composition.

The growth of Dhaka from 1949 to 1989 largely followed the limits determined by the Mughals (i.e. towards north up to Tongi, up to Mirpur in north-west, up to Postagola in south- east). The growth of modern Dhaka reached its apex just after the liberation war. The growth caused many low lands filled up owing to scarcity of land and consequent rise in its price. All the low lying areas on the eastern and western side came under occupation.

In the course of time, land use pattern was modified, and business activities were dispersed from Gulistan to a number of business streets. Although the major commercial buildings were still (in the 1980s) concentrated in the Motijheel area, the activities of CBD also became diffused. Dhaka city mainly divided into three region (Table 5.1) (Dhaka Structure Plan: 2016-2035, 2015).

Table 5.1 Regional differentiation of Dhaka city (Nilufar 2010)

General Historical Pattern of Dhaka	Distinct and Mutually Exclusive Pattern
Old or historic Dhaka city	Indigenous historical core e.g. Shankhari bazaar, Tanti bazaar, Sadarghat
New Dhaka city or Northern expansion	Colonial interventions or civil lines, e.g. Minto road, Hare road, Baily road
	New indigenous communities with mostly unplanned settlements, e.g. Kalabagan, Kathalbagan, Razabazar etc.
	Planned scheme of new communities, e.g. Dhanmondi, Gulshan
In general pattern	Informal settlements or squatters, e.g. various Slums

Source: Nilufar, 2010

The historical process of urban development in Dhaka City presents different trends based on its political development. Dhaka developed as a politico-administrative city and subsequently economic and commercial activities have also concentrated in the city making it the prominent city of the country. The urbanization activities in Dhaka City have been achieving tremendous growth for the needs of the newly independent country's capital. Overall, Dhaka City has experienced its highest rate of physical and population growth in recent decades that transformed it into a megacity.

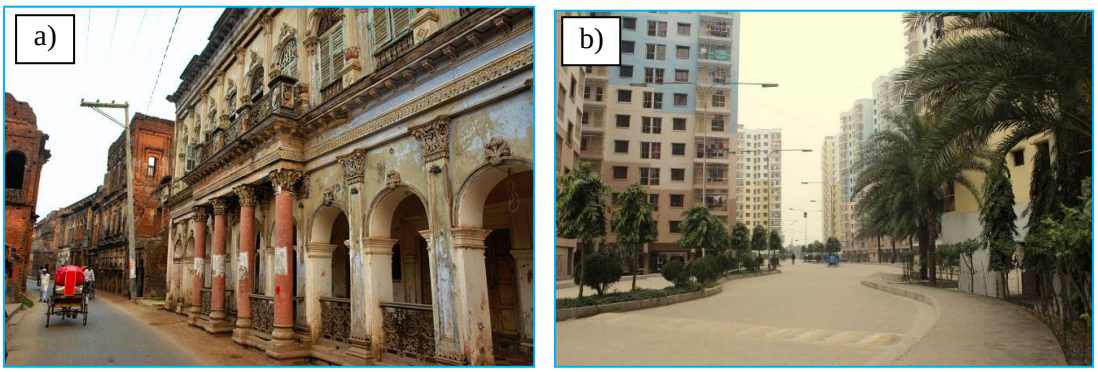

Figure 5.1 Housing pattern of old Dhaka (a) and new Dhaka (b)
Taken by the author, May 2014

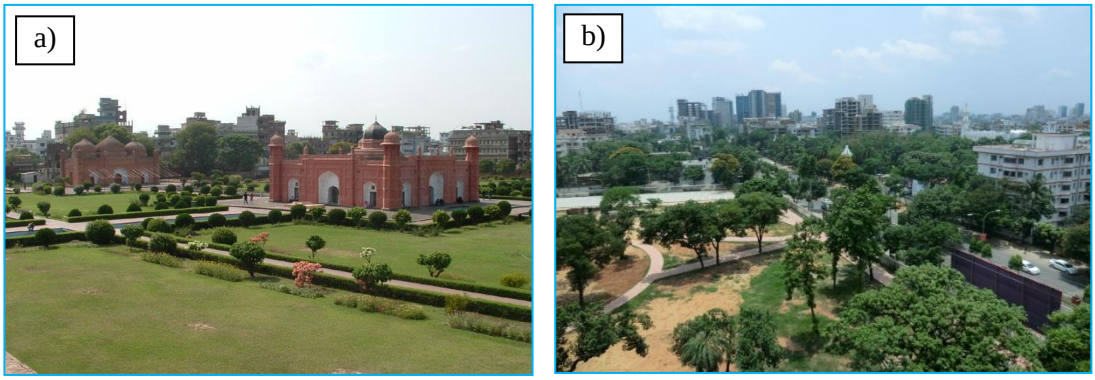

Figure 5.2 Green space of old Dhaka (a) and new Dhaka (b)
Taken by the author, May 2014

5.2.1 Regional difference of urban parks in Dhaka city

Dhaka City was once known for its serenity, beautiful parks, clean roads and lush greenery have now been converted into brick and concrete jungle. In the old part of city there is only 5% open space while in New Dhaka 12 % of land is green and open. The total amount of open spaces

in greater Dhaka is about 17% to 18% and the total stock of public open spaces is hardly over 5000 acres (Mowla 2011).

In old Dhaka is its serious shortage of open space combined with its high plot coverage, which allow little space for recreation purpose. Traditionally informal public open spaces, like street corners, court yards etc., helped to generate local social activities and ensured social control. Similar informal and intimate open spaces are rare in new Dhaka in spite of its organic morphological character and spontaneous development. Only a few spaces are kept open in planned residential areas which are also being swallowed day by day (Nilufar 1997). However, in spite of growing densification of built-up areas in newer parts of Dhaka, a number of medium and large scale open spaces are scattered in the city. Such areas often found to be misused by anti-social occurrences, thereby resulting into dehumanized areas. It is believed that role of urban public spaces, both at community and metropolitan level, is important to improve the social ties and social control for future generations (Nilufer 1999).

Tabassum et al. (2013) measured the accessibility and social interaction of parks in two parts of Dhaka city. According to them, in the planned area (new Dhaka) although the parks are comparatively better located and maintained but somehow social structure of these high-class residential areas do not allow their children to play in those parks, rather they encourage indoor play facilities. The scenario of socialization at old Dhaka is comparatively better. In old Dhaka remain lively all day long by the presence of local children, young and adults. Because of social conservative pattern and also due to the location and poor maintenance, participation of the female member of the community is low at old Dhaka.

Mishu et al. 2015 findings from the case studies reveal that although these places are public considering the ownership, their quality and characteristics as public place are diminishing day by day. Location of parks and limited accessibility have narrowed the group of users who can use the public place for a variety of purposes.

Therefore there is a gap of regional importance (influence) of parks in Dhaka city which is also common some other developing cities. For this chapter tried to analyze second hypothesis of the research work.

Hypothesis 2: Regional differentiation inequitably effect on urban parks in developing countries. To prove the hypothesis specifically, tried to answer two questions: (1) How regional difference influence the urban parks? (2) What is the effect of urban structure on parks?

5.3 Methodology

For identifying regional differentiation of parks, six case study parks were selected from each region of Dhaka Metropolitan area. Based on size (Chapter 4) and location of parks all case study parks were selected. Table shows the location of case study parks with their name (detail description in Chapter 2).

Table 5.2 Name of case study parks

Park Location	Year of boundary	Small size park	Medium size park	Large size park	Extra-large size park
Old Dhaka	1905	Bahadur sha **(S3)**	Osmani Uddan **(M3)**	**City center** Dhanmondi lake **(L)**	**City boundary** Botanical garden **(EL)**
New Dhaka	2015	Uttara sector 7 **(S1)**	Gulshan Lake **(M1)**		

Analysis of land use change of case study parks by aerial photos -

Three years (1984, 2000 and 2010) aerial photos collected from SPARRSO (Space Research and Remote Sensing Organization) Dhaka, Bangladesh. SPARRSO provided all data as vector data. So two steps follow to identify land use:

- Features identification: Morgan et al. (2010) some criteria used to identify features. Such as, Tone/Color, Size, Shape, Texture, Pattern, Shadow, Context (Chapter 2).
- Digitization: Second step is digitization. After identified features need to digitized the particular features to know the area of land use.

ArcGIS 10.2 used to prepare map of land use of each park. Moreover, calculated value of area of different years also showed by graph.

Present condition of parks using Quick Birds and Google earth images -

Visualization tool for land use/cover maps (Hu et al., 2013)

Photographs –

Visual quality of the parks (Ter 2012)

Secondly, data of parks collected from different organizations. Old Dhaka located in southern part of city and new Dhaka situated in northern part. So Dhaka South City Corporation (DSCC) and Dhaka North City Corporation (DNCC) data used for identify regional differences.

Population data collected from Bangladesh Bureau of Statistic (BBS 2011).

Urban structure data (land use and road network) data collected from RAJUK (Rajdhani Unnayan Kartripakkha 2015). After collected data map produce by ArcGIS 10.2.

Moreover an in-depth literature review also an important method to know the previous models about urban land use of developing nation.

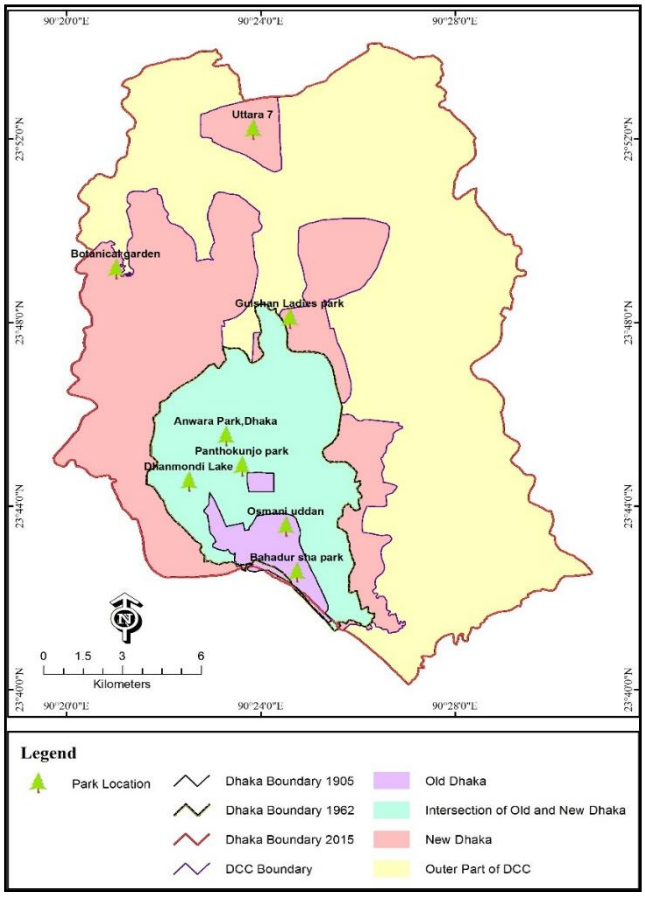

Figure 5.3 Case study parks location with different year's boundary of Dhaka city

5.4 Regional differentiation of case study parks

The multi-temporal satellite data provided valuable information on the change of green spaces in case study parks during 1984, 2000 and 2010. Tables clearly show how land use change in the case study parks over the course of time. After comparing, aerial photos of three years showed that inside the parks land use change of each park and it was found that land use change both in positive and negative pattern. On the other hand, recent land cover was also found of each parks in detail and it's easy to compare with different region.

Small size parks (old Dhaka and new Dhaka):

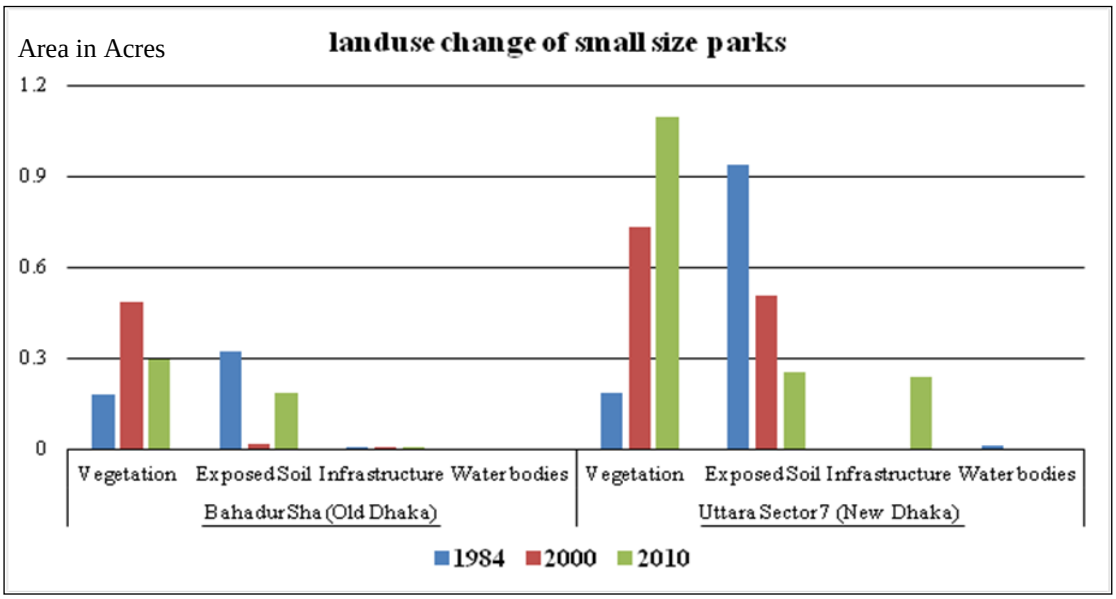

Figure 5.4 Land use change of small size parks
Source: Aerial photos of different years

In old Dhaka small size case study parks vegetation increased during 1984 to 2000, but after 2010 vegetation decreased and exposed soil increased. On the other hand, new Dhaka small size park's vegetation gradually increased and exposed soil decreased. Again both in intersection and new Dhaka, water bodies filled up and turned into infrastructure.

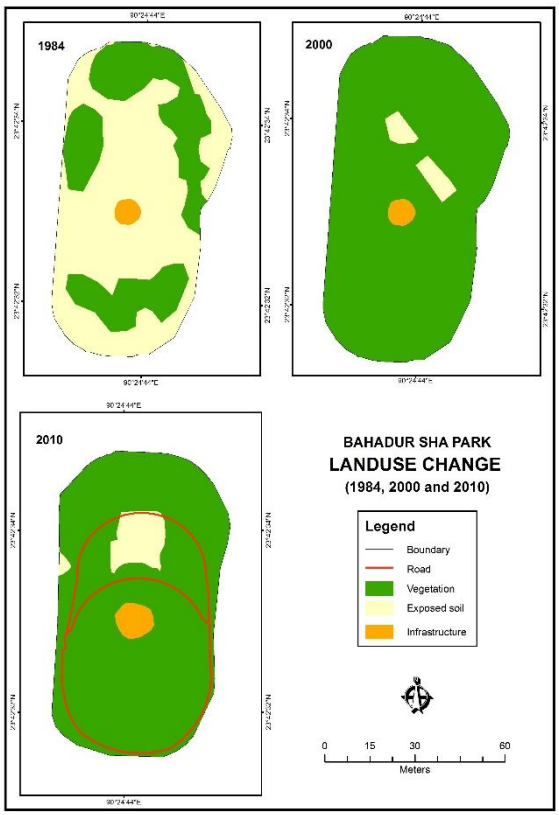

Figure 5.5 Old Dhaka small size park
Source: Aerial photos of different years

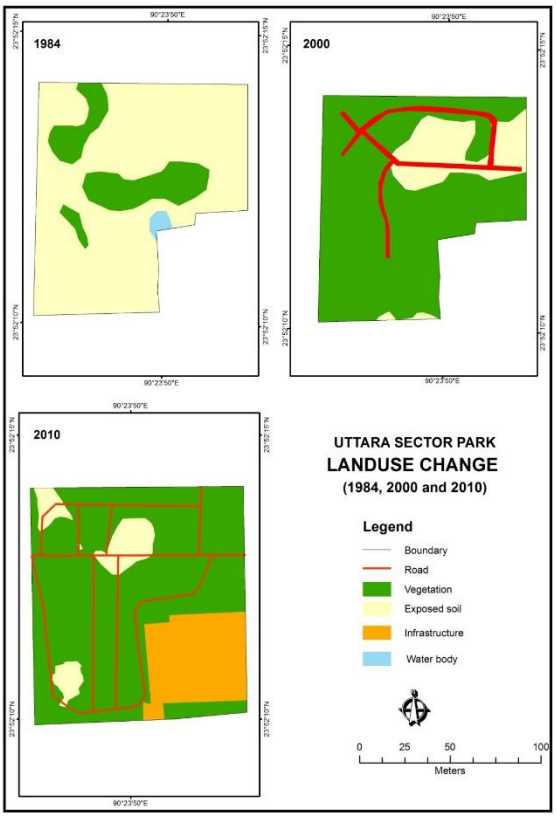

Figure 5.6 New Dhaka small size park
Source: Aerial photos of different years

a. New Dhaka (Uttara sector 7 park) **b.** Old Dhaka (Bahadur Sha park)

Figure 5.7 (a, b) Setting place of small size parks

Taken by the author, November 2015

In new Dhaka park's small size has bench with shade beside boundary (Figure 5.7a). Well planned. Good in condition. In old Dhaka there is no specific bench, people sit under the tree. Inside the park narrow place and poor in condition (Figure 5.7b).

a. New Dhaka (Uttara sector 7 park) **b.** Old Dhaka (Bahadur Sha park)

Taken by the author, November 2015

Figure 5.8 (a, b) Walking way of small size parks

In small size parks people use for daily walking and physical exercise purpose (Chapter 4). So inside the park walking way is very necessary. In new Dhaka has separate walking way (Figure 5.8a) but its narrow. In old Dhaka there is no separate walking way inside the park(Figure 5.8b) .

Medium size parks (old Dhaka and new Dhaka):

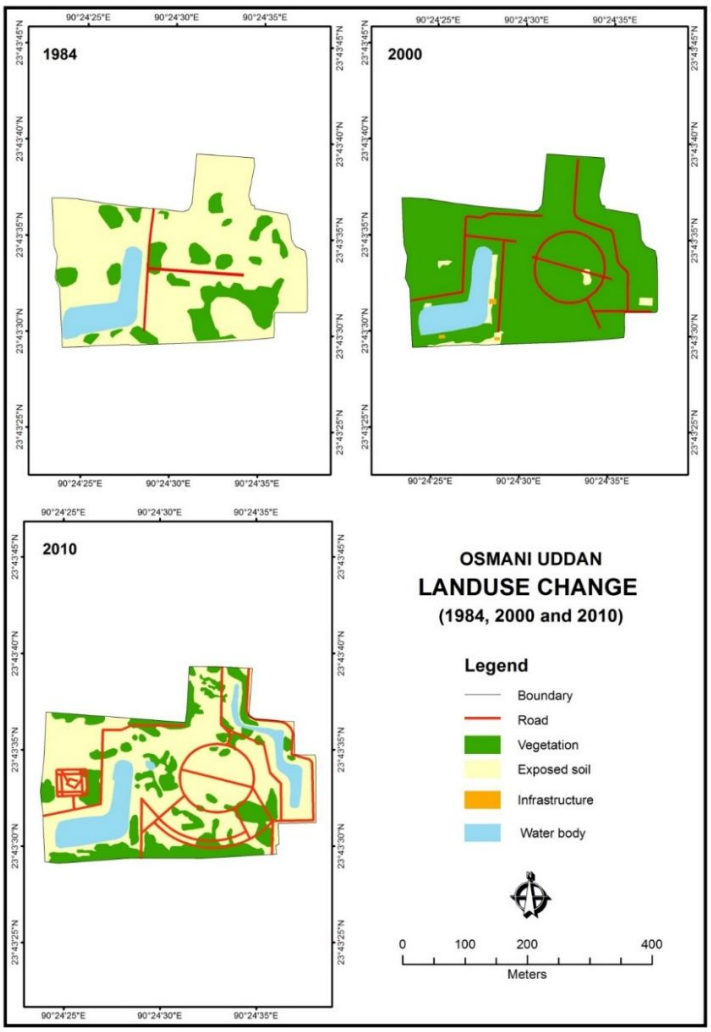

Figure 5.9 Old Dhaka medium size park

Source: Aerial photos of different years

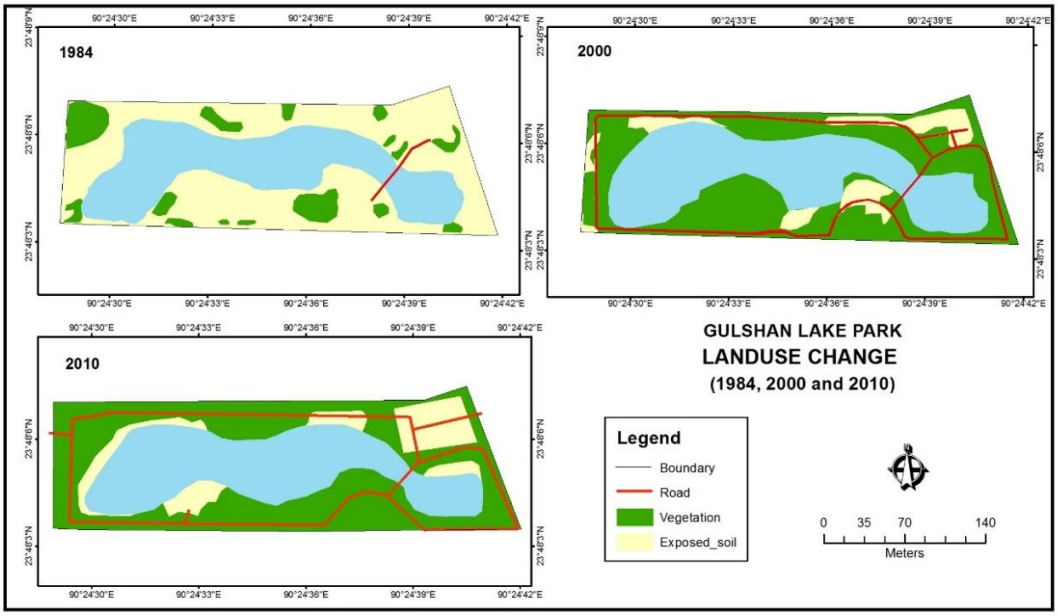

Figure 5.10 New Dhaka medium size park

Source: Aerial photos of different years

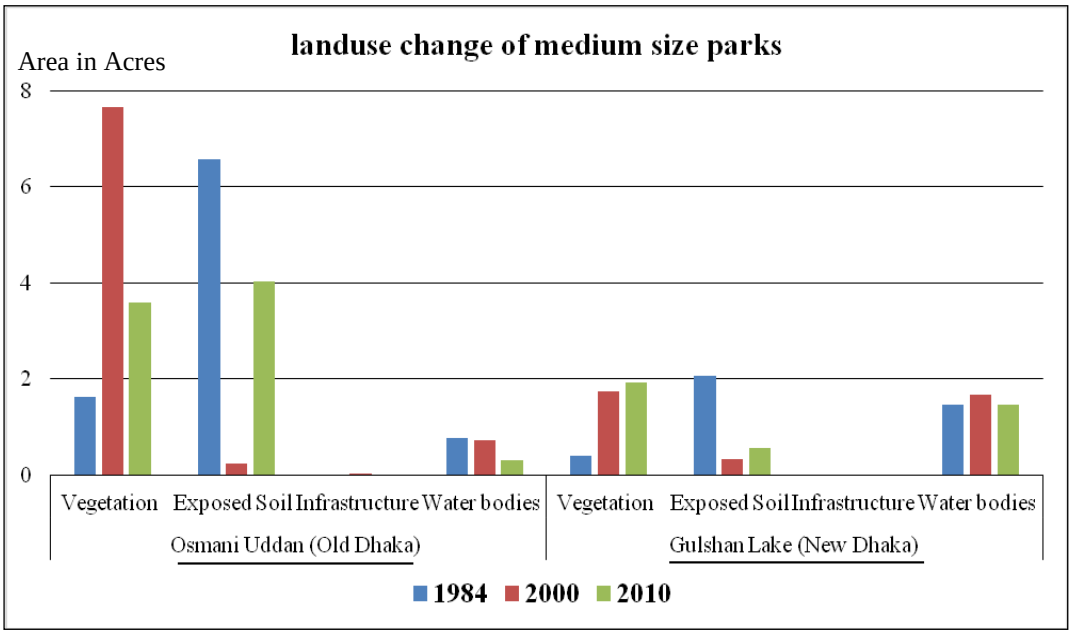

Figure 5.11 Land use change of medium size parks

Source: Aerial photos of different years

In old Dhaka medium size case study park vegetation increased during 1984 to 2000, but after 2010 vegetation decreased and exposed soil increased. On the other hand, new Dhaka medium size park's vegetation gradually increased and also exposed soil little increased. Again old Dhaka, water bodies total area increased and in 2010 there was no infrastructure inside the park.

Below figure described that same feature in different parks are in different condition:

a. New Dhaka (Gulshan lake park) **b.** Old Dhaka (Osmani uddan park)

Figure 5.12 (a, b) Playing zone of medium size parks

Taken by the author, November 2015

In new Dhaka there is a particular place for playing and this area surrounded by high wood (Figure 5.12a). Whole park is well planned and good in condition. On the other hand no place assign for playing zone in old Dhaka parks. Picture showed kids play on the walking way (Figure 5.12b). Sometime it makes problem for park visitors. Moreover sometime people play on the open space. Poor in condition.

a. New Dhaka (Gulshan lake park) **b.** Old Dhaka (Osmani uddan park)

Figure 5.13 (a, b) Walking way of medium size parks

Taken by the author, November 2015

In new Dhaka medium size park has a wide and regular walking ways for visitors (Figure 5.13a). On the other hand, in old Dhaka has no separate walking way. Boundary side narrow place use as walking way (Figure 5.13b). Inside the park is not so clean.

Large size park (city center) and Extra-large size park (city boundary):

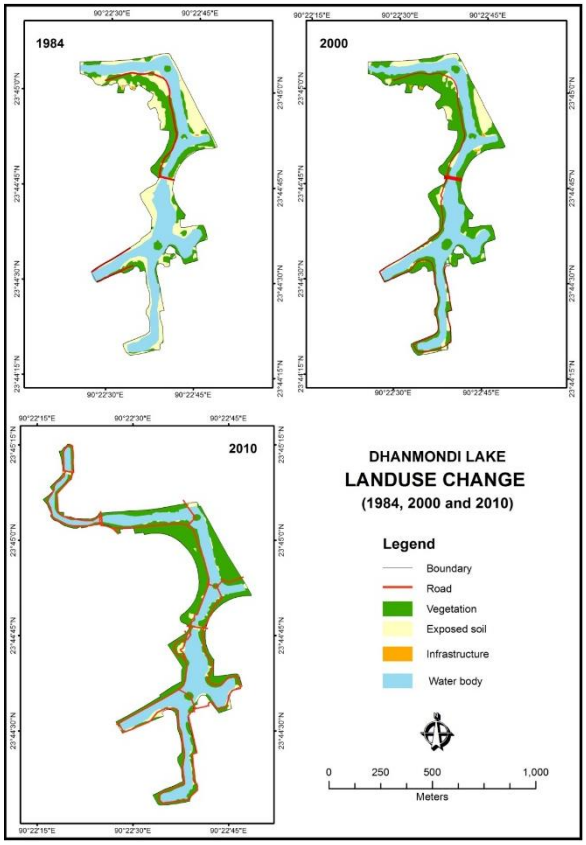

Figure 5.14 Large size park in city center

Source: Aerial photos of different years

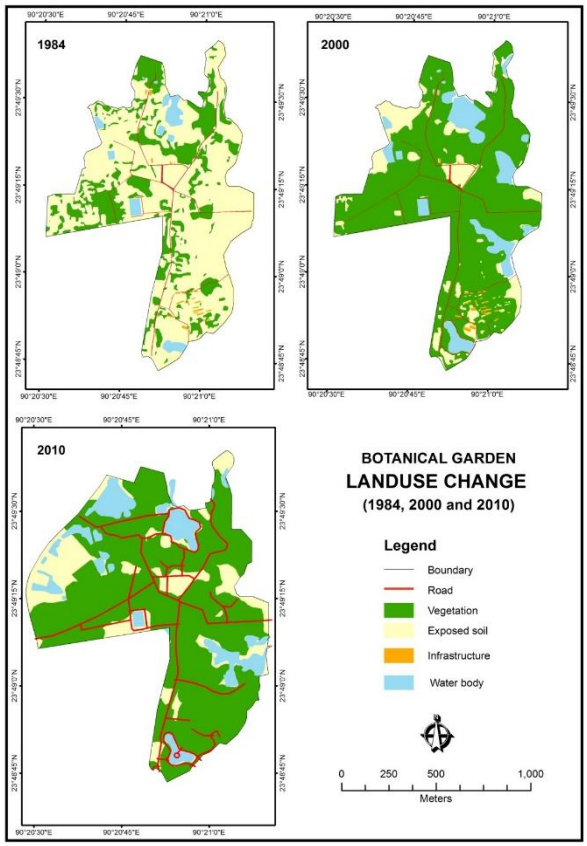

Figure 5.15 Extra Large size park in city boundary

Source: Aerial photos of different years

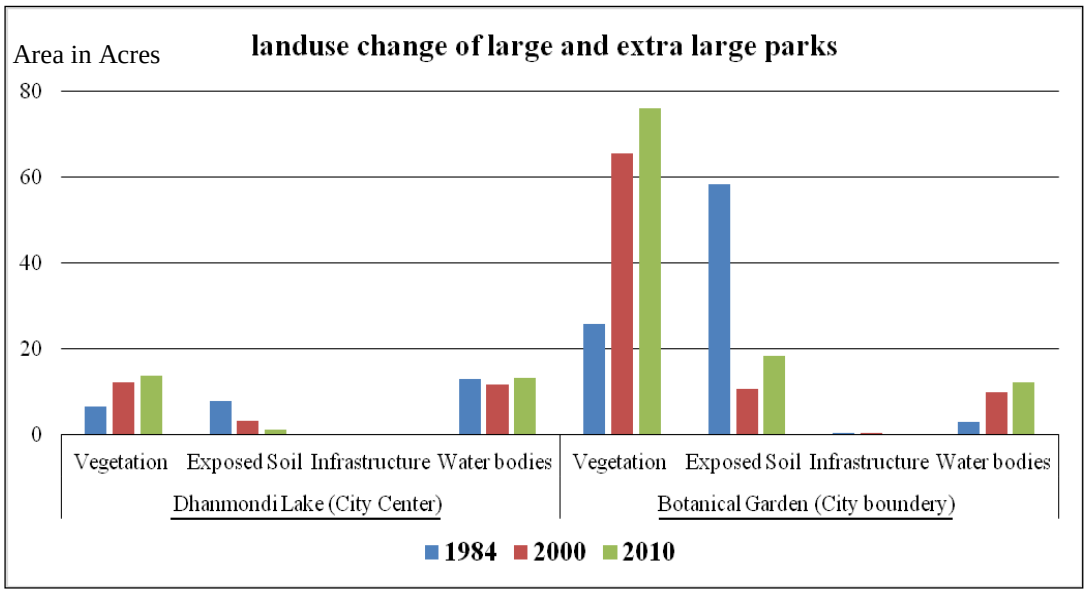

Figure 5.16 Land use change of large and extra-large size parks
Source: Aerial photos of different years

Large park vegetation increase and exposed soil decrease. But in extra-large park's a good amount of vegetation increase. Again exposed soil and water bodies both also increase.

a. City center (Dhanmondi lake park) **b.** City boundary (Botanical garden park)

Figure 5.17 (a, b) Huge tree in large and extra-large size parks
Taken by the author, November 2015

Large park– High trees, under small infrastructure

Extra-large park– plenty of vegetation and increase

Both parks water bodies area increase. Well managed

5.5 Parks ratio in old Dhaka and new Dhaka

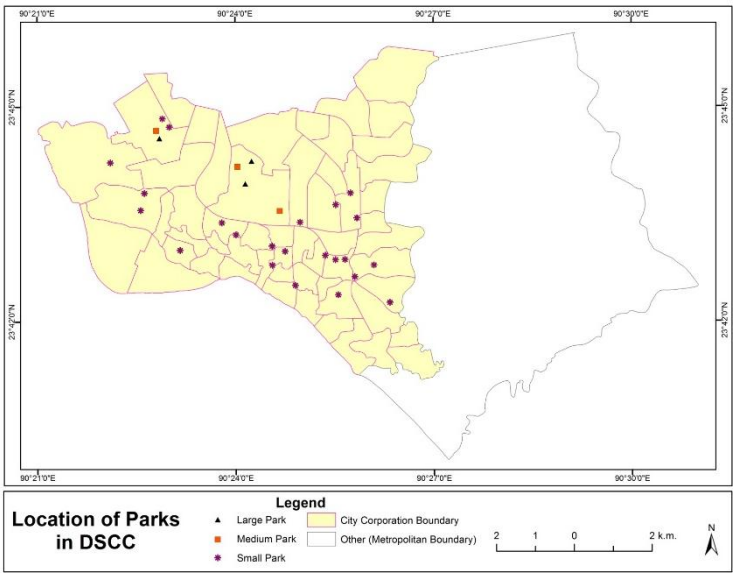

Figure 5.18 Location of Parks in DSCC

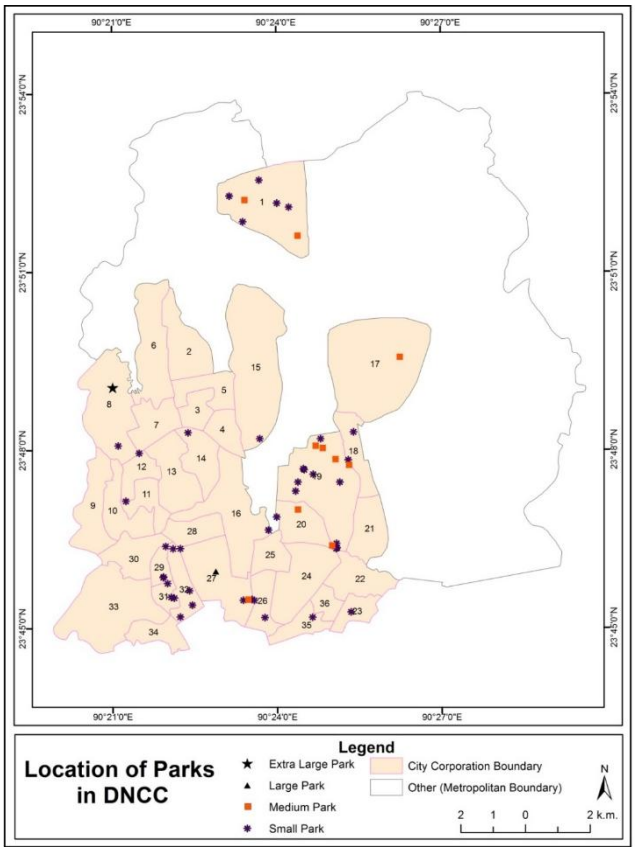

Figure 5.19 Location of parks in DNCC

In old Dhaka small size parks number are more than the other size of parks (Figure 5.18).

Number of medium size parks = 3

Number of small size parks = 28

Ratio, 28 : 3 = 9 : 1

So in old part of city mainly dominant by small size parks. From chapter 4, service area of small size parks are also limited. So some part of the city has no included any service area of parks.

On the other hand, in new Dhaka small and medium size parks were well distributed and balanced (Figure 5.19) .

Number of medium size parks = 10

Number of small size parks = 43

Ratio, 43 : 10 = 4 : 1

5.6 Urban structure of Dhaka

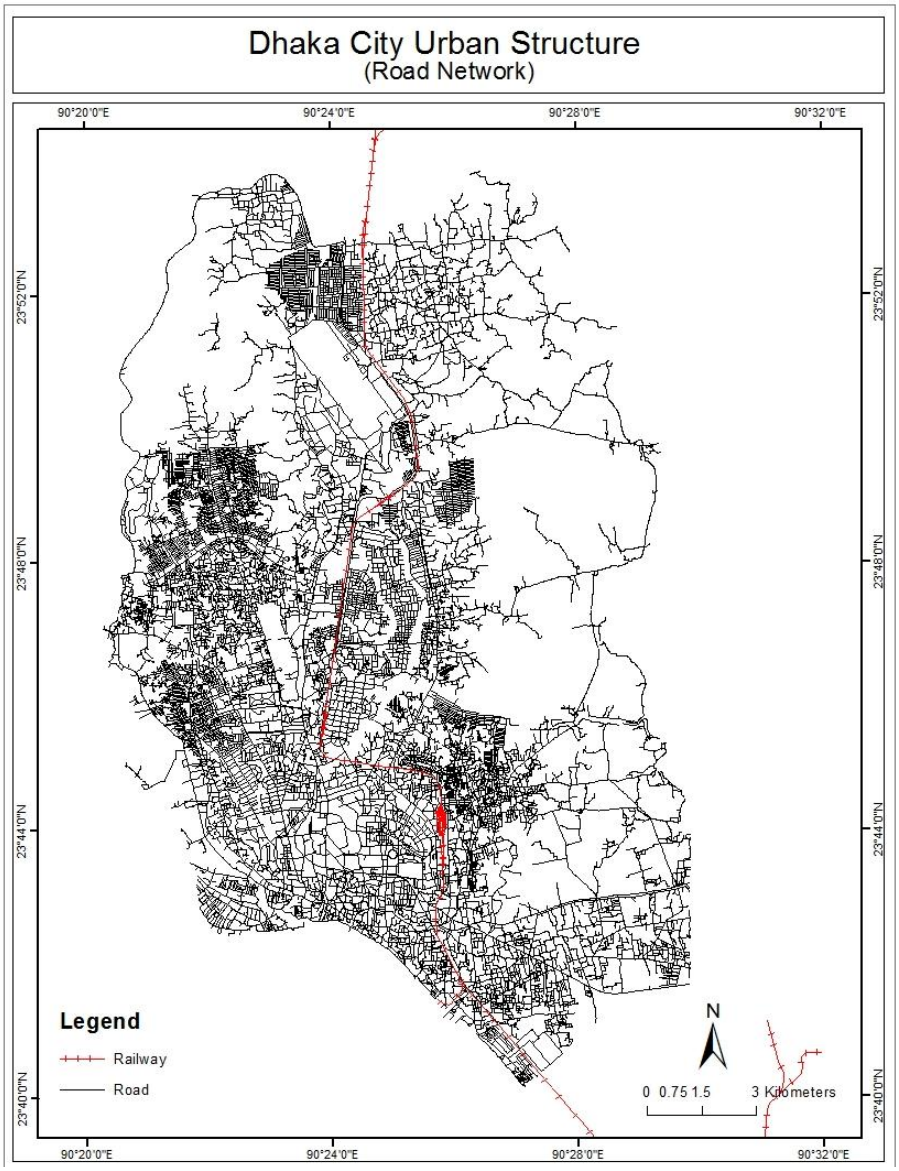

Figure 5.20 Road network of Dhaka city

Source: Adapted from RAJUK, 2017

The urban development of Dhaka city is well known for its spatial structure. Most important civic center older part of the town, formed and dominated by the major congregation mosque, bazaar, palace and/or fort, and supported by the Muslim cultural (social and religious) order. Gradually Muslims dominated Dhaka, who rather than being entrepreneurs or artisans were either under royal patronage and/or were landowners. The local morphology and spatial distribution of urban spaces in indigenous old Dhaka are characterized by a nonlinear overlapping and combination of socio-spatial structures of different social units and communities. On the other hand in new Dhaka, settlement and urban structure are contemporary type (Ferdous 2012).

According to Nilufar (1997) old Dhaka resembles a 'linearly discrete' character as in Arab cities but new Dhaka resembles the organic morphological pattern of some western European cities, for example London.

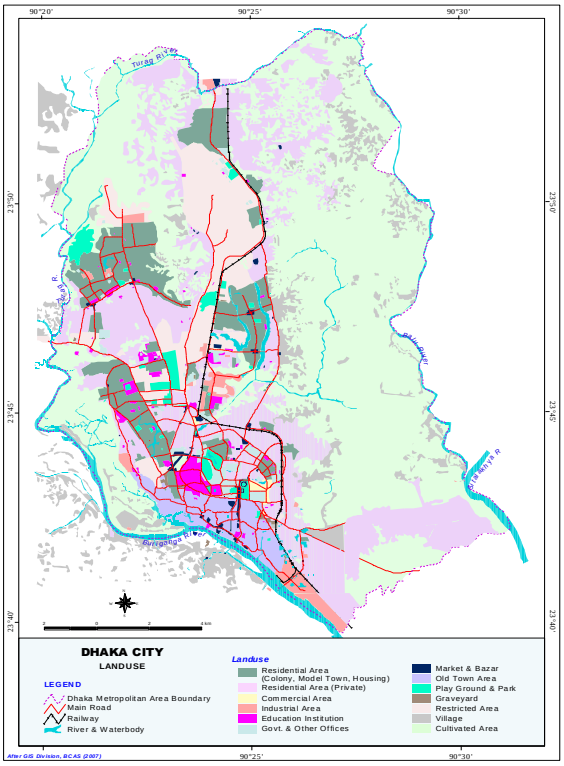

Figure 5.21 Land use of Dhaka city
Source: GIS Division of BCAS, 2007

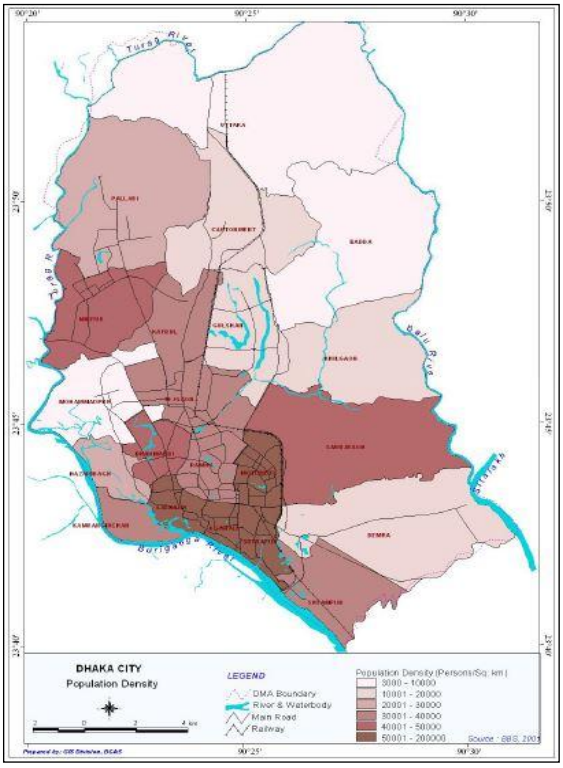

Figure 5.22 Population density of Dhaka city
Source: GIS Division of BCAS, 2007

Again, based on land use map in old Dhaka mixed and diversified land use pattern. But in new Dhaka land use pattern is regular and follow planned way (Figure 5.21).

The population density map of Dhaka city collected from GIS Division of BCAS (Bangladesh Center for Advance Study) 2007. Based on this map in older part of city population density is higher than other part of city (Figure 5.22).

5.7 Different city model of Asian region

Table 5.3: Stages of colonial urbanization in Asia

Chronological phases	Major features of urbanization
Pre-contact	Small, organically patterned towns predominate
1500 Mercantile colonialism	Limited colonial presence in existing ports. Trade usually in natural products of local region
1800 Transitional phase	Reduced European interest in investment overseas. Greater profits to be made in the industrial revolution
1850 Industrial colonialism	European need for cheap raw materials and food. Colonialism takes territorial form, new settlement patterns and morphology created
1920 Late colonialism	Intensification of European morphological influence. Extension to smaller towns in hierarchy. Increased ethnic segregation
1950 Early independence	Rapid growth of indigenous populations through migration in search of jobs. Expansion of slum and squatter settlements
1970 New international division of labour	Appearance of multinational corporation factories. Further migrational growth of cities. Increasing social polarisation

Source: Drakakis-Smith, 1987

As in other regions of the Third World, contemporary urban forms in South Asia reveal the imprint of both indigenous and colonial forces. Two basic models depict the effect of these forces on the form of the South Asian city: the colonial-based city and the bazaar based city. The colonial-based city model reveals features characteristic of colonial foundations elsewhere but also reflects the particular colonial methods of the British in the Indian subcontinent (Figure 5.23):

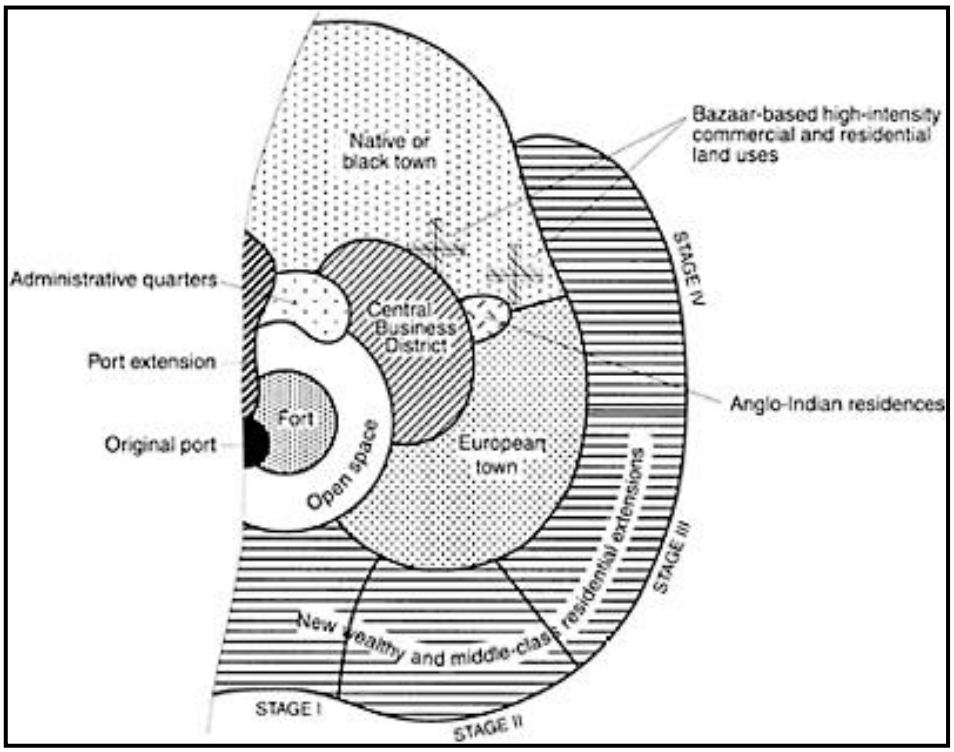

Figure 5.23: A model of the colonial based city in South Asia

Source: Brunn and Williams, 1983

Characteristics of colonial based city model given below:

- Growth point of the city.
- A nucleus of the colonial exchange system.
- An open space (maidan) around the fort for security.
- Part of the open space between the fort and European town was reserved recreational facilities.
- Beyond the open area was a native town developed.
- A Western-style CBD contained the major commercial and administrative functions.
- The planned European town.
- At an intermediate location between the 'black town' and 'white town'.

The ethnic diversity caused by the influx of foreign migrants is a prominent element in McGee's (1967) model of the South-East Asian city (Figure 5.24). Commercial zones are differentiated by the ethnicity of the entrepreneurs, whether alien (Chinese or Indian) or Western. A high-class residential sector extends outwards from the government zone. Squatter settlements are located on the urban periphery, along with more recent suburbs. The growth of the city is spreading urban influences into the surrounding countryside, producing a desakota, or extended metropolitan region. Another significant feature is the spontaneously evolving traditional villages (kampungs) which occur throughout the city, having been absorbed by urban growth. These include both planned legal kampungs, designed for those displaced by urban development, and illegal squatter settlements.

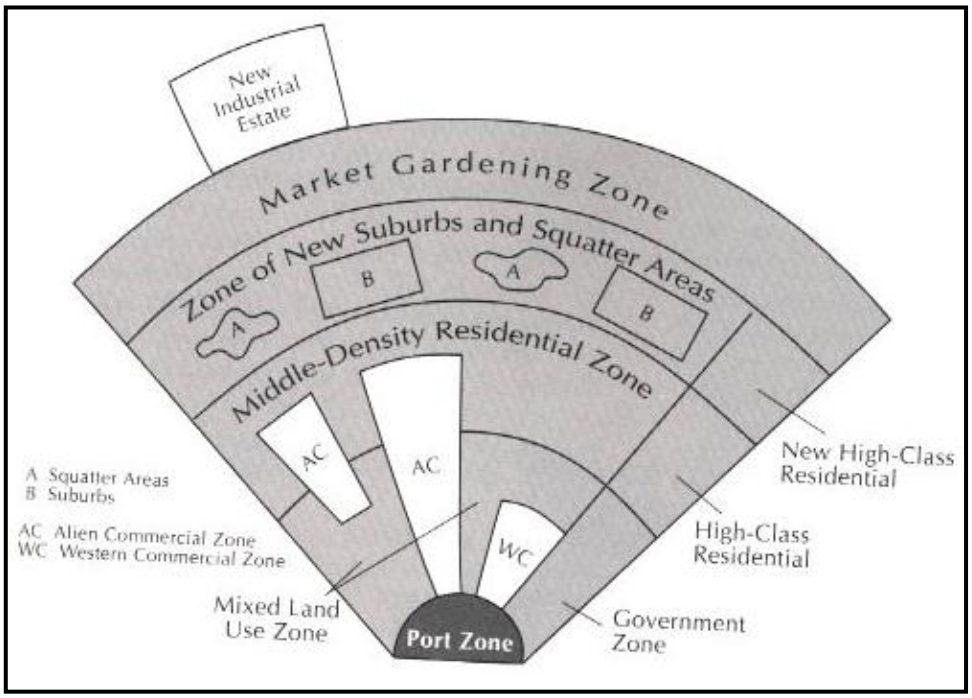

Figure 5.24: A model of the South-East Asian city

Source: McGee, 1967

Characteristics of McGee model given below:

- Old colonial port zone surrounded by a commercial business district
- Western commercial zone (dominated by Chinese merchants)
- No formal central business district (CBD)
- Hybrid sectors & zones growing rapidly
- New Industrial parks on the outskirts of the city

5.8 Proposed model of park distribution as a developing nation

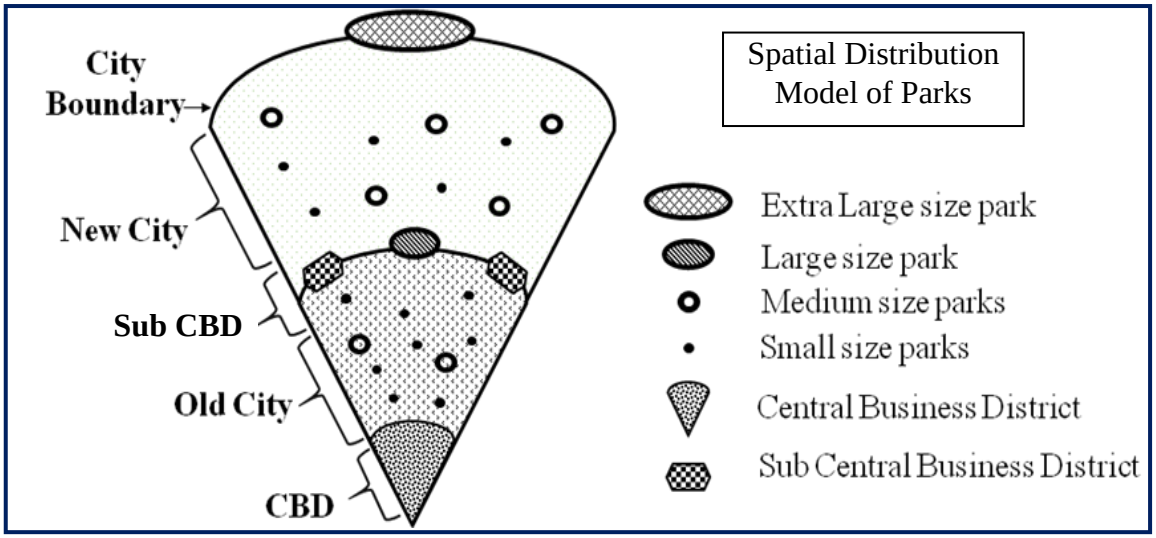

Figure 5.25: Spatial distribution model of parks in developing nation

Characteristics of proposed model:

Difference from previous land use model:

- Previously focus on different land use pattern.
- Mainly control by socio economic condition,
- Very old model.
- Based on colonial concept

Common with previous land use model:

- CBD is the main focal point.
- City expansion and land use change.
- City expansion in one side.
- City divided into different parts. (old and new city)

Characteristic of proposed Spatial Distribution Model of Parks:

- City till now change and expansion
- Main starting point central business district (CBD)
- A long ancient history of city

Old city –

- More traditional pattern.
- Parks are scatteredly situated.
- Small size parks are high number than the other size park.

New city –

- More planned and modernization
- Small and medium size parks are good in number
- Small and medium size parks equally serve the new part of city
- Large park situated in the city center beside Sub CBD.
- Extra-large park situated in city boundary

Description:

Like Dhaka, other developing countries urban structure influence the regional difference. In Bangalore, India, urban parks are divided in two types: Old parks and new or young parks (Nagendra et al. 2010). In old part of city, because of over population and diversity land use, open spaces and parks area encroached. On the other hand, in new city can effort planned way new urban parks.

Regional difference influence Dhaka city parks. In old Dhaka parks has good quantity of vegetated area but there has a maintenance problem. And also different recreational facilities absent there. In New Dhaka parks are well organized and maintenance than other part of the city.

The importance and necessity of green space is simply great and without it in too crowded a city like Dhaka. Most areas, old or new, of Dhaka city are unplanned and have little scope for creating any green space or enhancing the existing ones, if any still worthy to be called so. Therefore the authorities concerned as well as the respective area dwellers must be consciously eager to preserve whatever green spaces the city still have and call all others to join effort.

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Chapter Six
Physical and Social Environment of Urban Parks: A Case Study of Urban Parks System in Dhaka City

6.1 Environment of Parks

Urban parks have been recognized as key neighborhood features that provide residents with leisure-time opportunities (Cohen et al., 2007) as well as utilitarian physical activity (Zlot and Schmid 2005), including walking to the park and engaging in a variety of active recreation opportunities there. Parks are important sites for both organized and informal activities (Floyd et al. 2011) and also support psychological health (Tinsley et al. 2002) and social well-being (Prezza and Pacilli 2007). Usually, parks are available without charge to individual users and thus are particularly important in all diverse population groups.

Parks are valuable urban settings for physical activity, social interaction, contact with nature, and relaxation and can improve the health of park users (Potwarka et al. 2008; Payne et al. 2005). According to the socio-ecological model, the behavior 'use of urban parks' can be influenced by certain environmental factors (e.g. physical environment, social environment, cultural environment, policy environment) (Giles Corti 2006; Raymore 2002) (Figure 6.1). Therefore, in this chapter mainly focused on understanding which environmental role (both physical and social) relate most positively to greater use of parks in Dhaka.

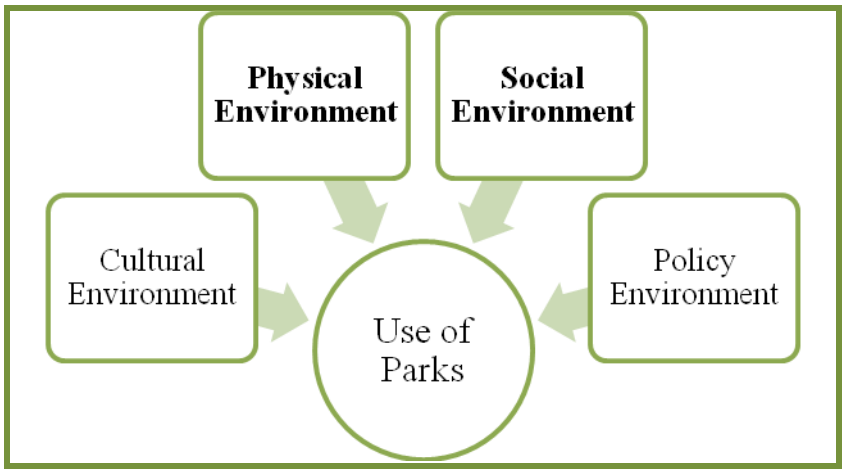


Figure 6.1 Socio-ecological framework for understanding use of parks

Source: Giles Corti, 2006; Raymore, 2002

6.2 Visitors characteristics and environment of parks

People would like to engage in physical activity in recreational areas, such as neighbourhood parks, public parks, sports complexes and community parks (Cohen et al. 2006; Floyd et al. 2011). Parks are the most common venue for physical activity, and residents can assess them at no cost. Several factors have been identified that influence the use of parks for physical activity such as environmental characteristics, individual characteristics and social characteristics (Loukaitou-Sideris 2004; Ries et al. 2008). However, the influence of environmental characteristics is an issue that is poorly understood (Humpel et al. 2002). According to Bedimo-Rung et al. (2005), physical environment of the parks seems to be related to physical activity and park visitation. For example, the availability of a facility is positively associated physical activity levels (Ries et al. 2008). In another study, Ries et al. (2008) identified four dimensions of the environment that can affect the use of recreational facilities for physical activity: physical, social, organizational and economic. They conclude that increasing facility availability may promote park's visitors and decrease the risk of obesity.

Liu et al. (2017) described park space, the availability of other services, transport facilities and preferences, and age and gender of park visitors are related to the recreational services of urban parks. Iqbal et al. (2010) identified the accessibility and utilization, a questionnaire survey has been carried out in Dhaka city both user and non-user respondent. A questionnaire survey has been conducted to get the user's opinion regarding environmental quality, landscape quality, safety and security quality and aesthetic quality of parks in Dhaka city (Neema et al. 2014). Again Mishu et al. (2014) described limited physical and social accessibility have narrowed the group of users who can use the urban parks of Dhaka city for a variety of purposes.

Therefore there is a gap of the relationship of park's visitors with physical and social environment of parks in Dhaka city.

In this chapter tried to find a relationship between visitors characteristics and environment of parks.

For this chapter tried to analyzed third hypothesis of the research work.

Hypothesis 3: Environmental role (both physical and social) positively enhance the type of parks in Dhaka.

To proved the hypothesis specifically, tried to answer two questions: (1) What is the environmental role of urban parks? (2) How size of parks control the characteristics of park's users?

6.3 Methodology

Both physical and social environment are important for visitors of parks. For identifying the relationship of urban parks with physical and social environment, eight case study parks were selected from Dhaka Metropolitan area. Table shows the respondent number of case study parks (Case study and questionnaire survey detail in Chapter 2).

Table 6.1 Name of case study parks

Name of Parks	Location	Type of parks	Number of respondents
S1	DNCC	Small size park	80
S2	DSCC	Small size park	80
S3	DSCC	Small size park	80
M1	DNCC	Medium size park	90
M2	DNCC	Medium size park	90
M3	DSCC	Medium size park	90
L	DSCC	Large size park	100
El	DNCC	Extra-large size park	100

DNCC (Dhaka North City Corporation), DSCC (Dhaka South City Corporation)

For this chapter different methods were used as primary data sources. Such as, questionnaire survey of parks visitors, interviews with government authorities, check table information, field observations, photos, sketch etc. The sample was selected randomly from each parks visitors. This survey was done from October to November in 2015.

The questionnaire is designed to meet research objectives and to answer research questions. Closed-ended and open-ended questions were used to measure people's attitudes toward Urban Park. For this study, the data was analyzed using descriptive statistics and content analysis. To facilitate the descriptive statistical analysis, the researcher used SPSS 10.0 for Windows software. The descriptive analysis provided an analysis using frequency, chi-square and regression analysis.

Check table mainly used for identified different features inside the parks.

Photographs used to identify facilities and quality of parks.

Quick Birds images of case study parks (2010) used to identified features and present situation of case study parks by using digitization.

Moreover, in-depth literature review used as secondary data source to know the previous study about areal functional model.

6.4 Physical Environment

Physical environment of park is a important factor to influence the user of park. physical environment factors of the existence and quality of park elements (e.g., walking path) and the neighborhood and built environment context in which parks exist, have not been systematically evaluated as park use predictors. However, the presence of specific park and playground features are the factors that parents rate as important in play space choice for their children regardless of familial demographic factors (Sallis et al. 1997).

Resident's proximity to parks has been examined as an environmental indicator of park access, (Giles-Corti and Donovan 2002; Booth et al. 2000), with greater proximity related to greater use (Mowen et al. 2003; Troped et al. 2001). Proximity constitutes only one of many park and playground factors potentially relevant to use and physical activity within these settings. Perhaps based on the lack of instruments to quantify park elements and quality, studies examining the

relation between park use and physical activity have generally by default considered all parks to have the same elements and qualities, despite the awareness that they may differ substantially on these characteristics (Saelens et al. 2006).

After check table data (Appendix B) and observed all case study parks, there is a list of elements of physical environment are given below:

Table 6.2 List of elements of physical environment

Factors	List of elements
Vegetated area	• High wood (tree height, > 3 meters) • Low wood (tree height, < 3 meters) • Mixed wood (high and low wood) • Grass land • Nursery
Non vegetated area	• Open space
Amenity	Parking, Bench, Toilet, Rain shelter, Visitor shed, Dustbin, Electric pole, Gate, Medical center, Rest zone, Food and beverage, Water supply station, Mosque and temple, Sculpture, Security room
Recreation	Artificial Waterfall, Open theater, Rest house, Cactus house, Orchid house, Net house, Watch tower
Water bodies	• Lake • Pond
Other	• Park boundary • Road/Walking way • Bridge • Office

Source: Field work, 2015

All elements are not equally found in each case study park of Dhaka city. Present situation of physical environment of eight case study parks showed by graph and maps.

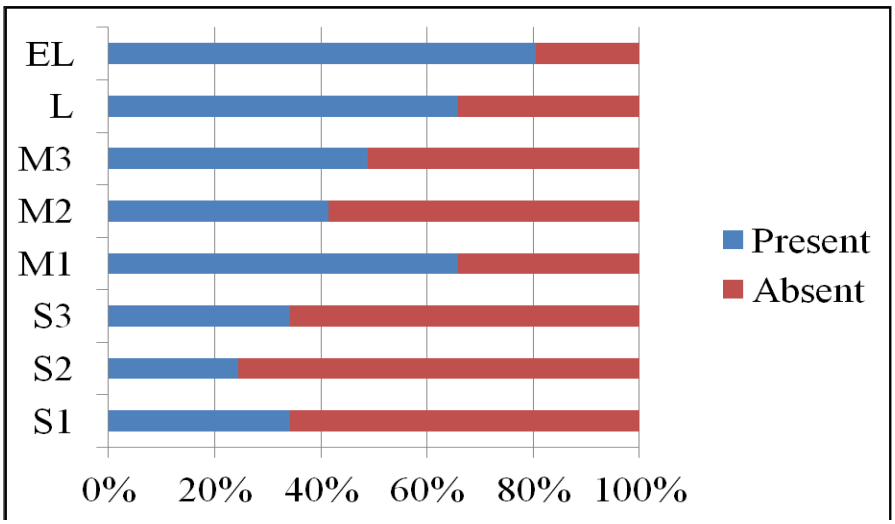


Figure 6.2 Percentage of physical environment

Source: Field work, 2015

Based on check table data (Appendix C; table 4 and 5) measured the percentage of present and absent of element of physical environment. From figure 6.2 showed that size of parks influence physical elements. In small size parks most of the physical element are absent. On the other hand,

in large and extra-large parks get large number physical element. Using Quick Bird image present status of small size parks given below:

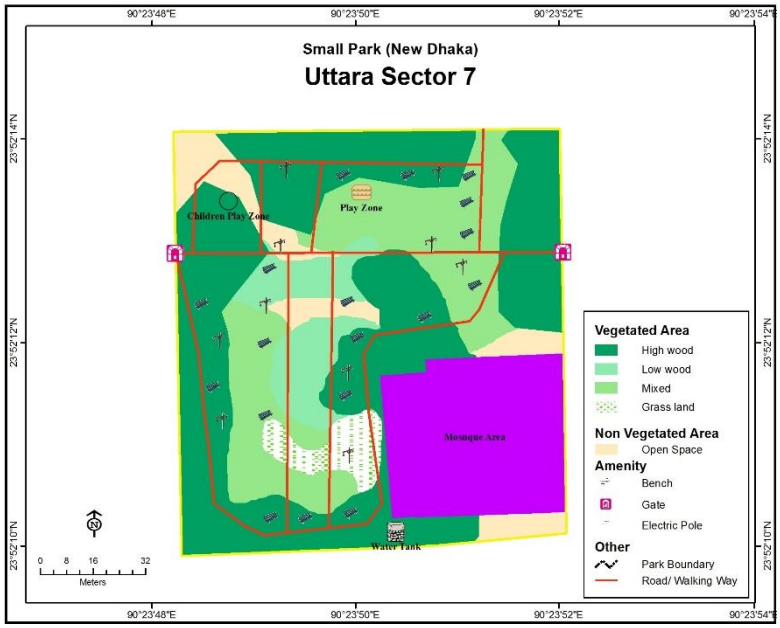


Figure 6.3 Physical environment of S1 park
Source: Field work and observation, 2015; Quick Bird image, 2010

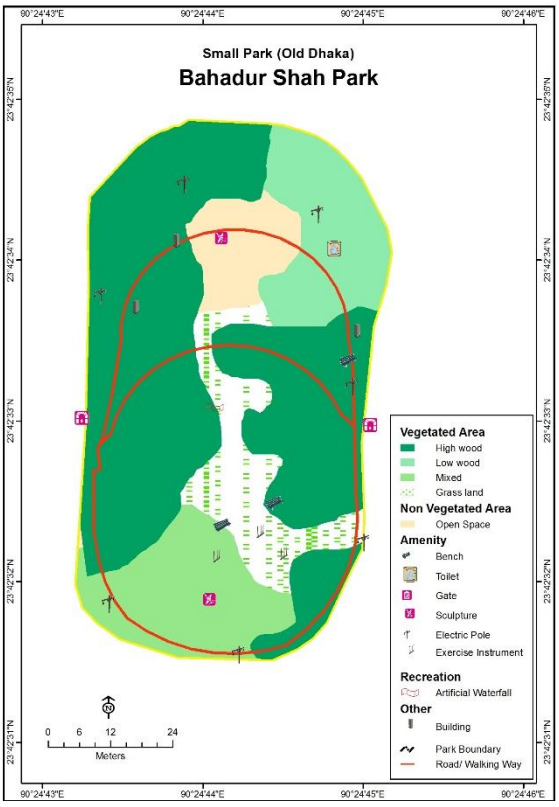


Figure 6.4 Physical environment of S3 park
Source: Field work and observation, 2015; Quick Bird image, 2010

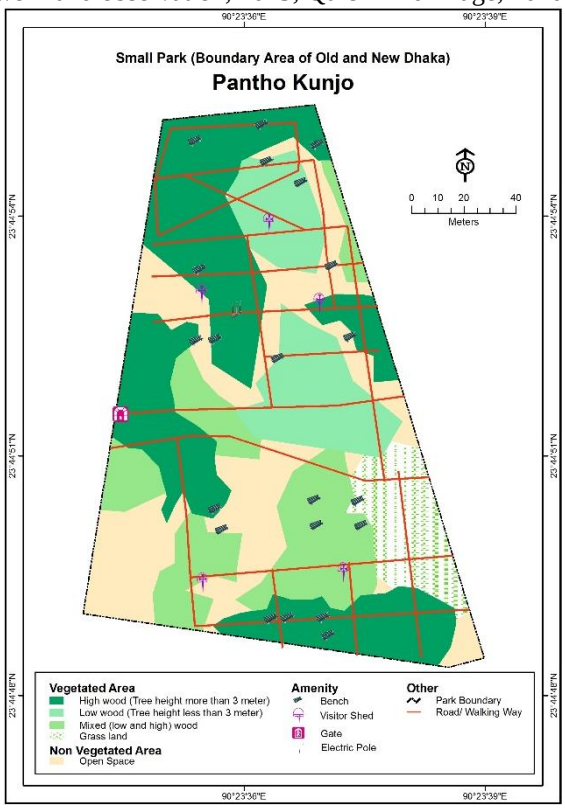


Figure 6.5 Physical environment of S2 park
Source: Field work and observation, 2015; Quick Bird image, 2010

From figure 6.3, 6.4 and 6.5 showed that the condition of physical environment of small size parks in Dhaka city. In small size parks people visited daily purpose and spend shot time inside the

parks. Mainly active activates found in here. In here number of physical elements was low. Again inside the parks walking way is in well design for people daily used. Some photos (Figure 6.6 - 6.11) of physical elements of these three parks given below:

Figure 6.6 Walking way (S1)
Taken by the author, November 2015

Figure 6.7 Playing zone (S1)
Taken by the author, November 2015

Figure 6.8 Visitor shed (S2)
Taken by the author, November 2015

Figure 6.9 Open space (S2)
Taken by the author, November 2015

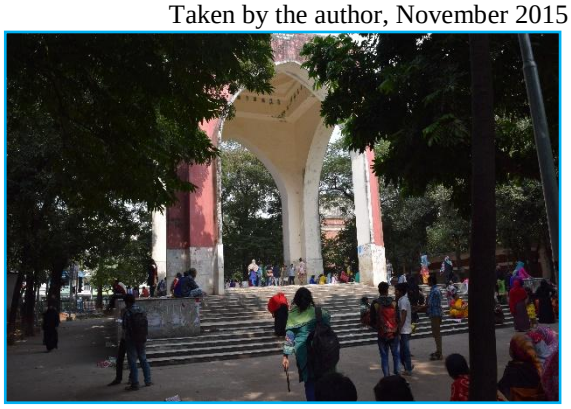


Figure 6.10 Sculpture (S3)
Taken by the author, November 2015

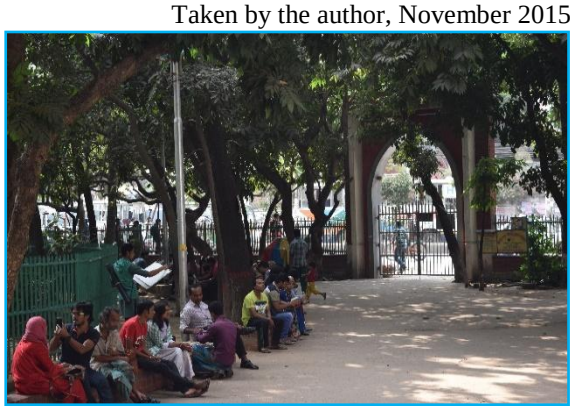


Figure 6.11 Gate (S3)
Taken by the author, November 2015

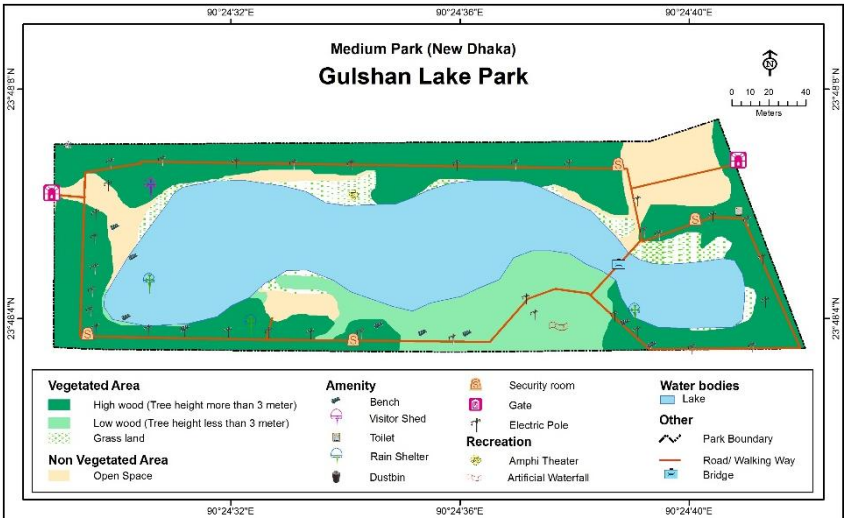


Figure 6.12 Physical environment of M1 park
Source: Field work and observation, 2015; Quick Bird image, 2010

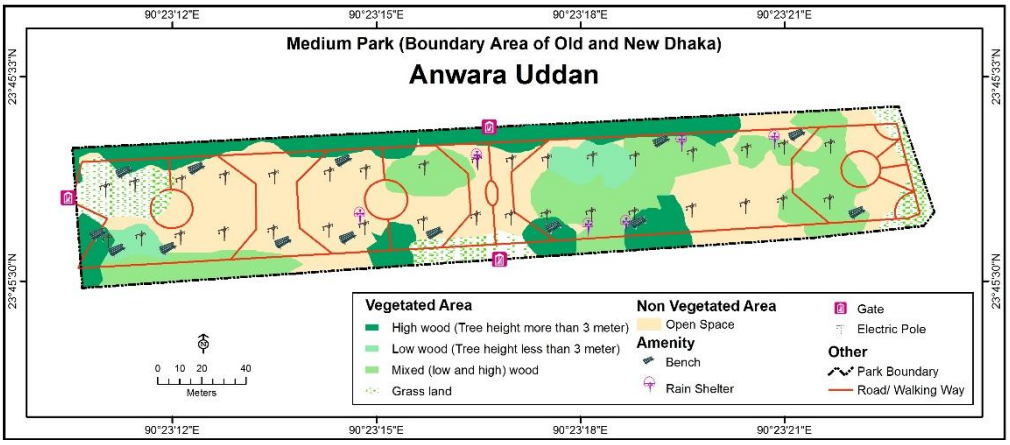


Figure 6.13 Physical environment of M2 park
Source: Field work and observation, 2015; Quick Bird image, 2010

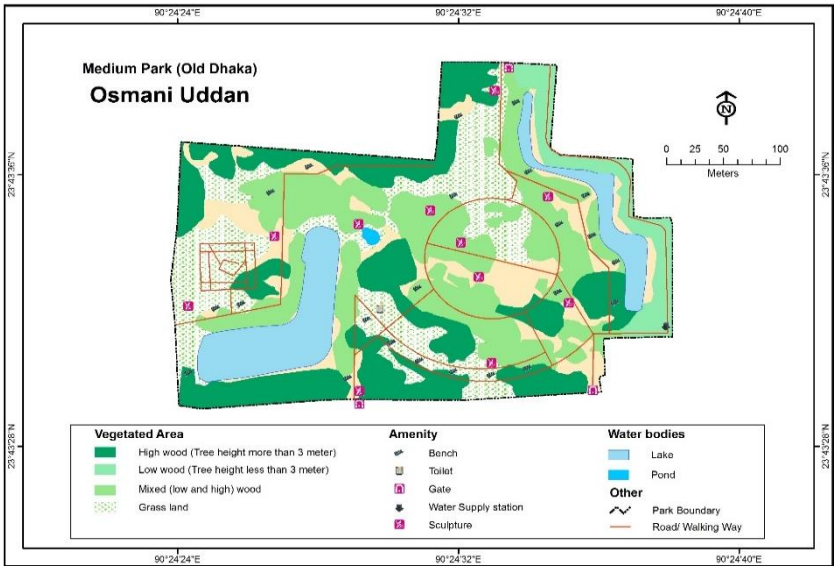


Figure 6.14 Physical environment of M3 park
Source: Field work and observation, 2015; Quick Bird image, 2010

From figure 6.12, 6.13 and 6.14 showed that the condition of physical environment of medium size parks in Dhaka city. In medium size parks people visited daily to weekly and attended different program inside the parks. Both active and passive activates found in here. In here number of physical elements was more than small size parks. Again inside the parks different size water bodies were found. Some photos (Figure 6.15 - 6.20) of physical elements of these three parks given below:

Figure 6.15 Water body inside (M1)
Taken by the author, November 2015

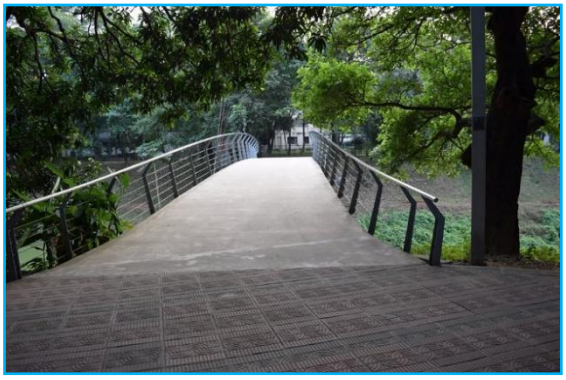


Figure 6.16 Bridge (M1)
Taken by the author, November 2015

Figure 6.17 Open space (M2)
Taken by the author, November 2015

Figure 6.18 Boundary and walking way (M2)
Taken by the author, November 2015

Figure 6.19 Sculpture (M3)
Taken by the author, November 2015

Figure 6.20 Food court (M3)
Taken by the author, November 2015

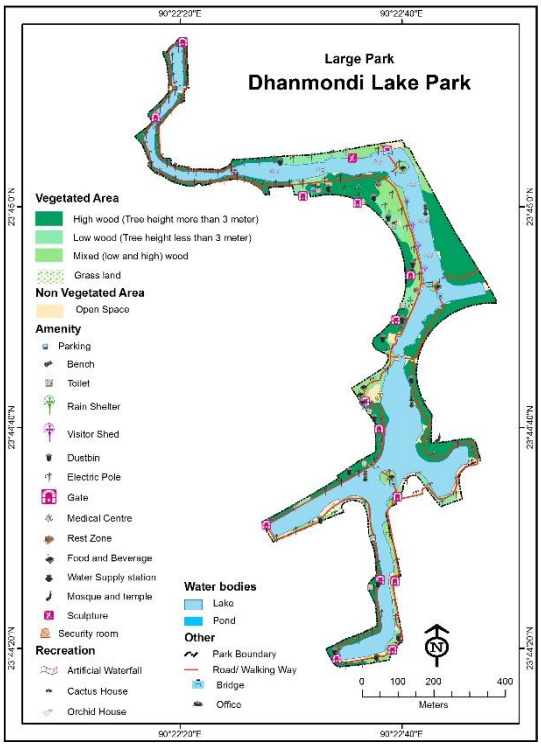


Figure 6.21 Physical environment of L
Source: Field work and observation, 2015; Quick Bird image, 2010

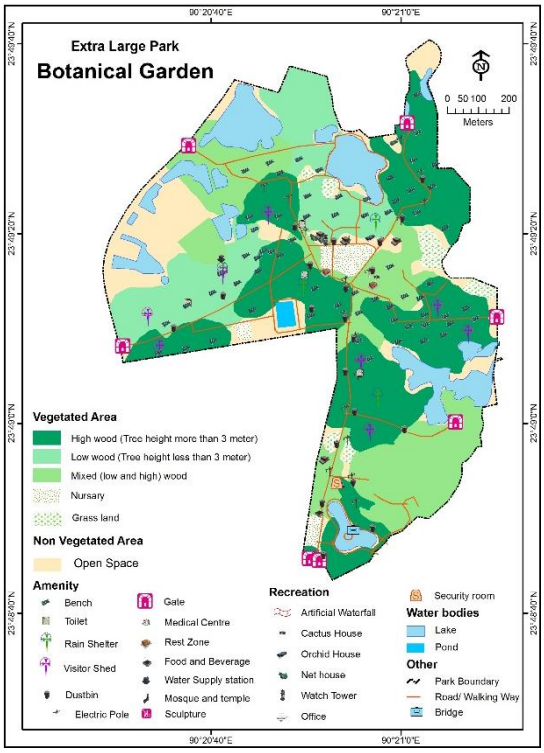


Figure 6.22 Physical environment of EL
Source: Field work and observation, 2015; Quick Bird image, 2010

From figure 6.21 and 6.22 showed that the condition of physical environment of large and extra-large size parks in Dhaka city. In large size park people visited monthly and attended different program inside the parks. In extra-large park people visited yearly and stay whole day inside the park. Mainly passive activates found in here. In both parks number of physical elements are high. Moreover inside the parks number of physical element is high than small and medium size parks. Some photos (Figure 6.23 - 6.30) of physical elements of large and extra-large parks given below:

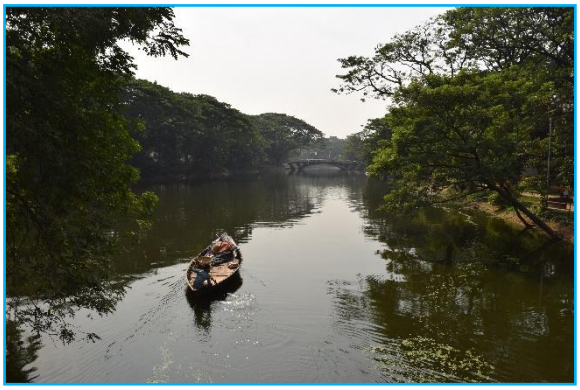


Figure 6.23 Large lake (L)
Taken by the author, November 2015

Figure 6.24 Open theater (L)
Taken by the author, November 2015

Figure 6.25 Parking (L)
Taken by the author, November 2015

Figure 6.26 Food and beverage (L)
Taken by the author, November 2015

Figure 6.27 Rest house (EL)
Taken by the author, November 2015

Figure 6.28 Watch tower (EL)
Taken by the author, November 2015

Figure 6.29 Nest house (EL)
Taken by the author, November 2015

Figure 6.30 Nursery (EL)
Taken by the author, November 2015

6.5 Social Environment

The social environment of parks is a key contributor to park use (Whyte 2000; McCormack et al. 2010). Sociable spaces, where people meet and have social interactions, are one of the key attributes of a successful public space. Sociability is a critical feature in urban public space success including in which public space provide gathering space that invites or allows social interaction among friends or strangers. These social environments foster a sense of belonging to a larger whole, for example, to a community, even if that community is only a momentary experience (Talen 2000; Whyte 1980).

To know the condition of social environment, in this research mainly used questionnaire survey of visitors. Same questionnaire used to collect data from each park but respondent number varies from park to park. Based on questionnaire, there is a list of elements of social environment are given below:

Table 6.3 List of elements of social environment

Factors	List of elements
Demographic characters	Age, Gender, Income Level, Occupation
Distance	From park to present address
Time	Time from park to present address Park staying time
Transportation system	Transport facilities Satisfaction on transport Transport cost
Visiting information	Purpose of visit Frequency of visit Visit before Visit again
Cost	Entry fee Staying cost
Other	Availability of food Quality of food Availability of drinking water Security system Face any trouble
Suggestion	Improve facilities Reduce trouble Improve environment

Source: Field work, 2015

Gender of visitors

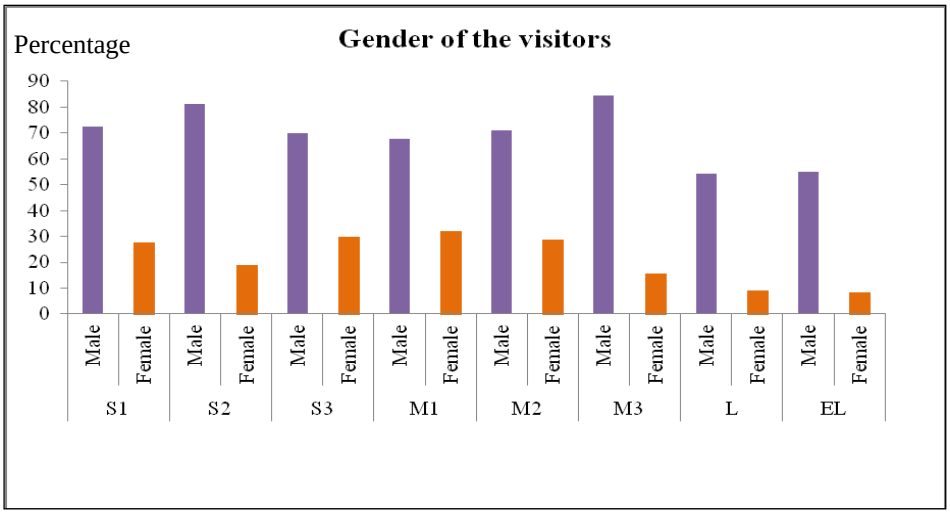


Figure 6.31 Gender of park's visitors

Source: Field work, 2015

According to figure 6.31 most of the parks visitors are male. The percentage of male visitors is more 50% than the female.

Age of visitors

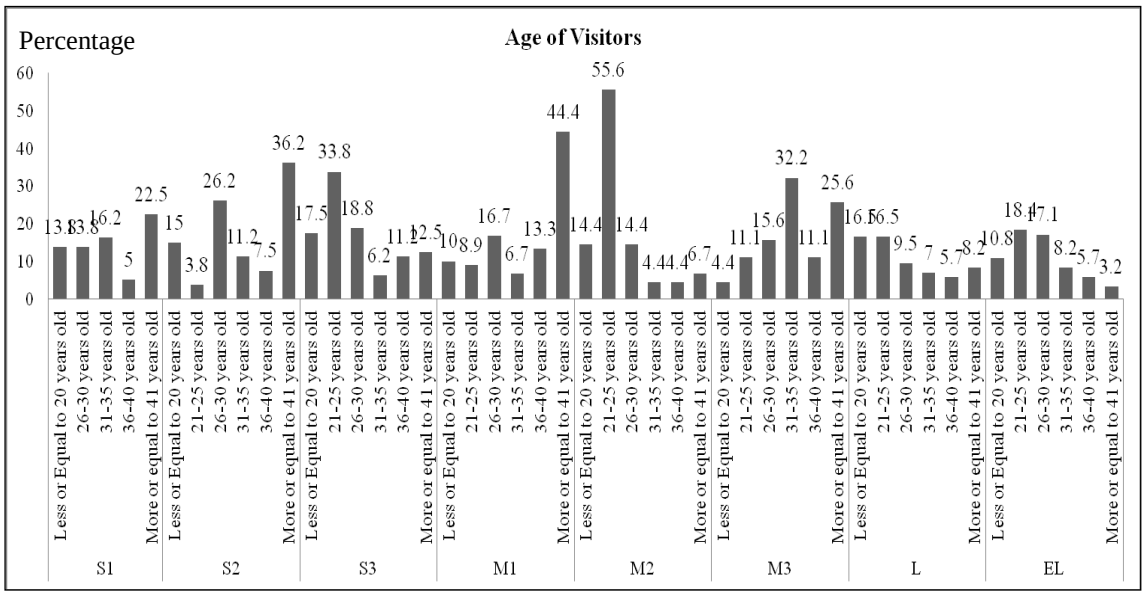


Figure 6.32 Age of park's visitors

Source: Field work, 2015

There is no regular pattern of visitor age in park users. But overall 20 - 35 aged population visited the parks in Dhaka city.

Occupation of visitos

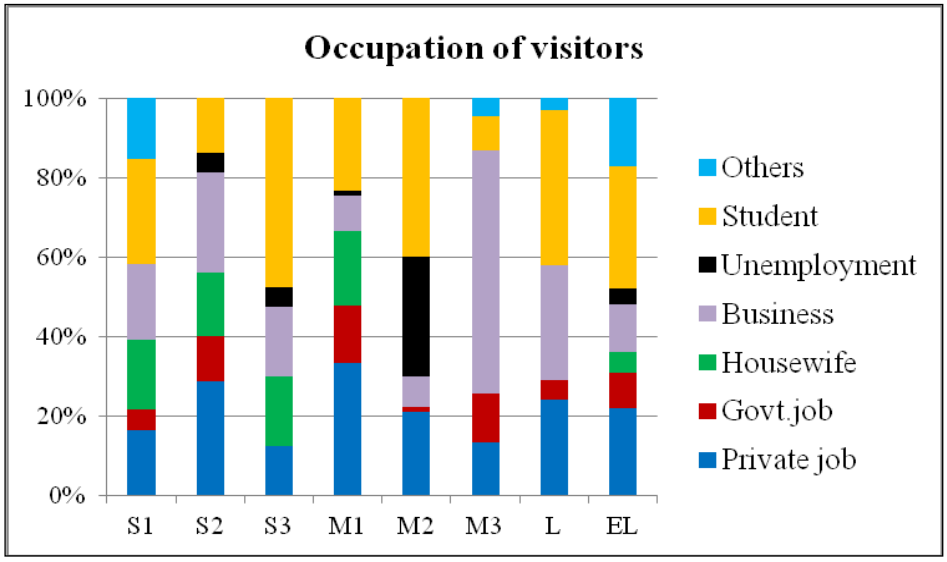


Figure 6.33 Occupation of visitors

Source: Field work, 2015

From figure 6.33 showed the occupation of visitors. From observation found that occupation mainly depend on parks location. Example, M3 park located in beside whole sale market place. So business person waiting inside the parks. Again, in S3 and M2 located near educational institution. So most of the visitors are student. In EL found mixed characters.

Satisfaction on Transport facilities

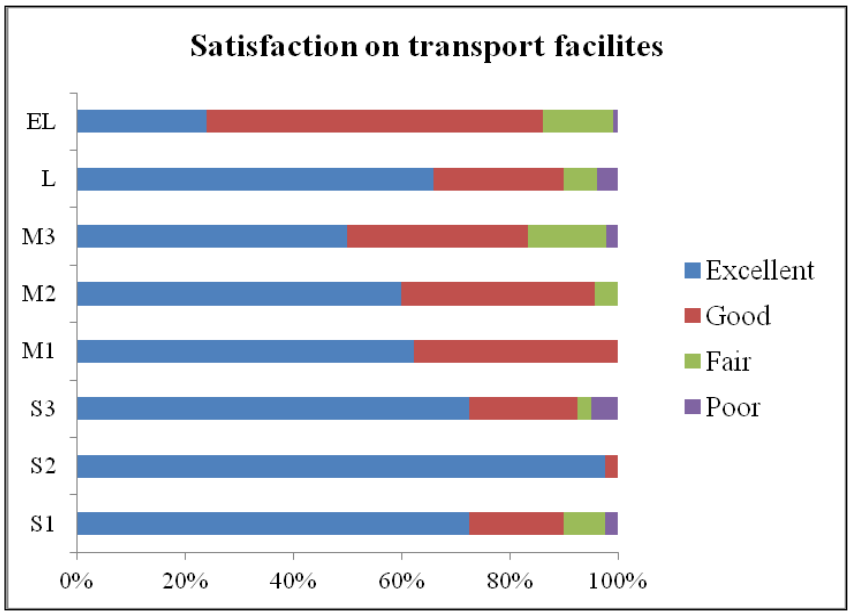


Figure 6.34 Satisfaction on trasport facilites

Source: Field work, 2015

Figure 6.34 showed satisfaction level on transport facilities. In small and medium size parks people were satisfied (excellent) on the transport facilities. But in large and extra-large parks because of long distance people face different trouble on transport facilities. So they selected good to fair.

Transport cost

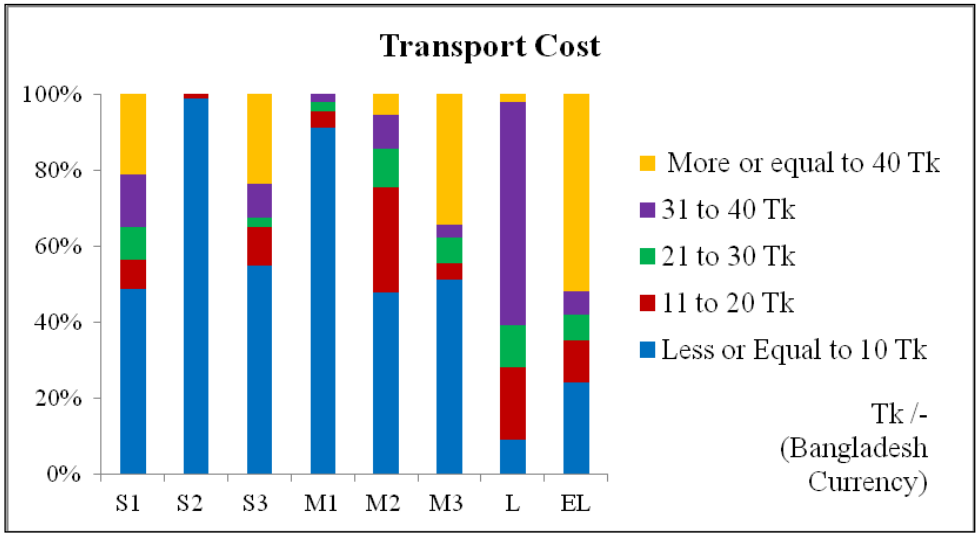


Figure 6.35 Transport cost with respondent

Source: Field work, 2015

From (Figure 6.35) found the idea about transport cost to visit the parks. In small and medium size parks transport cost is very (less than 10 /-, Bangladesh currency) because people visited from

near place. When the distance increase from home to park as well as transport cost also increase. As a result, in large and extra-large parks people need to pay more money for transport cost.

Staying time inside the parks

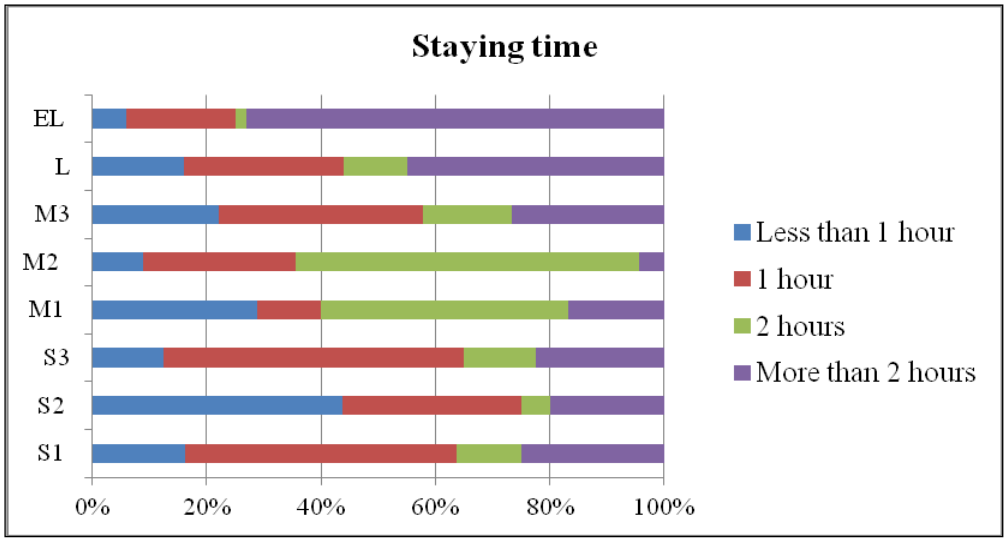


Figure 6.36 Staying time inside the parks

Source: Field work, 2015

Figure 6.36 showed the staying time inside the parks. In small size park people visited (Chapter 4) daily and stayed less than 1 hour. In medium size parks more than 1 hour. Moreover in large and extra-large parks people visited (Chapter 4) monthly and yearly. So they stayed long time inside the parks.

Staying Cost inside the parks

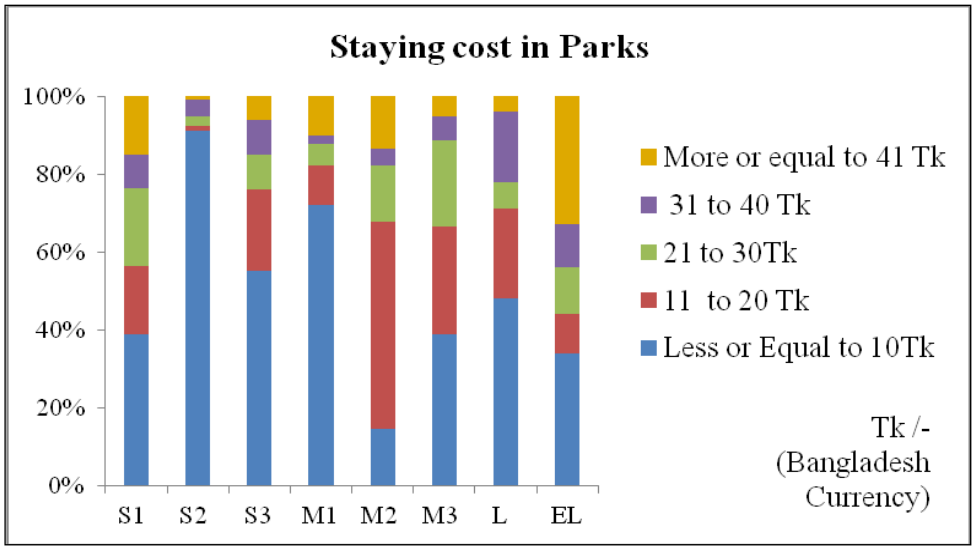


Figure 6.37 Staying cost of respondents

Source: Field work, 2015

From figure 6.37 get the idea about staying cost inside the park. In small park people stay short time and expenditure also low. But when they stayed more time in large and extra-large park they expenditure also increased.

Face any trouble

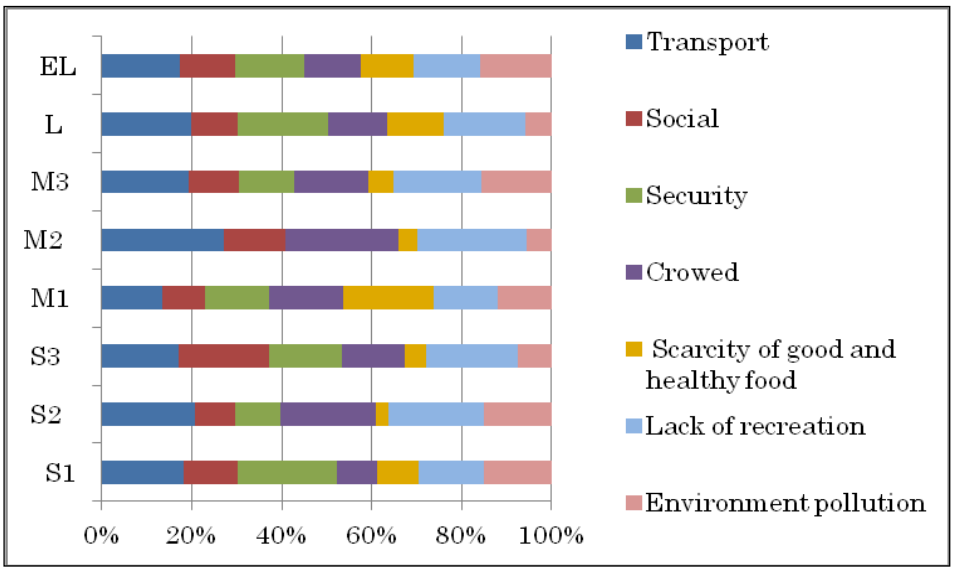


Figure 6.38 Face any trouble with respondent

Source: Field work, 2015

From Figure 6.38 showed that type of trouble differ in each type of park. In small size park visitor faced more crowded and lack of recreation. Again in medium size park transport problem, more crowded, transport problem and lack of recreation facilities. In large and extra-large park people mainly faced security problem and transport problem.

Security condition inside parks

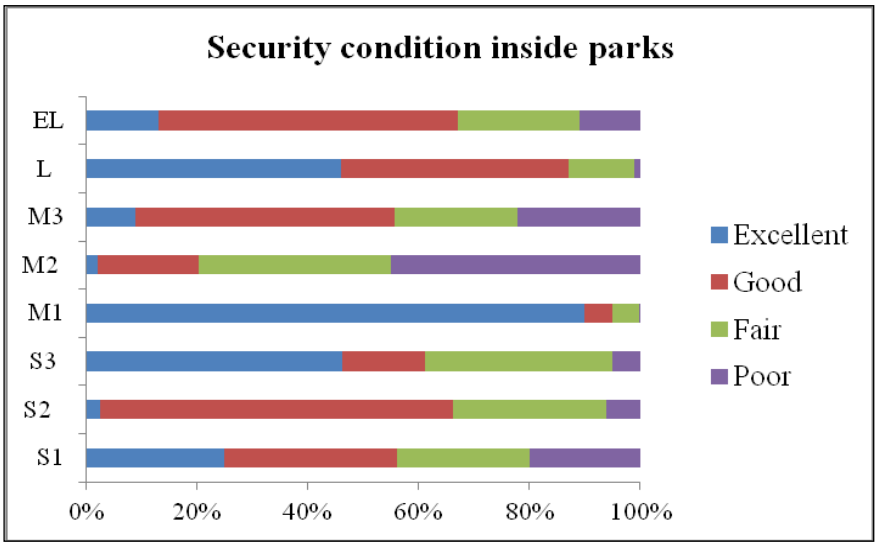


Figure 6.39 Security condition inside parks

Source: Field work, 2015

Figure 6.39 showed the security condition inside parks. Most of the park got comments good in security system. Only Gulshan lake park most of the respondent were happy to the security system (excellent). It's located beside the diplomacy zone.

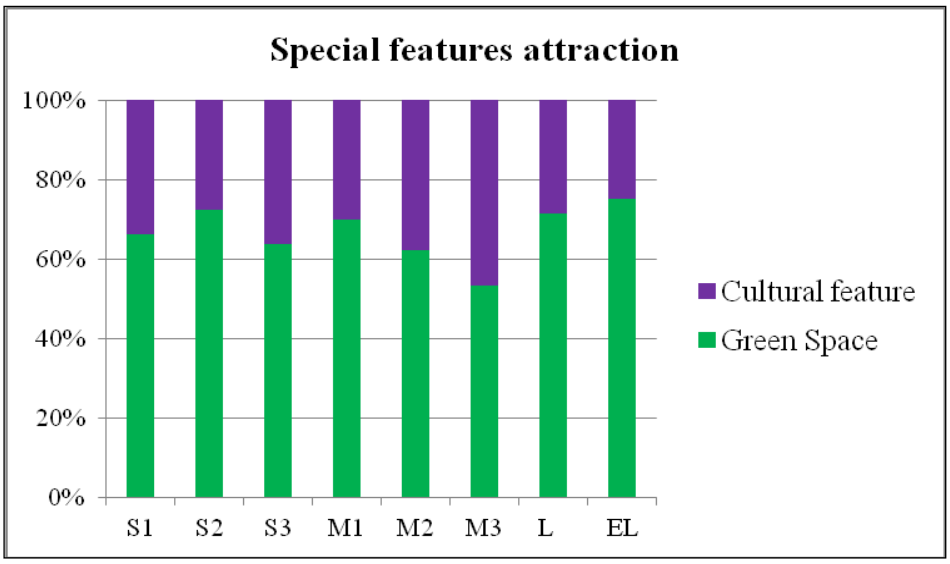


Figure 6.40 Special features attraction with respondent

Source: Field work, 2015

From Figure 6.40, most of the parks people visit for the attraction of green space than the cultural features. So green space is most important for a park.

6.6 Relation between distance and other element

Distance is an important factor for user of parks. Its control some other variables. Thus, in this research tried to find out the relation between distances with other variables. To identify the relationship chi square test and regression was conducted by distance with other variables.

Other variables are –

- Transportation system
- Satisfaction on transportation system
- Transportation cost
- Gender of respondent
- Age of respondent

Before used distance data, its categories into some classes (Appendix C; table 6)

Distance with transport system:

Table 6.4 Transportation system with distance

Pearson Chi-Square Test			
Parks symbol	Value	df	P-Value
S1	22.433[a]	9	.008
S2	119.488[a]	6	.000
S3	28.858[a]	9	.001
M1	46.169[a]	4	.000
M2	38.386[a]	15	.001
M3	46.558[a]	12	.000
L	71.048[a]	9	.000
EL	50.610[a]	15	.000

Source: Field work, 2015

In here all P values are less than 0.05. So we may reject the null hypothesis. That means there is a statistical significant association between distance and transportation system. From figure 6.41 it showed that when people visited shot distance park they used their own foot. When the distance gradually increased they used rickshaw, auto rickshaw etc. for long distance park they used bus. So transport system depends on distance of park.

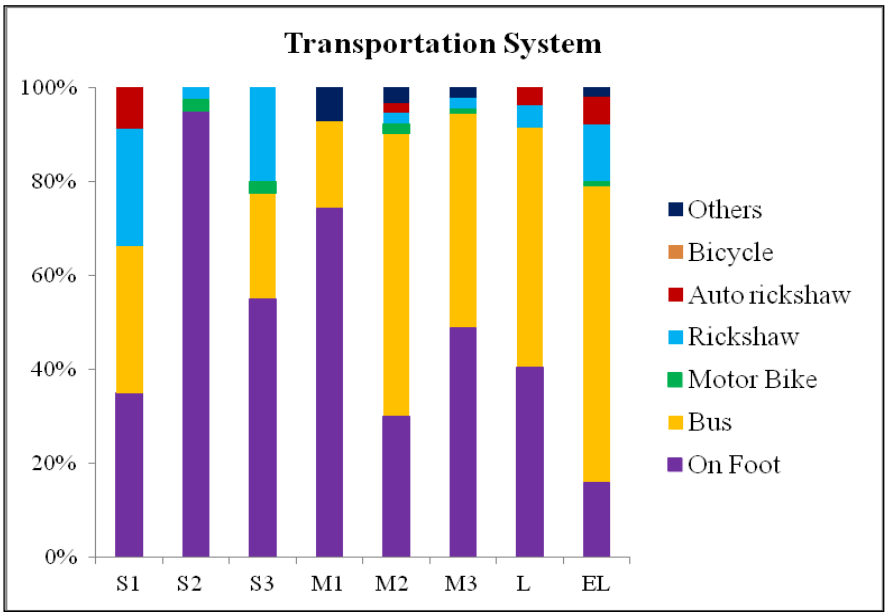


Figure 6.41 Transport system used to visit parks

Source: Field work, 2015

Distance with satisfaction on transportation system:

Table 6.5 Satisfaction on transportation system with distance

Pearson Chi-Square Test			
Parks symbol	**Value**	**df**	**P-Value**
S1	12.717[a]	12	.390
S2	.108[a]	3	.991
S3	13.368[a]	9	.430
M1	1.472[a]	2	.479
M2	5.820[a]	9	.118
M3	8.572[a]	6	.199
L	.638[a]	12	.847
EL	8.874[a]	9	.449

Source: Field work, 2015

In here all P values are more than 0.05. So we may reject the alternative hypothesis and accept the null hypothesis. That means there is no statistical significant association between distance and satisfaction on transport system.

Distance with transport cost:

Table 6.6 Transportation cost with distance

Pearson Chi-Square Test			
Parks symbol	**Value**	**df**	**P-Value**
S1	24.031[a]	12	.020
S2	109.3[a]	3	.000

S3	31.699[a]	12	.002
M1	110.436[a]	6	.000
M2	30.094[a]	12	.003
M3	37.563[a]	12	.000
L	81.819[a]	12	.000
EL	54.414[a]	12	.000

Source: Field work, 2015

In here all P values are less than 0.05. So we may reject the null hypothesis. That means there is a statistical significant association between distance and transportation cost.

To prove the relation between distance and transportation cost further regression analysis had done and result given below:

Table 6.7 Model Summary of regression of distance and transportation cost

Symbol of parks	R	R Square	Adjusted R Square	Std. Error of the Estimate
S1	.061[a]	.004	-.009	25.85474
S2	.026[a]	.001	-.012	2.24958
S3	.283[a]	.080	.068	33.12186
M1	.653[a]	.427	.420	6.37912
M2	.370[a]	.137	.127	13.63429
M3	.842[a]	.709	.706	64.08911
L	.541[a]	.293	.285	90.19763
EL	.252[a]	.064	.054	137.77550

a. Predictors: (Constant), Q1: Distance from your present address (km)

Source: Field work, 2015

From Table 6.7 showed that R value is simple correlation value between distance and transport cost. Here all parks R value are positive, its means distance and transport cost are positively correlated.

Table 6.8 Coefficients[a] analysis of distance and transportation cost

Symbol of parks	Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
S1	(Constant)	24.574	3.514		6.993	.000
	Q1:Distance from your present address(km)	.247	.454	.061	.544	.588
S2	(Constant)	.280	.283		.990	.325
	Q1:Distance from your present address(km)	.033	.142	.026	.232	.818
S3	(Constant)	18.686	4.481		4.170	.000
	Q1:Distance from your present address(km)	1.397	.537	.283	2.601	.011
M1	(Constant)	1.867	.898		2.080	.040
	Q1:Distance from your present address(km)	4.352	.538	.653	8.091	.000
M2	(Constant)	10.280	2.174		4.728	.000
	Q1:Distance from your present address(km)	1.488	.398	.370	3.737	.000
M3	(Constant)	22.015	7.225		3.047	.003
	Q1:Distance from your present address(km)	1.279	.087	.842	14.652	.000

L	(Constant)	16.979	9.496		1.788	.077
	Q1:Distance from your present address(km)	1.673	.263	.541	6.367	.000
EL	(Constant)	73.851	15.196		4.860	.000
	Q1:Distance from your present address(km)	1.169	.454	.252	2.578	.011

a. Dependent Variable: Transport cost (Tk)

Source: Field work, 2015

From simple linear regression,

$$y = \beta_o + \beta_1 x + \varepsilon$$

Here, **y** = Dependent variable (Transport cost, TK)
x = Independent variable (Distance, Km)
β_o = Constant
β_1 = Regression
ε = Random error term

So from Table 6.8 all parks constant values are positive. Example, Anwara park,

Transport cost = 10.280 + 1.488 Distance

That means if one unit of distance increase, transport cost will be increase by 1.488 unit. That means if distance increase transport cost also increase.

Distance with gender of respondents:

Table 6.9 Gender of respondent with distance

Pearson Chi-Square Test			
Park's symbol	**Value**	**df**	**P-Value**
S1	5.109[a]	3	.164
S2	.972[a]	3	.808
S3	2.455[a]	3	.483
M1	2.239[a]	2	.327
M2	2.704[a]	3	.440
M3	.628[a]	3	.890
L	7.099[a]	3	.701
EL	5.971[a]	3	.113

Source: Field work, 2015

In here all P values are more than 0.05. So we may reject the alternative hypothesis and accept the null hypothesis. That means there is no statistical significant association between distance and gender of respondent.

Distance with age of respondents:

Table 6.10 Age of respondent with distance

Pearson Chi-Square Test			
Park's symbol	**Value**	**df**	**P-Value**
S1	28.486[a]	15	.019
S2	32.584[a]	15	.003
S3	29.459[a]	15	.014
M1	38.607[a]	10	.000
M2	34.103[a]	15	.003
M3	30.465[a]	15	.017

L	34.065[a]	15	.003
EL	28.606[a]	15	.041

Source: Field work, 2015

In here all P values are less than 0.05. So we may reject the null hypothesis. That means there is a statistical significant association between distance and age of respondent.

To prove the relation between distance and age of respondent further regression analysis had done and result given below:

Table 6.11 Model Summary of regression of distance and age of respondent

Name of parks	R	R Square	Adjusted R Square	Std. Error of the Estimate
Uttara 7	.131[a]	.017	.004	6.39970
Pantha kunjo	.053[a]	.003	-.010	1.79091
Bahadur sha	.076[a]	.006	-.007	6.96515
Gulshan lake	.211[a]	.045	.034	1.23562
Anwara	.101[a]	.010	-.001	3.63170
Osmani uddan	.235[a]	.055	.045	76.06912
Dhanmondi lake	.125[a]	.016	.006	34.40236
Botanical garden	.147[a]	.021	.011	30.35652

a. Predictors: (Constant), Age

Source: Field work, 2015

From Table 6.11 showed that R value is simple correlation value between distance and age of respondent. Here all parks R value are positive, its means distance and age are positively correlated.

6.7 Urban parks systems

The current roles of urban parks systems to further define the roles and to demonstrate the benefits of spaces have on individual and community wellbeing. The collection of park spaces within an urban municipality is defined as an urban parks system. Urban parks systems play a critical role in achieving the objectives of the following public sectors: Culture; recreation; community development; heritage; economic development; health and wellness; natural environment; education; and transportation (Ellis and Schwartz 2016).[15]

Analysis of parks system

Hawthorn et al. 2000, management effectiveness

Nicholls 2001, accessibility and equity by GIS

Harnik et al. 2014, economic value of parks

Ibes 2014, holistic policy, planning, and management of parks

[15] See more in https://www.worldurbanparks.org/images/Documents/The-Roles-of-an-Urban-Parks-System.pdf

In this research work integrate the following relationship:

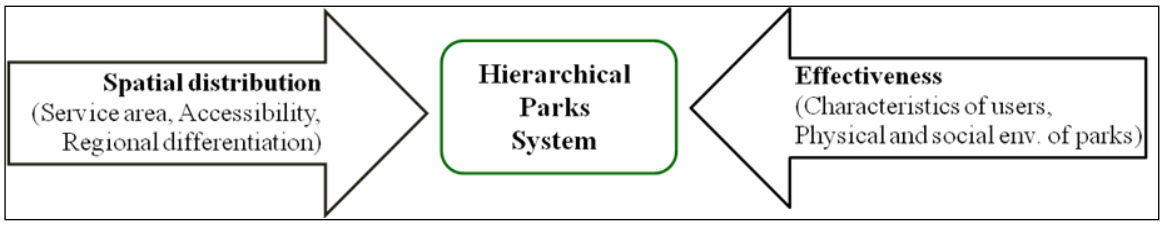


Figure 6.42 Integrated spatial distribution and effectiveness of urban parks by hierarchical parks system

6.7.1 Areal functional model of parks in Dhaka city

Areal functional organization may appear to be a somewhat cumbersome term. The word 'areal' is used since geographers study phenomena in the context of their areal distribution. The word 'functional' is used because the different yet associated purposes or functions of human establishments compose in the aggregate the different functional patterns of human activity which make generalization about society possible in the context of areal distribution. The word 'organization' is used because human activity is interdependent and interconnected in area. People in establishments through their actions interconnecting them with other people in other establishments create larger areal units of human organization than the establishments in which they focus their lives (Philbrick 1957).

Philbrick, A. K. 1957 first described this model in his paper. After many scholar used this model to describe the functional area of different purpose.

Satio, I. 1984, used this model in his paper to describe the dairy regions in Tokyo Metropolitan area.

Visitors pattern of case study parks in Dhaka city given below:

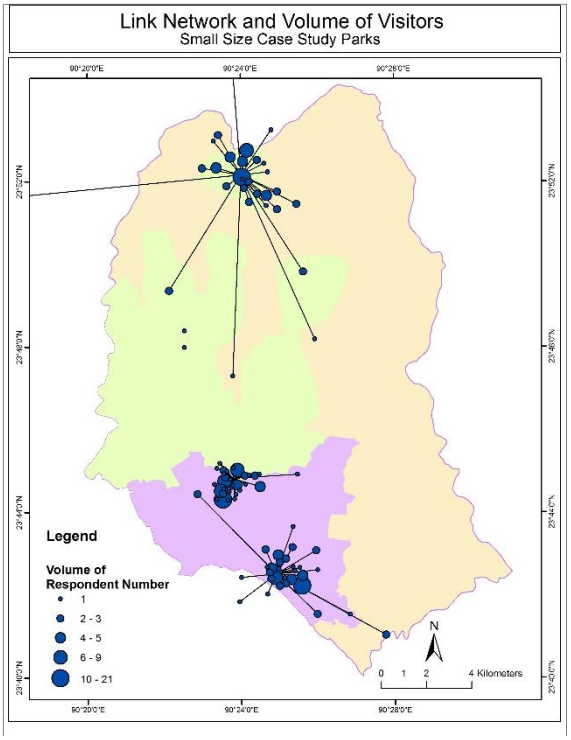


Figure 6.43 Small size parks visitor pattern
Source: Field work, 2015

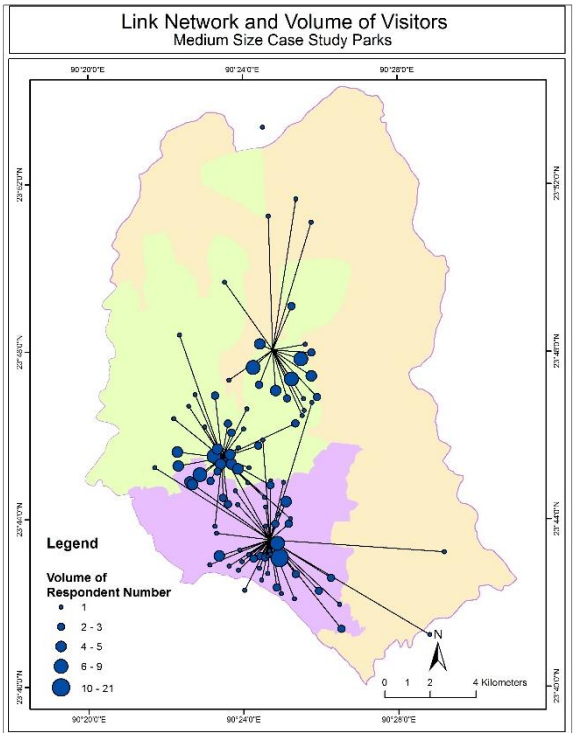


Figure 6.44 Medium size parks visitor pattern
Source: Field work, 2015

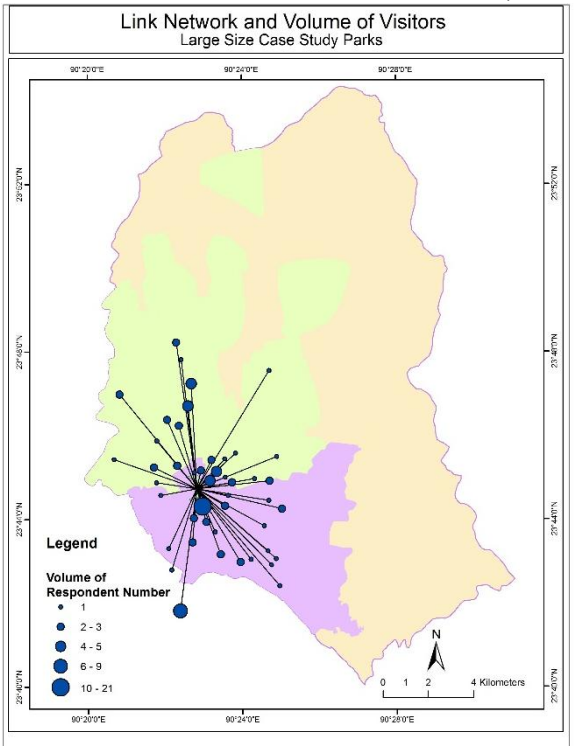


Figure 6.45: large size parks visitor pattern
Source: Field work, 2015

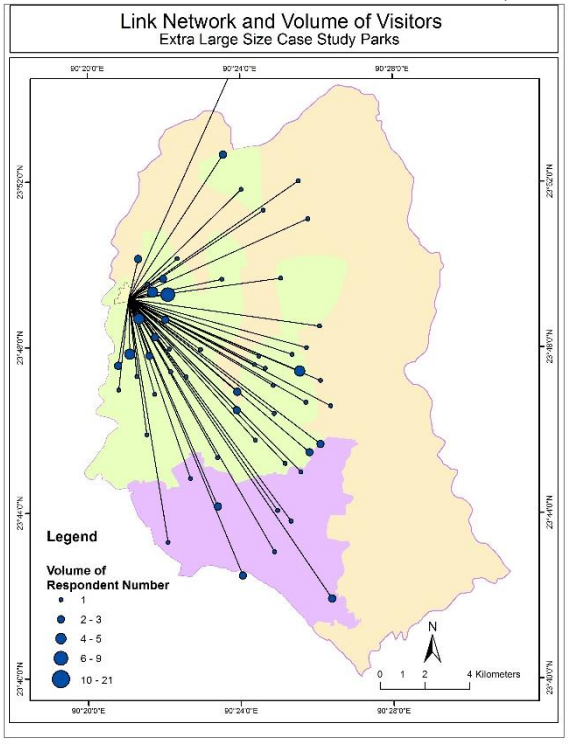


Figure 6.46 Extra-large size parks visitor pattern
Source: Field work, 2015

From maps 6.43 to 6.46, showed park size and distance influence visitor number and pattern. Based on Areal Functional Organization model, use of parks in Dhaka city described below:

First Order Areas of Functional Organization - Small size parks: The focus of each individual establishment is the core of a first-order area of functional organization. In the case of

the small size parks shown in Figure 6.42, it has already been noted small park is the nucleus; and because of its location it is the primary focus. Small size parks situated very near to people living place (residents). So in here accessibility is high and easy. Moreover people visited this park daily basis.

Second Order Areas of Functional Organization - Medium size parks: Each boundary is a generalization of part of a first-order area of functional organization for a particular establishment. All first order service area overlapping, plus an additional finite number of other first-order functional areas not shown, define an area for which Boswell enterprise as a whole is the primary focus. This is the internal portion of a second-order area of functional organization (Philbrick 1957). In the case of the medium size parks shown in Figure 6.43, more people come from further distance than the small size parks. Moreover, some parts also overlapping with first-order functional area. In medium size parks people's accessibility is medium. Again people visited this park daily to weekly.

Third Order Areas of Functional Organization (the Cluster of Focal Places) - Large size parks: One distinguishing mark of third-order areas of functional organization is the integration of a contiguous cluster of second-order areas of organization into a larger areal unit (Philbrick 1957). In here large size parks shown (Figure 6.44) as third order central establishment. Large size park situated in city center and serve both part of city. Because of the location, it should be easy to access. Although most of the visitor come from far place and once a month to attend some program inside the park. Only nearby people use it daily purpose.

Fourth Order Areas of Functional Organization (the Cluster of Clusters of Focal Places) - Extra-large size parks: the higher orders of areal organization, it is still imperative for the each individual areal unit of functional organization is composed of the sum of all of its lower-ordered components. In short, a fourth-order area of function makes a given city the center of - all organization, the focus of a cluster of clusters of focal places (Philbrick 1957). In here extra-large size parks shown (Figure 6.45) as fourth order central establishment. Large size park situated in city boundary and serve whole city. Because of the location, it is not easy to visit the park. Most of the visitor come from far place once a year and stayed all day long inside the park. After analysis all maps and data, areal functional organization model of parks in Dhaka city given below,

Every order of areal functional organization possesses the characteristics and interconnections of all its lower-ordered components. That means, all second-order focal places have cores with which first-order establishments are interconnected; all third-order centers of clusters of focal places have cores upon which second-order communities, as well as individual first-order establishments, focus (Philbrick 1957).

Technique used in GIS to draw functional area

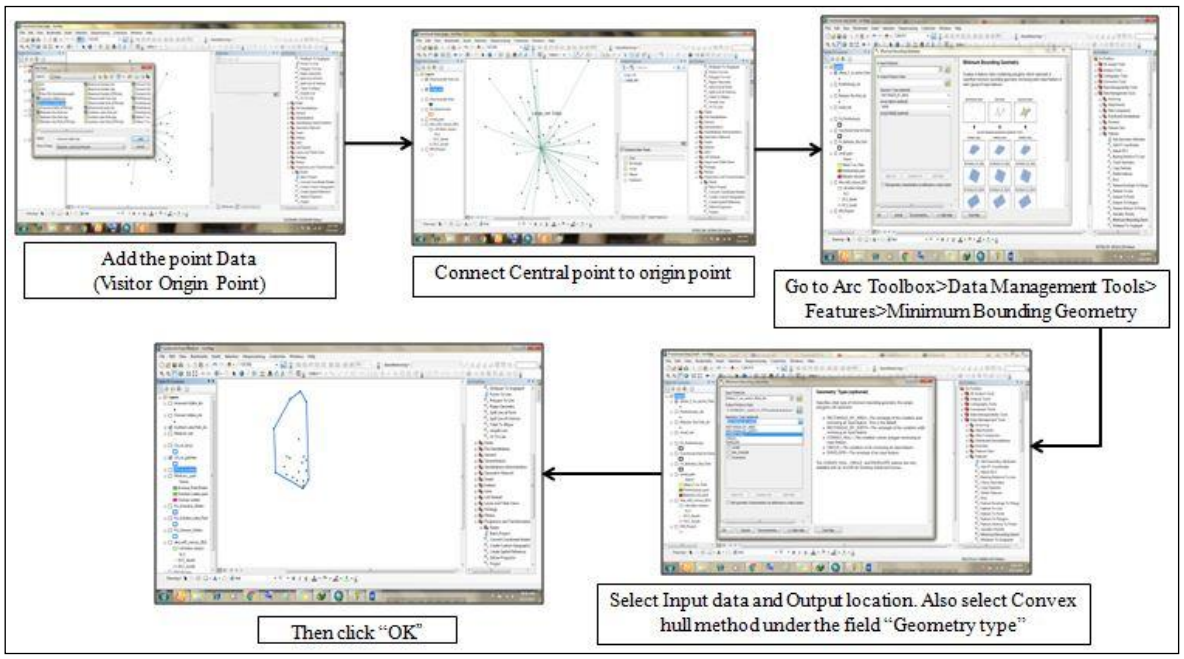
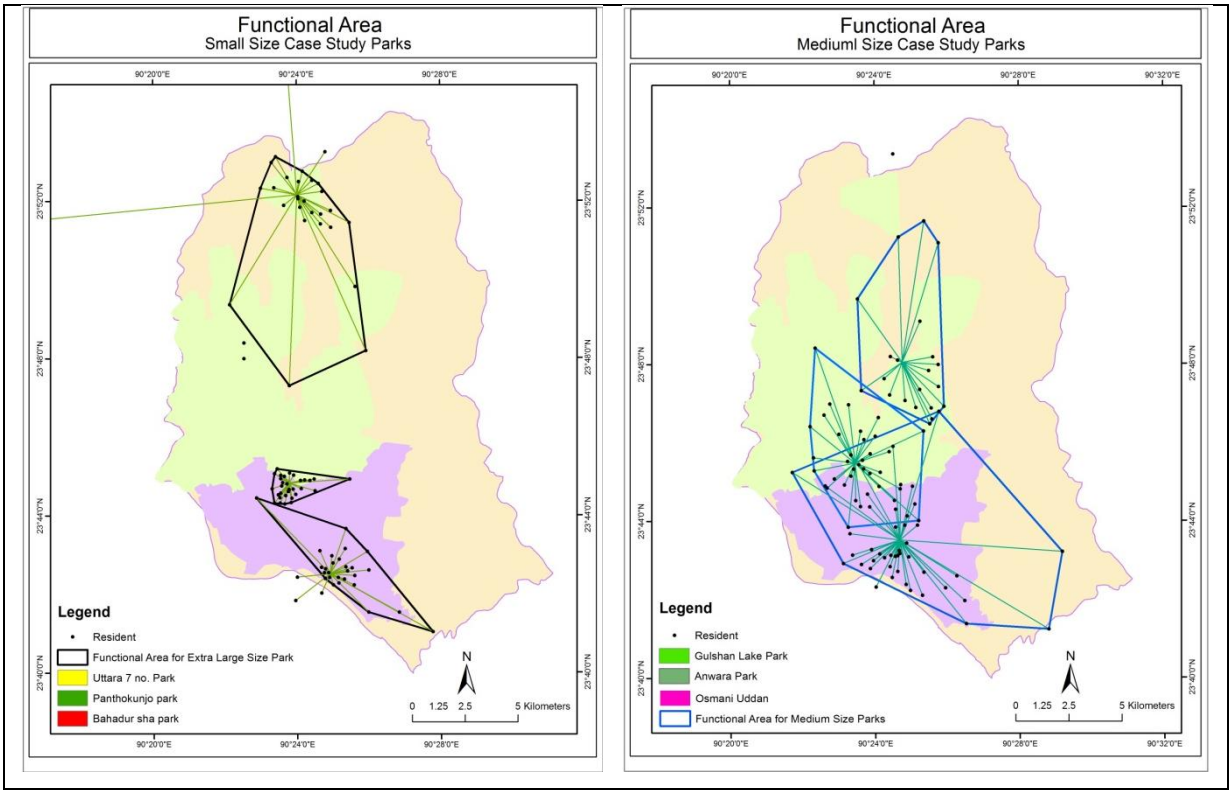
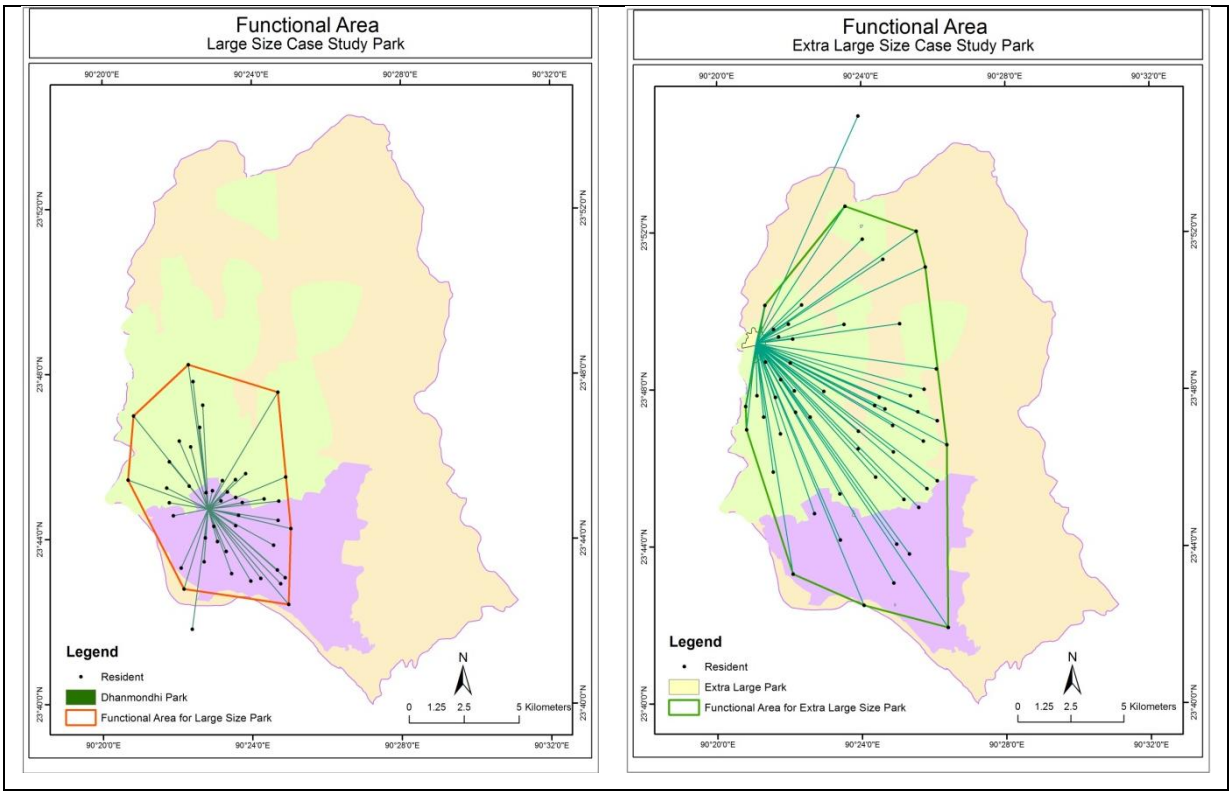


Figure 6.47 Technique used in GIS to draw functional area (Convex Hull method)

Based on the visitor origin and parks location, functional area of different case study parks in Dhaka city given below:

Table 6.12 Functional area of different case study parks in Dhaka city





Source: Field work, 2015

6.7.2 Proposed areal functional organization model of parks system

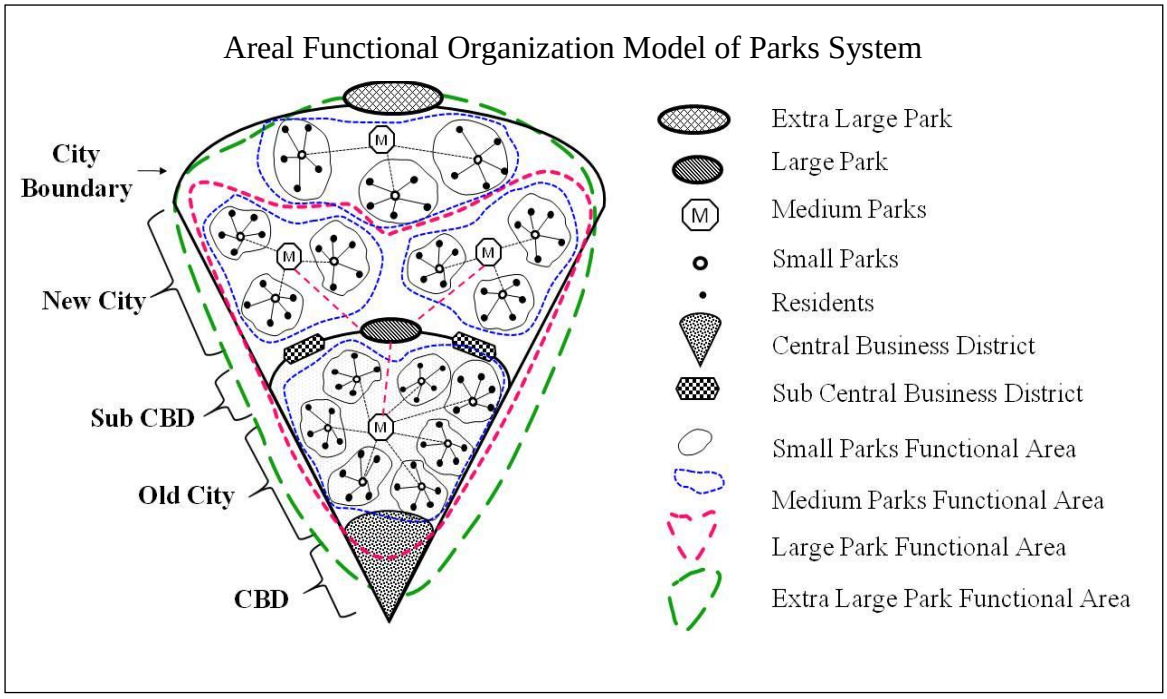


Figure 6.48 Areal Functional Organization Model of Parks System

After analysis all data and previous model, it found that there is a relationship between spatial distribution of park (Physical aspects) and areal function of parks (Social aspects). In chapter four proposed a spatial distribution model of parks. Base on this model, in old city small size park is more than other size parks and all parks are scatterdly distributed. So in old part of city dominant

by first order functional area. Again in new city, both small and medium size parks are good in number and well planned. So in here first and second order functional area overlapping. In large size park situated in city center and it's mainly covered the center area of both parts of city. And according to functional model, it is third order which cluster the focal point. Moreover, the extra-large park which situated in city boundary, largely served the new part of city than the older part. It's fourth order functional area which cluster all focal point of the parks.

Table 6.13 The areal functional organization of use of parks

Areal unit in order	Central establishment	Functions of Central establishment	Functional area
I - •	Residents	People live	
II - S	Small size parks	Daily use and high accessibility	I
III - M	Medium size parks	Weekly use and medium accessibility	II
IV - L	Large size parks	Monthly use and low accessibility	III
V - EL	Extra-large size parks	Yearly use and very low accessibility	IV

The hierarchy of parks depends on size and number of parks. Small size parks are highest in number and it's near to residents. People used the park as every day for various purposes and accessibility is high in here. In medium size parks, people visited daily to week and parks number is lower than small size parks. Moreover, in large size people visited to attend the program and accessibility is low in here. People mainly visited large park in monthly. Again for extra-large park, accessibility is very low because of its location. Besides this only one extra-large park in the city also influence the visitors. And in this park, people visited yearly.

6.7.3 The Hierarchical Structure of parks system in Dhaka city

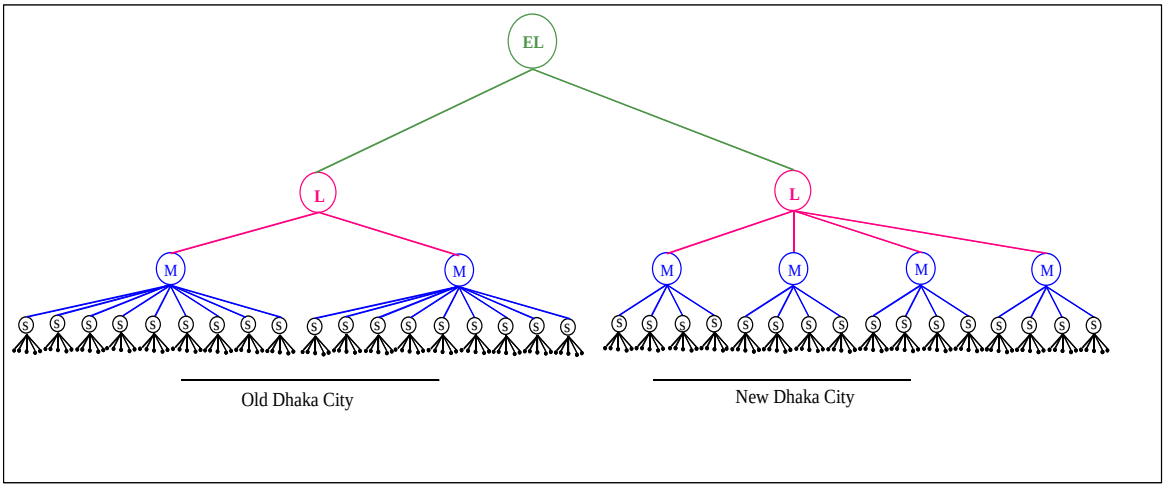


Figure 6.49 Hierarchy of parks system in Dhaka city

Functional areas of the central establishments consist of several order mentioned above. They are organized in the manner that a higher certain establishment includes the parks structurally of the lower establishments. Therefore, they can be arranged as in based on the concepts of areal functional organization. Constructing them along the park systems, hierarchical structure like a pyramid is observed as in Figure 6.49.

In old Dhaka dominant by small size parks that means first order functional area and in new Dhaka dominant by both first and second order functional areas.

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Chapter Seven
Conclusion

7.1 General description

Urban parks play a very important role in neighborhood life and must provide opportunities for comfort, relaxation, active and passive engagement, discovery and mystery to create more livable and stimulating places for urban people (Carmona 2007). The management of urban parks has been shown to being of real importance for the sustainability of large cities (Chiesura 2003; Brander and Koetse 2011). The issue is of even large interest for expending cities whose population increases at high rates and decreases green spaces like in developing countries. Urban parks constitute green spaces managed largely for recreational purposes and form the largest proportion of publicly available green space for urban dwellers (Oleyar et al. 2008). Indeed, for many poor city residents in developing countries, urban green spaces may provide the only reference to "nature" that they will ever experience, providing important social and psychological functions that substantially improve the quality of city life ((Nagendra et al. 2010). In this research work tried to make a relationship between spatial distribution of parks and effectiveness (use of parks) by a parks system which is suitable for developing countries.

In this research urban parks were chosen from Dhaka city, which is good example of city of developing countries. All common characters of developing countries are found in here. Over population, limitation of green spaces, land use change and encroachment, lack of recreation facilities are existing in Dhaka city. So it's really challenging to fulfill the demand of urban dwellers by limited number of urban parks. After analysis of images through 20 years interval, give a clear concept about rapid change of green space in Dhaka city. Greeneries of the city decrease rapidly and on the other hand, built-up area increase very fast. Again, NDVI analysis also describe the vegetation condition of last 20 years. Moreover, Parks authorities and regulations also important to analysis the parks system. But in Dhaka parks rules and regulations are very old and its need to update-to-date. Again, different authority manages urban parks but there is a lack of coordination among these authorities.

To analysis the distribution of parks, the first step to know the classification of parks based on their physical size. The classification of urban parks is an important step in focusing the planning, development and management to balancing public recreation opportunities and resource integrity to a city. Through park classification, the dominant character and principal values of an area are defined and use and management policies are established. There are many classification system which define by different international organizations. But most of them only suitable for developed countries. But in the cities of developing countries, where size of parks are low, limited parks

number and over population, need to classify based on their physical size and regional characteristics. According to physical size, parks of Dhaka city is classified into four types: Small, Medium, Large and Extra Large parks. The observed result showed that characteristics of urban parks varies with their size. Small size parks people visit daily purpose and their accessibility level is high. In medium size parks people visit daily to weekly and accessibility is moderate. Moreover in large size park people visit occasionally signify once a month and accessibility level is moderate. And in extra-large parks people visit yearly as for whole day staying and accessibility level is low in here. Furthermore, service area of parks are different from international standard. Because of limitation of number and size of parks, people come from far place to visit the parks and its cover a large area as service area of parks.

On the other hand, regional differences another important aspect which influence the characteristics of parks. Most of the developing countries, morphology of urban form are dualism, the traditional or pre-colonial and the modern or post-colonial. These two urban structure also control the distribution of parks. In Dhaka city also found two types of urban structure: Old Dhaka and New Dhaka. In old Dhaka parks has good quantity of vegetated area but there has a maintenance problem. And also different recreational facilities absent in here. In New Dhaka parks are well organized and maintenance than the other parts of the city. In old part of the city, small size parks are more than other size parks. On the other hands, in new city different size parks are well distributed. Again, large parks located in city center beside the sub CBD (Central Business District) and only one extra-large park located in city boundary, far from city center. This parks distribution are common some of developing countries. Based on this distribution pattern, spatial distribution model of parks proposed for developing countries.

To analysis the effectiveness of parks, the first step to identify the relationship of urban parks with physical and social environment. Both physical and social environment are important for urban parks. People visit parks based on the environmental condition of parks. Again, size of parks also control the characteristics of visitors pattern. Physical environment depends on size of parks. When the park size increase, elements of physical environment also increase. Social environment also influence visitors pattern. In small size parks elements of physical and social environment are lower than the large size parks. On the other hand, in extra-large size park all element are available in here. Again, based on social environment use of parks also influence by some social factors, distance from home to park, transport cost and facilities etc. So, size of parks control both physical and social environment. And characteristics of visitors of parks influence by both physical and social environment.

In this research, firstly described the distribution of parks of Dhaka city based on spatial pattern. Secondly, identified effectiveness of parks based on characteristic of visitors. So finally tried to interaction spatial distribution with characteristic of visitors by hierarchical parks system of

Dhaka city. This hierarchical parks system described based on areal functional organization model. It's a new approach in urban geography.

Urban park is a important element of recreation facilities of urban people. It is easy to access for all level and aged population. So as a developing county, like Bangladesh where over population and lack of recreation facilities, urban park play a important to the society. Moreover, naturally its balance the environment of the city.

7.2 Conclusion

Most of the areas of Dhaka city are so unplanned that there is very little scope for creating a new park or open space to meet the needs of the growing population. In this case, it is inevitable that the existing parks need to be improved or developed. But unfortunately till now no initiatives have been taken to improve the parks of Dhaka city (Alam 2012). Allocating new parks in Dhaka city is very complex due to land scarcity. Enhancement of this condition of the existing parks seem to be the only the viable solution to meet the needs of the citizens. But to improve the quality of existing parks it is necessary to identify which park has lacking and develops new parks system. So that resources can be efficiently owed to develop the quality of parks of Dhaka. In this research tried to find out the importance and efficiency of parks in urban area. So analyzed information and model will be helpful to urban planner for the future perdition and planning.

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Chapter Seven

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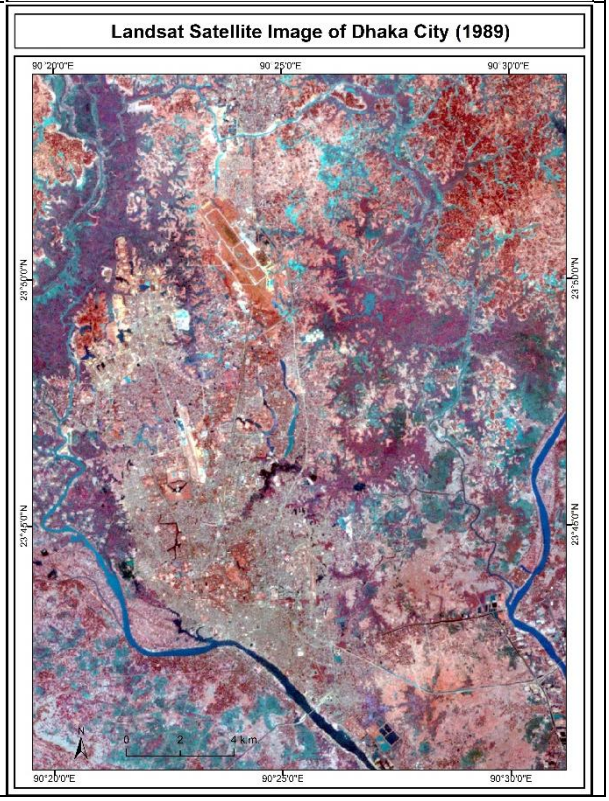
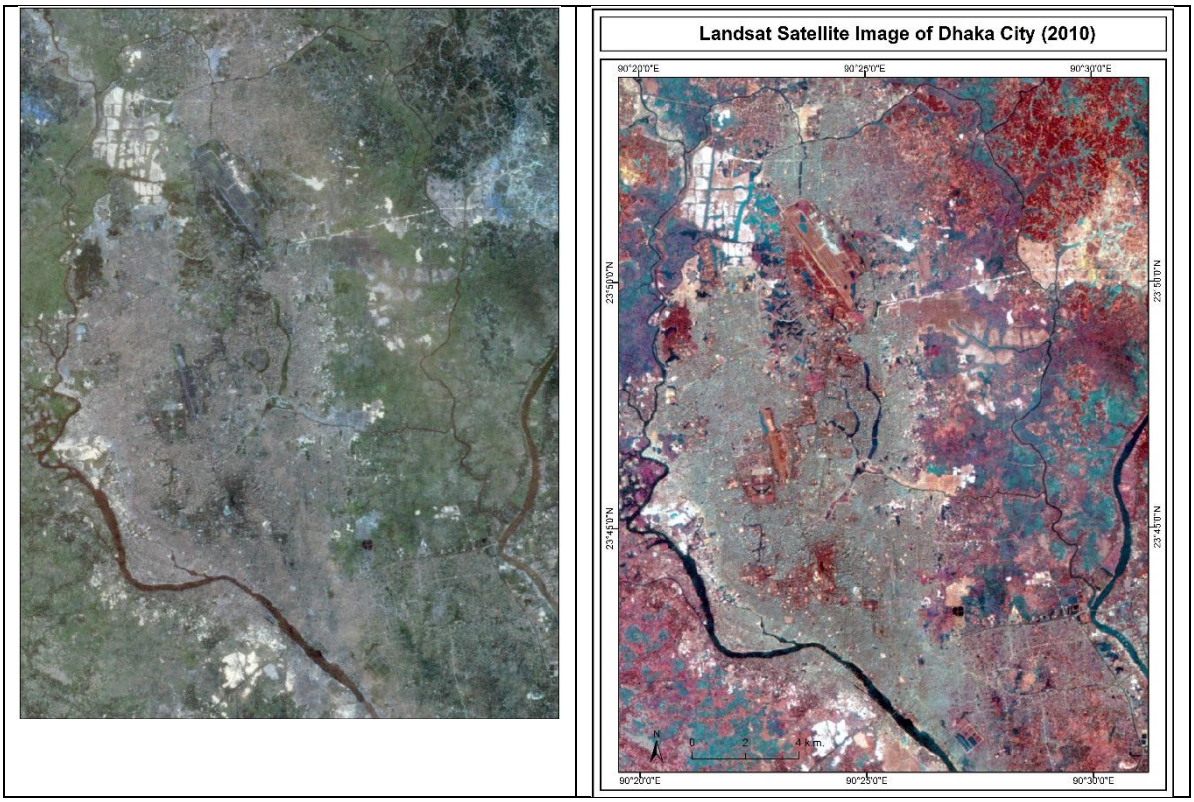
Appendix-A
Images

Table 1. LandSAT images of Dhaka city





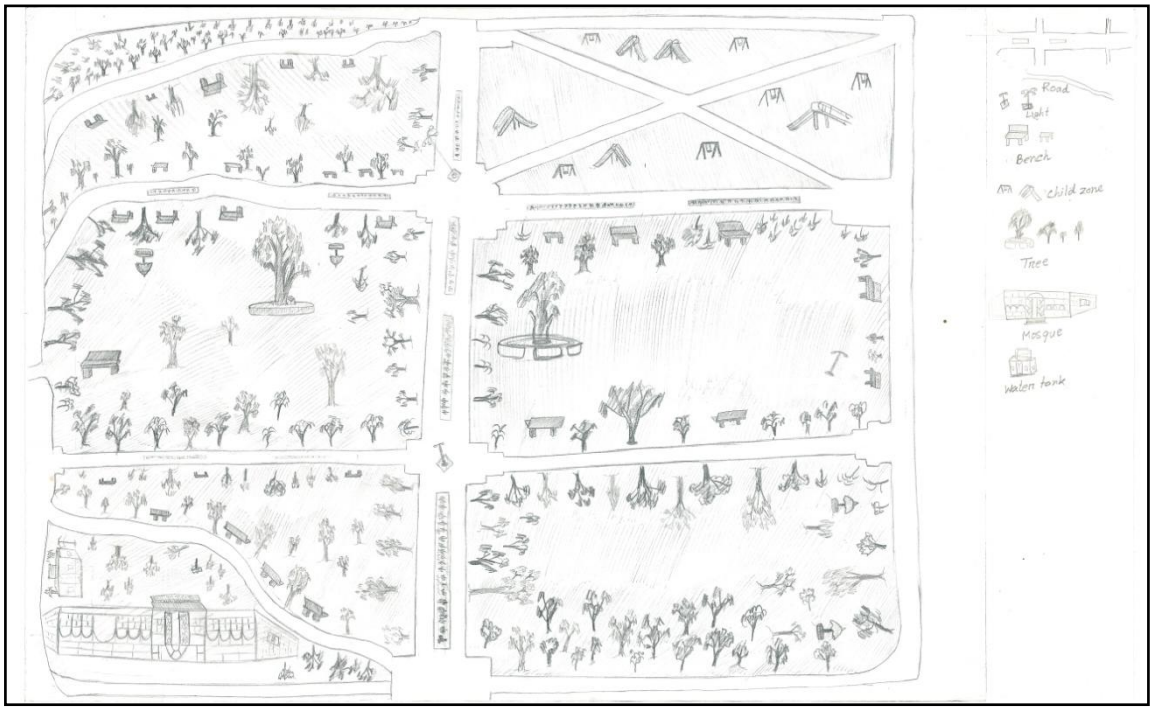


Figure 1. Sketch of Uttara 7 park

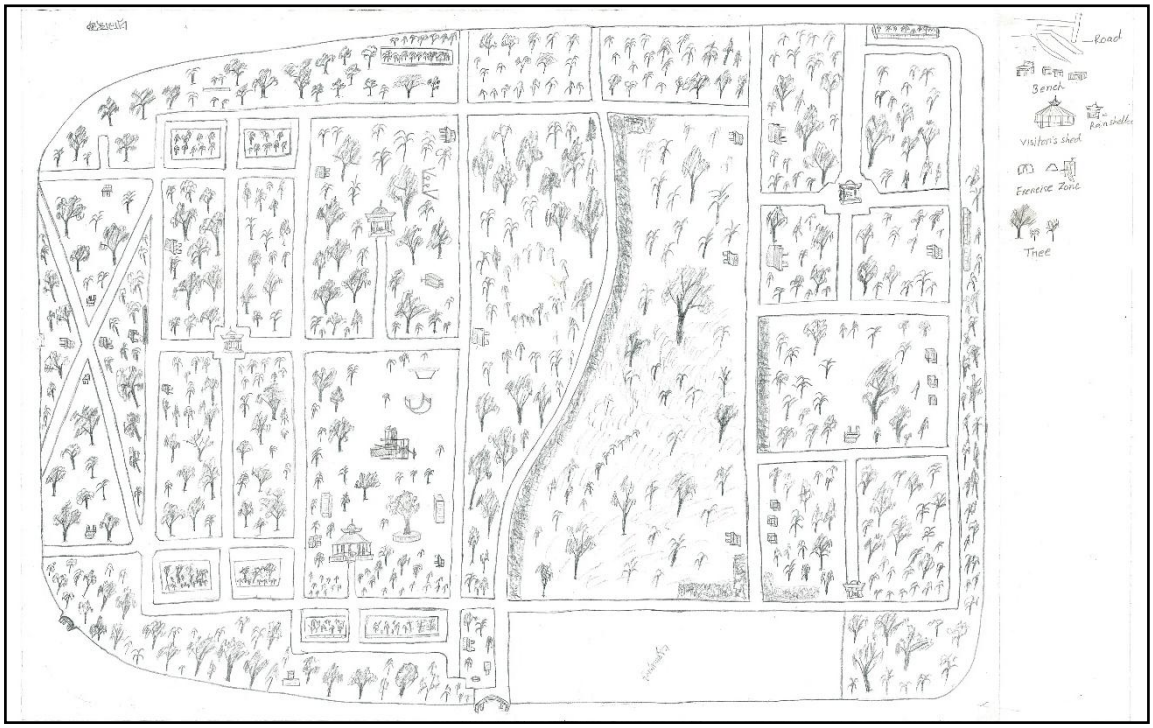


Figure 2. Sketch of Pantho kunjo park

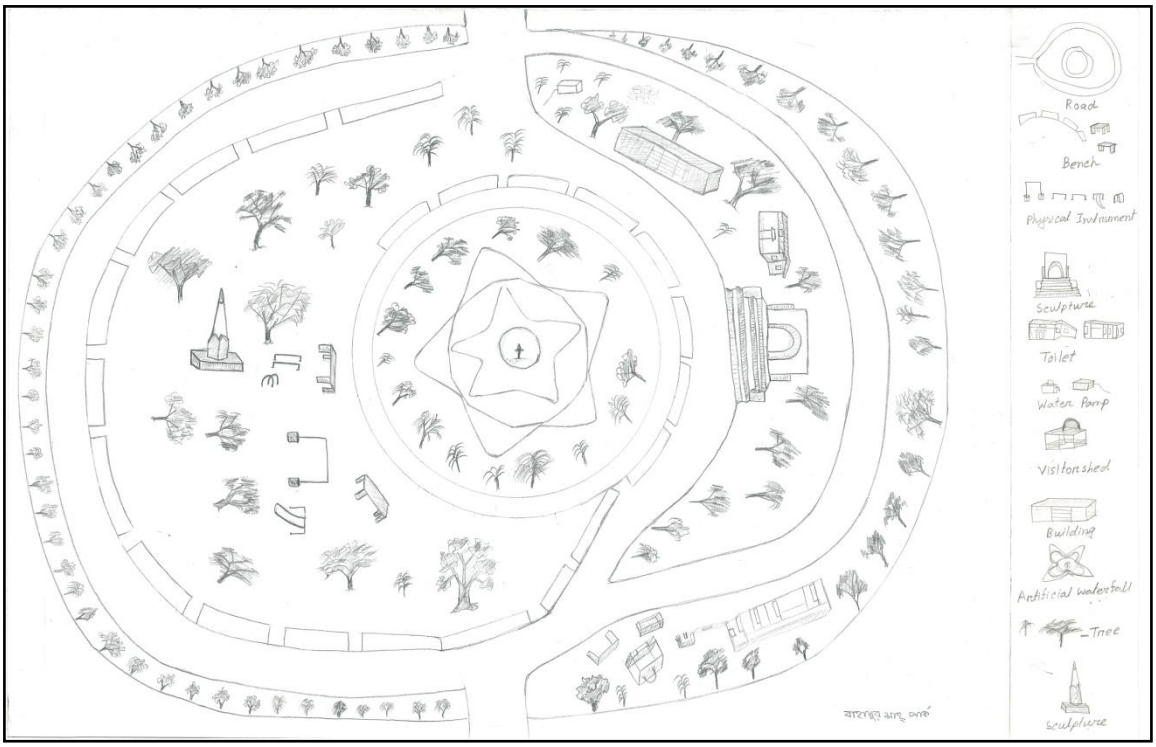


Figure 3. Sketch of Bahadur sha park

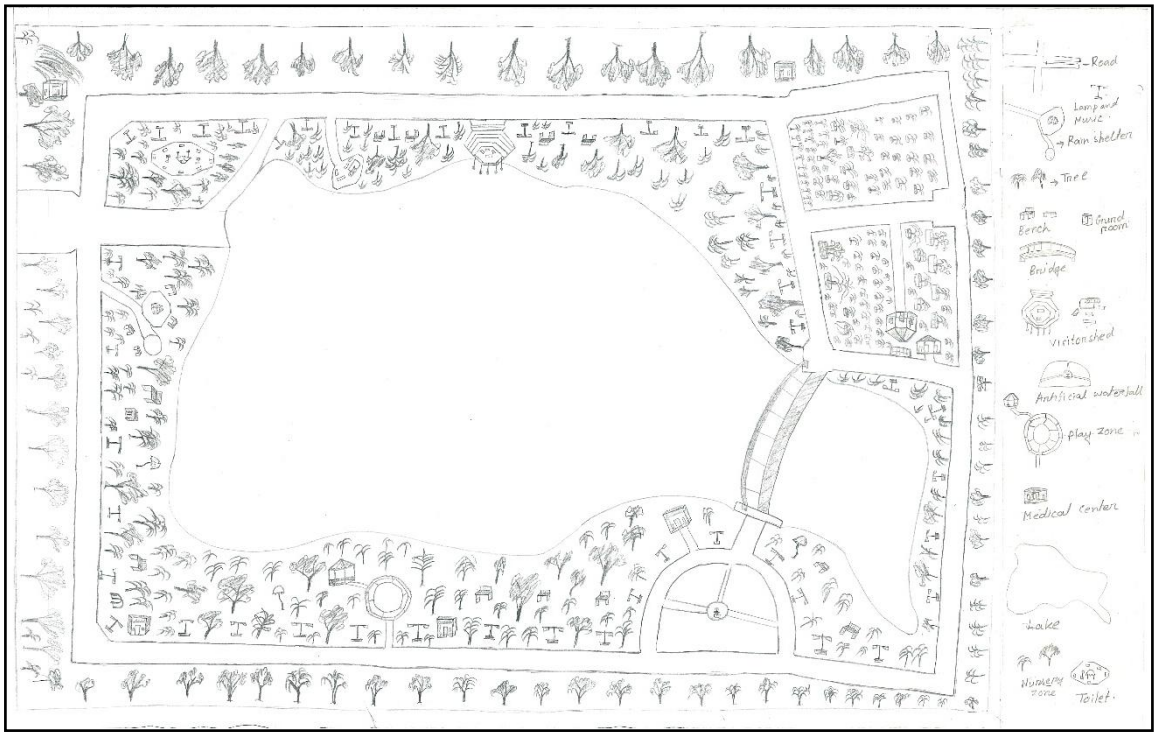


Figure 4. Sketch of Gulshan lake park

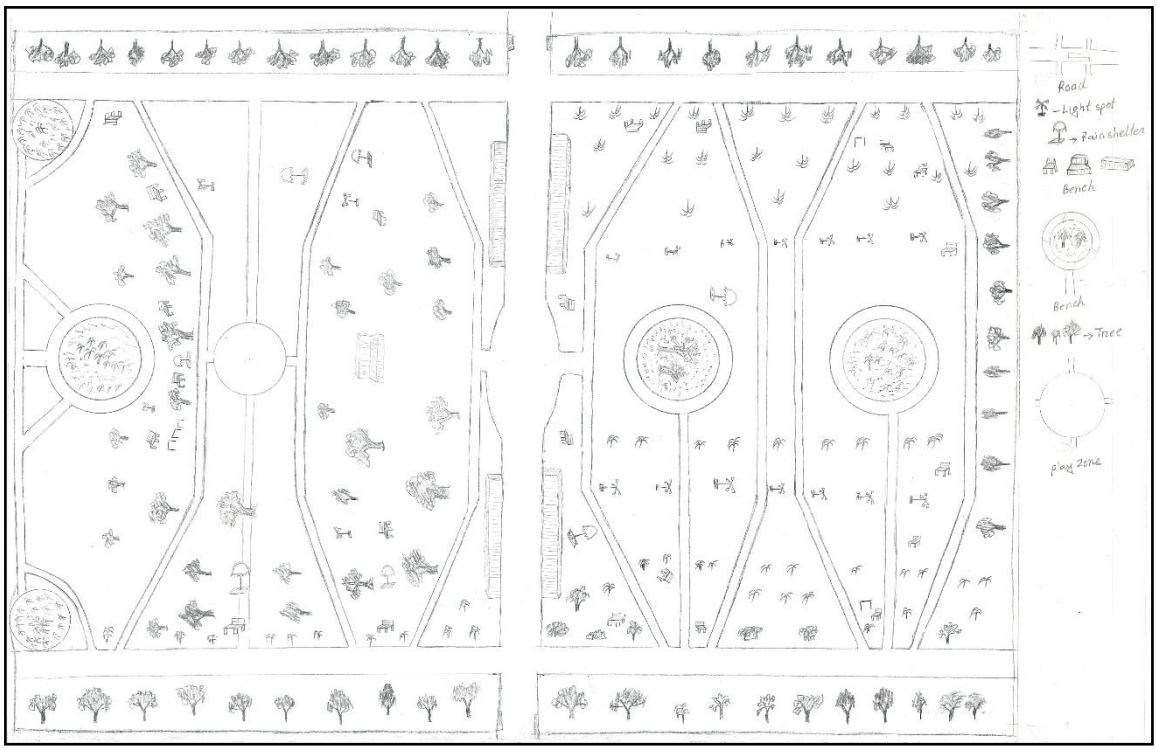


Figure 5. Sketch of Anwara park

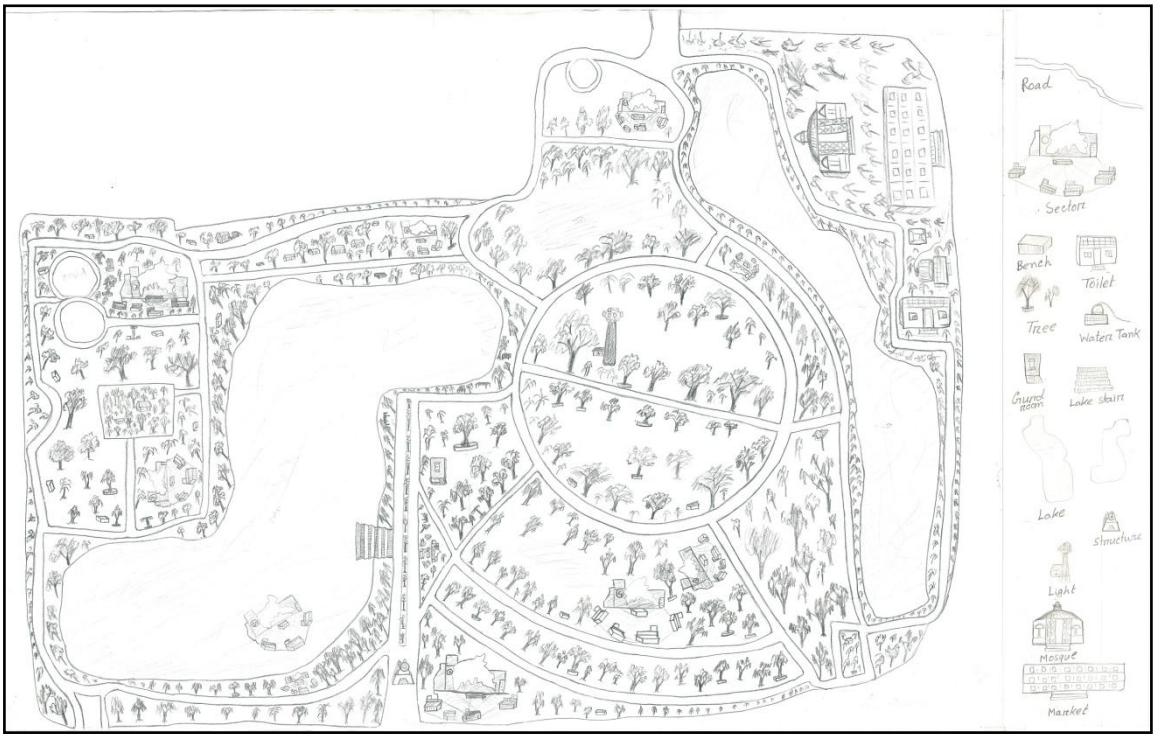


Figure 6. Sketch of Osmani uddan park

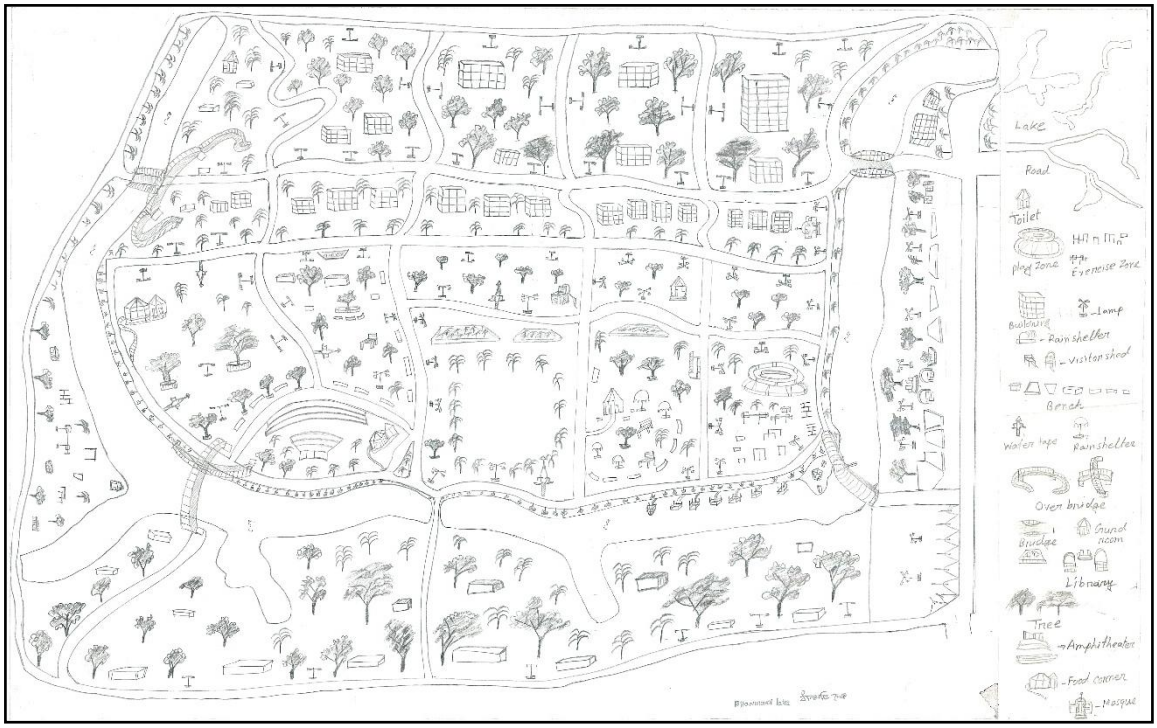


Figure 7. Sketch of Dhanmondi lake park

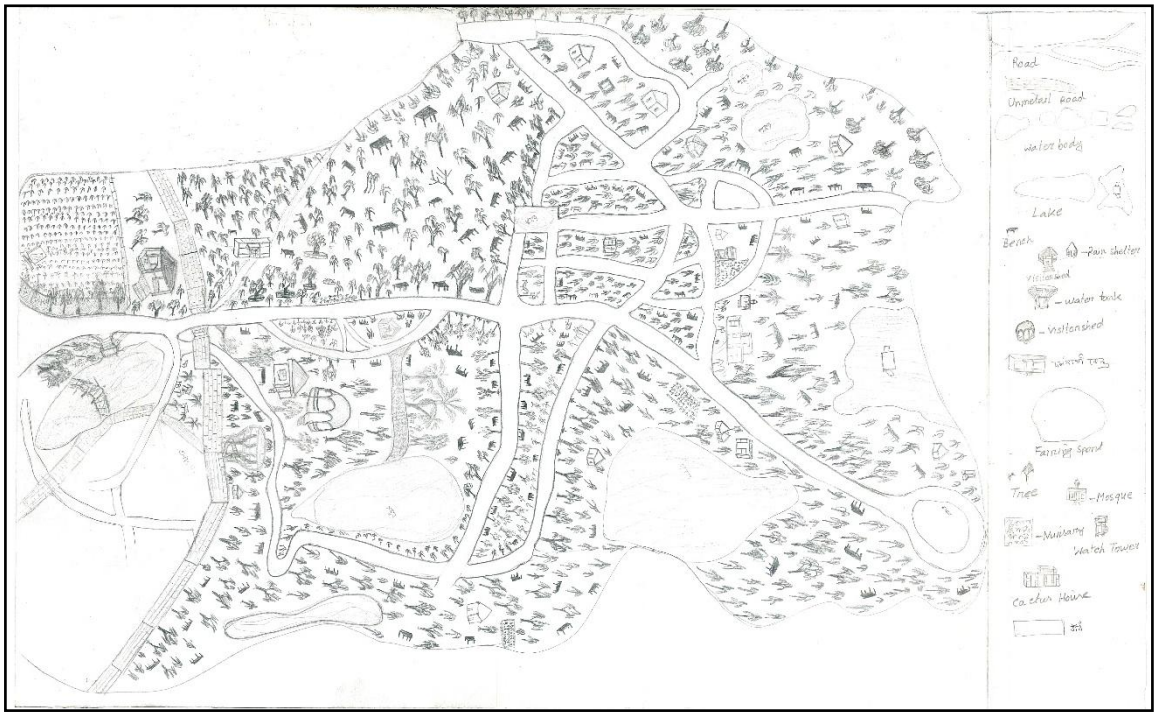


Figure 8. Sketch of Botanical garden park

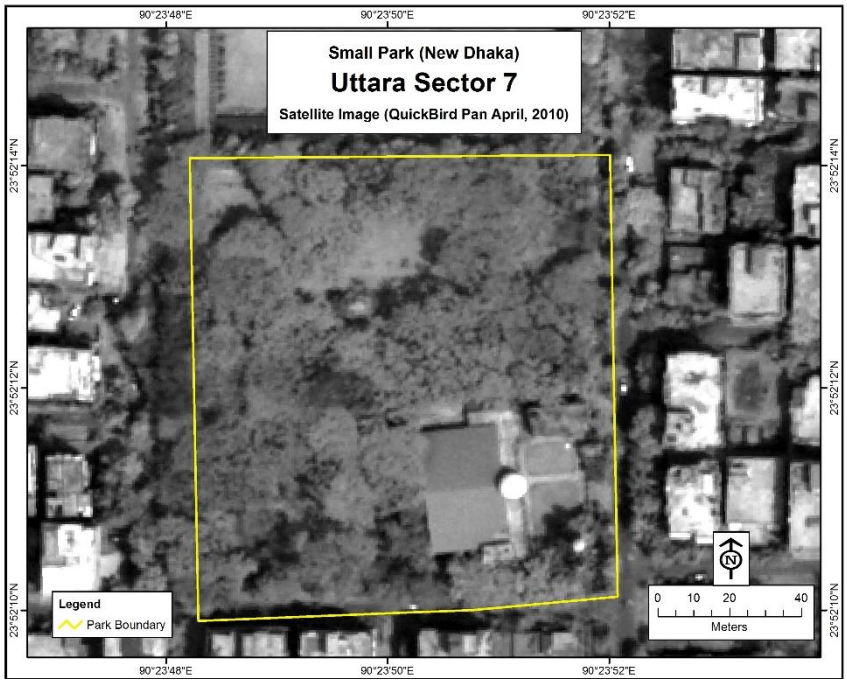


Figure 9. QuickBird image of Uttara 7 park, year 2010

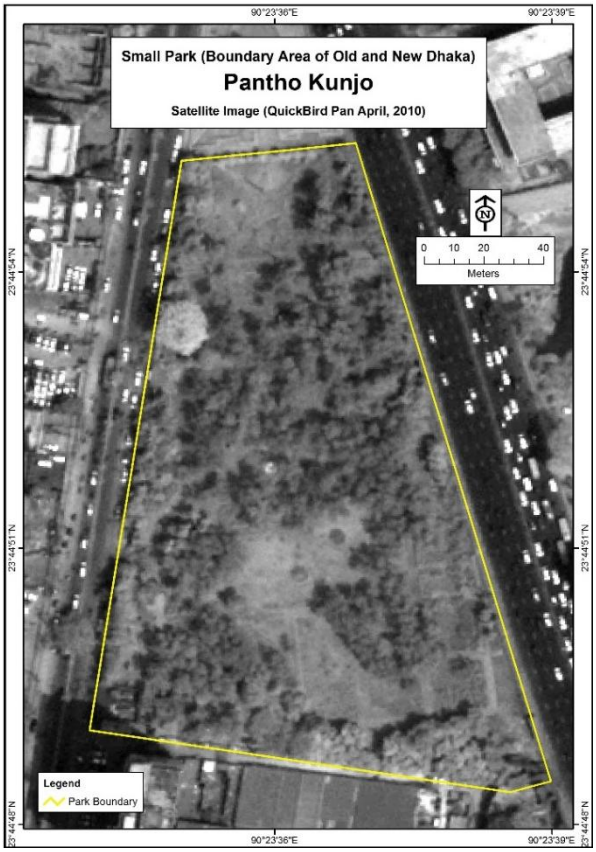


Figure 10. QuickBird image of Pantho kunjo park, year 2010

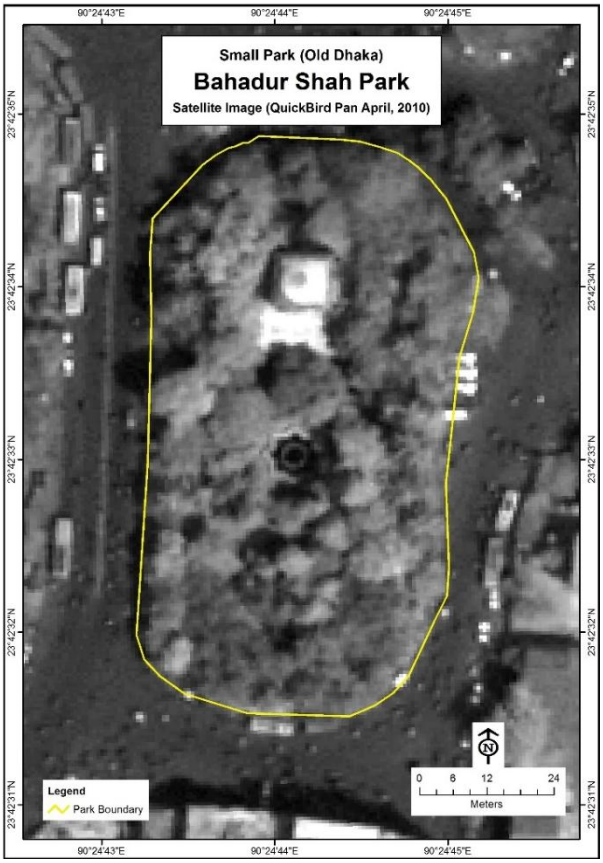


Figure 11. QuickBird image of Bahadur sha park, year 2010

Figure 12. QuickBird image of Gulshan lake park, year 2010

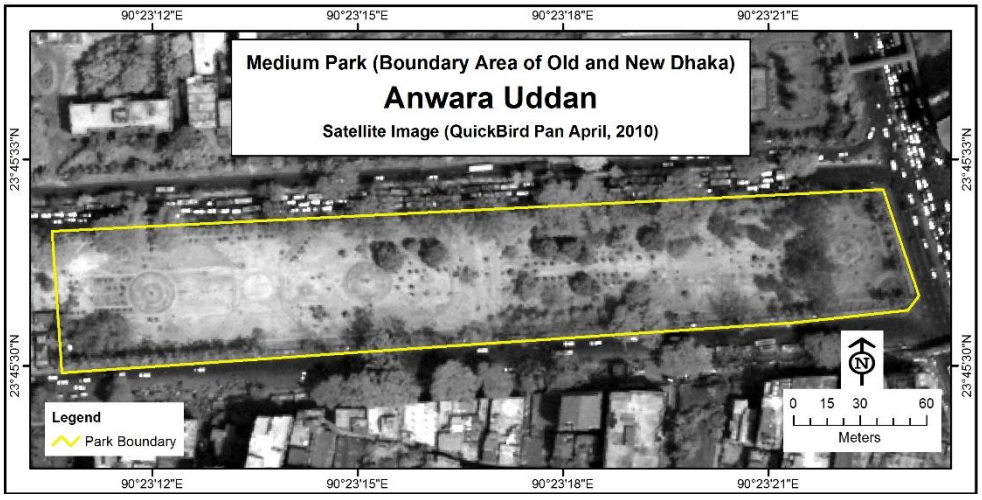


Figure 13. QuickBird image of Anwara park, year 2010

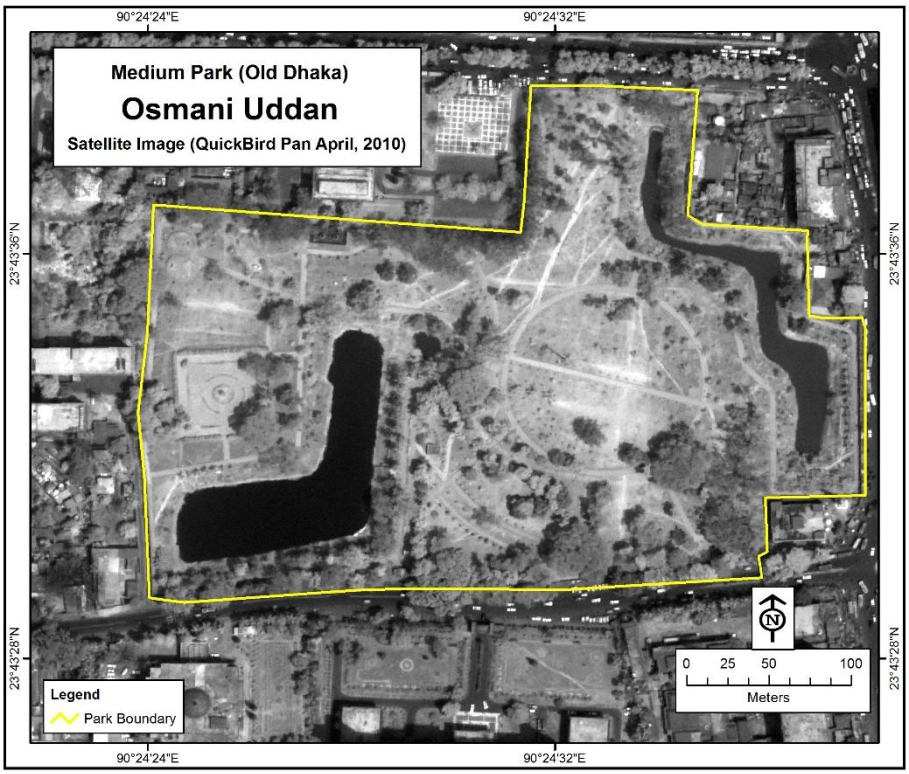


Figure 14. QuickBird image of Osmani uddan park, year 2010

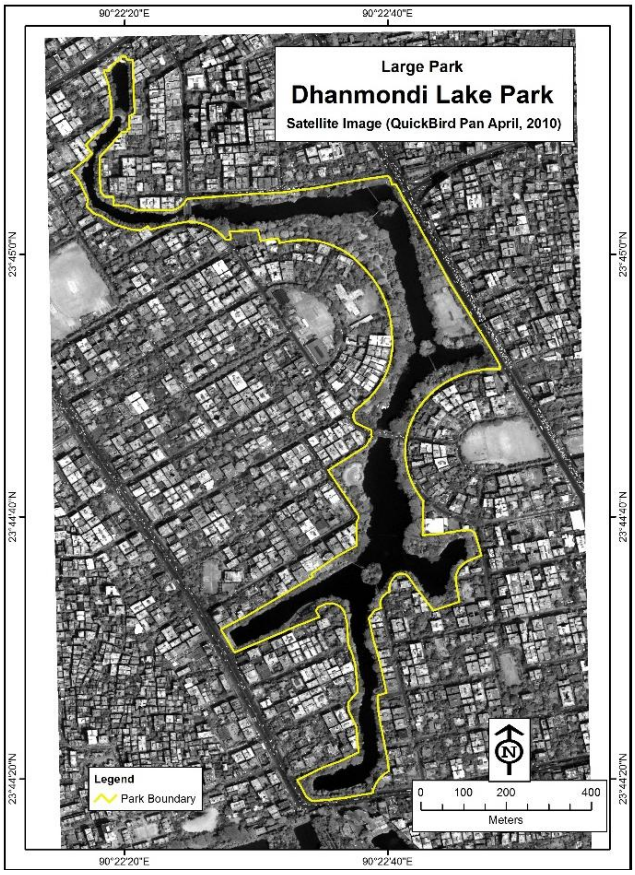


Figure 15. QuickBird image of Dhanmondi lake park, year 2010

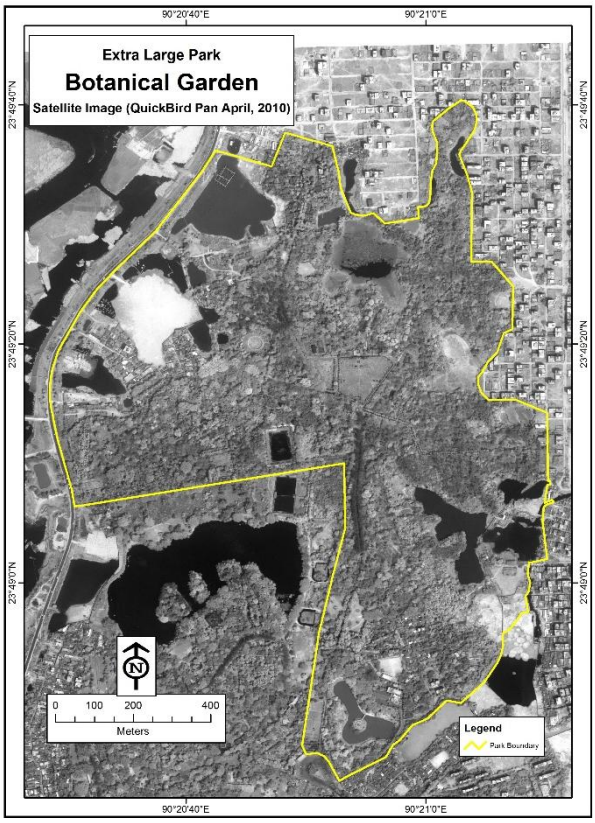


Figure 16. QuickBird image of Botanical garden park, year 2010

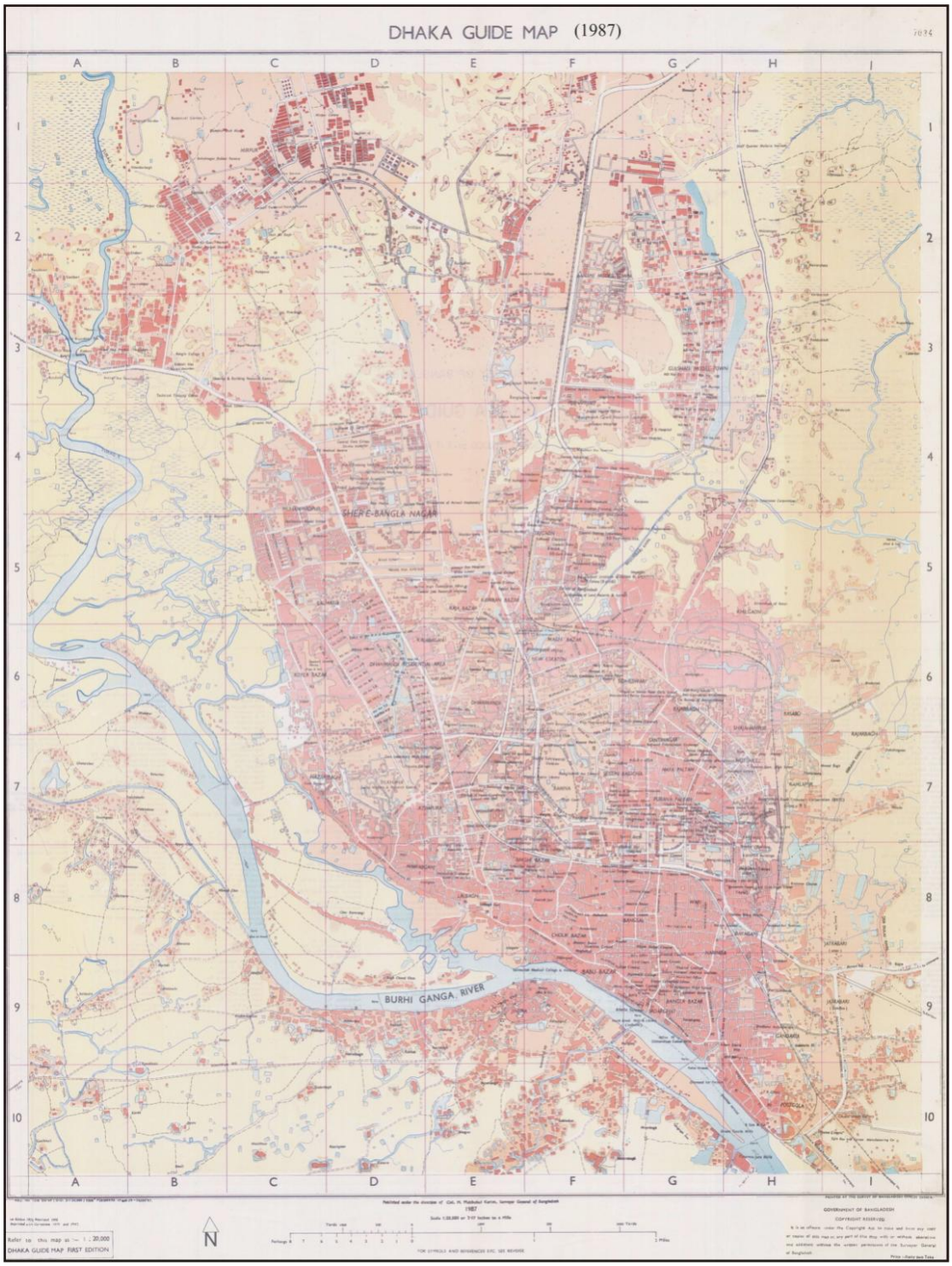


Figure 17. Dhaka City Guide Map (1987)

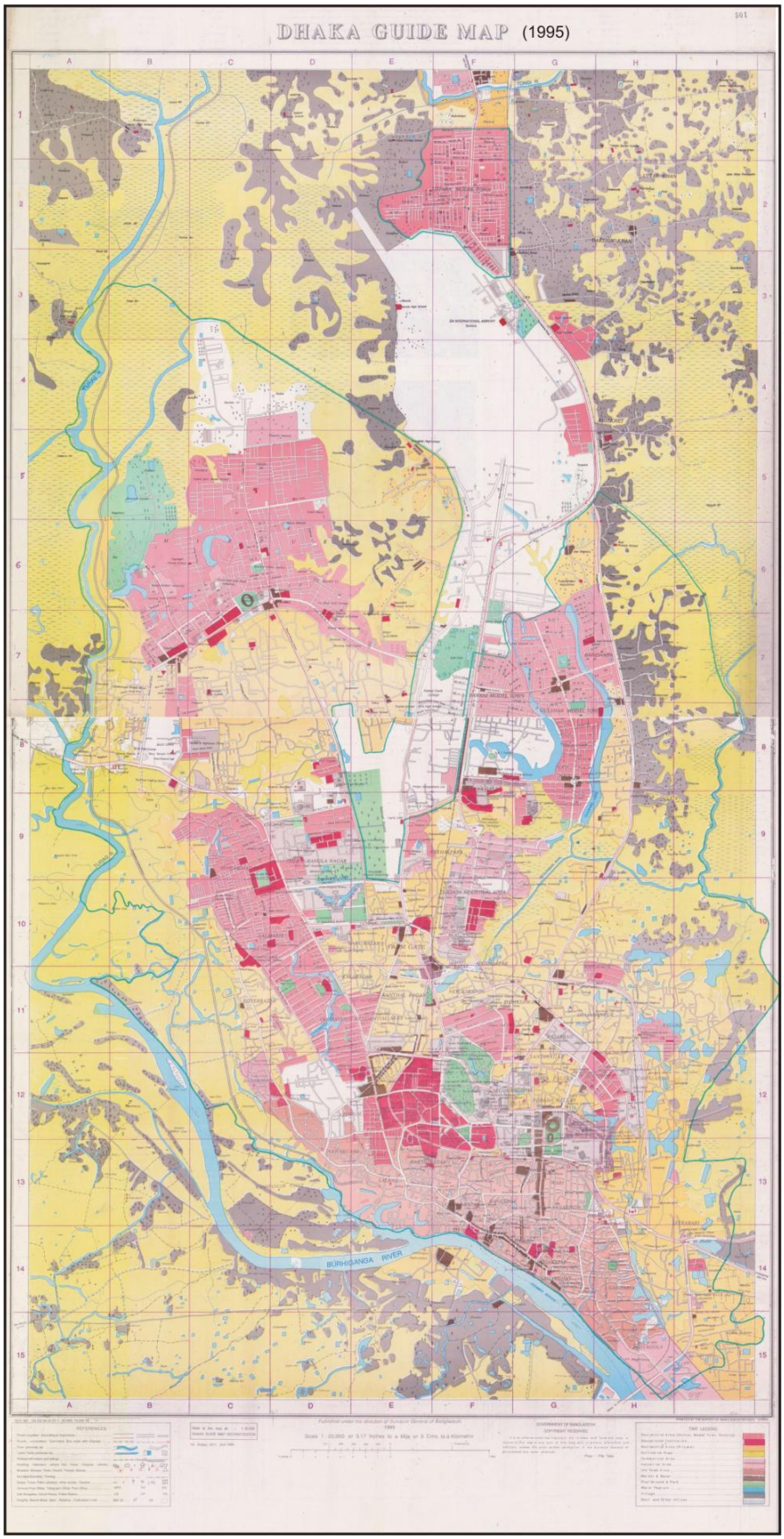


Figure 18. Dhaka City Guide Map (1995)

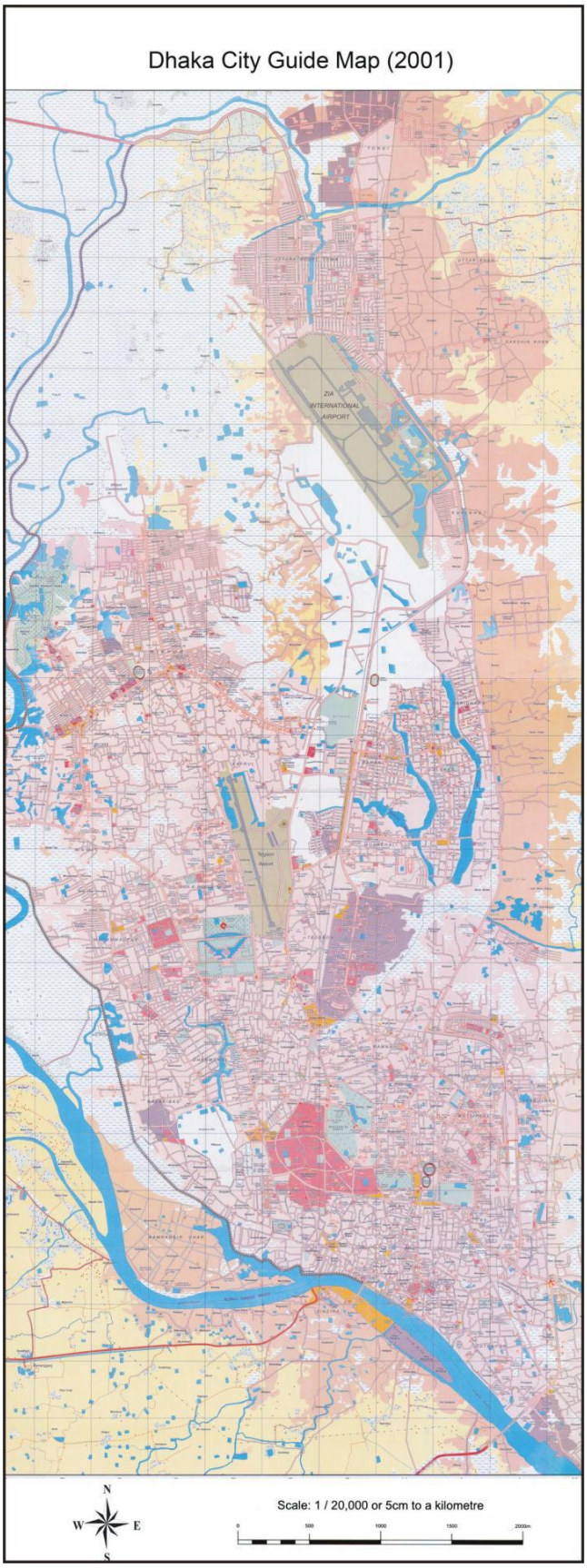


Figure 19. Dhaka City Guide Map (2001)

Appendix-B
(Questionnaire and Check table)

Questionnaire Survey- 01

The Integration of Urban Life with the Hierarchical Structure of Urban Parks Distribution in Developing Countries: A Case Study of Dhaka City, Bangladesh

PhD Research

Tokyo Metropolitan University,
1-1 Minami-Osawa, Hachioji, Tokyo, Japan.
Mobile: +8170-1571-1001.

[Questionnaire Survey: This information will be used only for research purpose at the PhD degree]

Date of Interview:

Questionnaire serial no:

Name of Park:

Location:

a. **Geographical location:**
b. **Relative location:**

Name of Respondent:……	Age:……
Occupation:……	Sex: Male/Female
Present Address:……	Nationality:
Permanent Address:……	Mobile No:

1. How far distance from your Present address: (km)….
2. How much time you have taken to come here (hour)….
3. What types of transport you have used to come here: On foot/Bus/Motor Bike/Auto Rickshaw/Bicycle/others…….
4. Your comments on the transport facilities: excellent/ good/ satisfactory/ bad/ worse.
5. Transport cost: (tk)…….
6. Purpose of your visit: Physical exercise/ Meeting place/ Recreation event/ Research purpose/ Walking/ Fishing/ Recreation/ Picnic/ others……
7. Did you visit this park before: yes/ no
8. Do you visit this site: Daily/ weekly/ monthly/ yearly/ others……..?
9. How many people are travelling with you: alone (please specify)…….
10. You are travelling with: alone/ spouse/ spouse & children/ other family member/ friends/ colleagues/ others……..
11. How long you intend to spend here: (please specify)……..
12. Availability of food: available/ satisfactory/ scarce.
13. Your comments on food quality: excellent/ good/ satisfactory/ low/ very low.
14. Available of source of drinking water: available/ satisfactory/ scarce.
15. Your comments on the security: excellent/ good/ satisfactory/ bad/ worse.
16. Entry fee: (If applicable) tk……..

17. Your comment on the entry fee: very high/ high/ satisfactory/ low/ very low.
18. Which special features of the park attract you very much (please mention)……
19. Are you satisfied with the environment of the park: yes/no?
20. If the answer is no what is your suggestion about the environment……
    ……
21. Staying cost: Food/ recreation fee
22. What type of recreation?.....……
23. Did you face any trouble visiting here: yes/ no?
24. If you have trouble, what types of them are: (please specify rank)
    - Transport
    - Social kind/ security.
    - Crowd
    - Scarcity of good and healthy food.
    - Scarcity of drinking water.
    - Lack of recreation.
    - Environment pollution.
    - Others……..
25. Which kind of measures would help to get rid of these problems, you think……
    ……
    ……
    …….
26. Would you like to visit here again: yes/ no?
27. Which kind of facilities will help to improve the present condition of these park……
    ……
    ……
    ……..
28. What is you're feeling about current visit: excellent/ good/ satisfactory/ bad/ worse/ others…….

Thank you.....

Signature of Supervisor
…**……..**

Signature of Surveyor
…….

Check Table Survey- 02

The Integration of Urban Life with the Hierarchical Structure of Urban Parks Distribution in Developing Countries: A Case Study of Dhaka City, Bangladesh

PhD Research

Tokyo Metropolitan University,
1-1 Minami-Osawa, Hachioji, Tokyo, Japan.
Mobile: +8170-1571-1001.

[Check Table Survey: This information will be used only for research purpose at the PhD degree]

Social / Human Features

Elements	Dhaka South City Corporation (DSCC)			Dhaka North City Corporation (DNCC)			(Boundary of DNCC and DSCC)	
	Bahadur Sha Park **(Small)**	Osamani Udden Park **(Medium)**	Dhanmondi Lake Park **(Large)**	Uttara 07 Sector Park **(Small)**	Gulshan Lake Park **(Medium)**	Botanical Garden **(Extra Large)**	Panthokunjo Park **(Small)**	Anawara Park **(Medium)**
Gate								
Bench								
Table								
Rain Shelter								
Visitor's Shed								
Artificial Waterfall								
Vendor stall								
Attraction								
Sculpture								
Orchid House								
Net House								
Snack corner								
Toilet								
Parking								
Watch tower								
Food and Beverage								
Building								
Rest Zone								
Masque/ Temple								
Bridge								
Electric Pole								
Children Play Zone								
Water Supply Station								
Nursery area								
Picnic Area								
Cactus House								
Research Centre								
Dustbin								
Artificial lake								

Music facilities								
Medical Facilities								
Walking way								
Drinking Water								
Sports Field								
Excise Area								
Amphitheater								

This information collected though field survey

Natural Features

Elements	**Dhaka South City Corporation (DSCC)**			**Dhaka North City Corporation (DNCC)**			**(Boundary of DNCC and DSCC)**	
	Bahadur Sha Park **(Small)**	Osamani Udden Park **(Medium)**	Dhanmondi Lake Park **(Large)**	Uttara 07 Sector Park **(Small)**	Gulshan Lake Park **(Medium)**	Botanical Garden **(Extra Large)**	Panthokunjo Park **(Small)**	Anawara Park **(Medium)**
Area								
Shape								
Wood Tree								
Water body								
Bamboo garden								
Fruits Garden								
Others								

This information collected though field survey

Questionnaire Survey- 03

(Base of Organization)

The Integration of Urban Life with the Hierarchical Structure of Urban Parks Distribution in Developing Countries: A Case Study of Dhaka City, Bangladesh

PhD Research

Tokyo Metropolitan University,
1-1 Minami-Osawa, Hachioji, Tokyo, Japan.
Mobile: +8170-1571-1001.

[In-depth Interview: This information will be used only for research purpose at the PhD degree]

General

- Do you think green space like Dhaka city of Bangladesh has a good for urban life?
- Do you think the available facilities of Park area is enough for Urban Dwellers?
- What are the development needs for enhancing urban life as you think?
- Do you think private authority is need for infrastructural development in Park area?
- Do you think the park area security system is enough?

Programs

- What programs is offering for Children and aged people?
- What benefits / facilities are offered? (Special play zone, Physical exercise zone and others.)
- What types of program take of your organization for increase green space in Dhaka city?
- How long the program has been running? How long it will be continued?
- Who is financing the program? Government /donor agency?
- Was there any program before this program? What type? Which area? For whom (specify)?

Program target and involvement

- Operation area this program?
- How they selected? What criteria do follow? Who determines the criteria?
- Do you see any outside influence (from dynamics and decision)?
- Are any local elite /political involved? Which influence?
- Any political influence?

Program strength and weakness

Recommendation / future action

- What do you see as the major barriers to promoting green space?
- Does go / organization have any ideas/program on how to address resource mobilization and enabling environments for urban recreation. Which have not yet been shaped into programs or do you have any suggestion of alternative method of addressing these issues?
- Does your organization have any program/policies to address climate change and urban green? Any networking with other organizations (international /national)?

Thank you.....

Appendix-C
Data

Table 1. According to National Recreation and Park Association (**NRPA**) Park Classification

Park Types	Size
Mini Park	1 acre or less
Neighborhood Park/Playground	1 - 15 acres
Community Park	16 - 99 acres
Regional / Metropolitan Park	100 - 499 acres
Regional Park Reserve	> 500 acres
Special Use Area	no specific standards
Linear Park	no specific standards
Conservancy	no specific standards

Table 2. According to **Rangwala 1974** based on size there are mainly five types of Parks

Park Types	Size
Small Size Park	Less than 4 ha or 9.88422 acres
Medium Size Park	Greater than 12 ha or 29.6526 acres
Large Size Park	Greater than 40 ha or 98.8422 acres
Reservations	400 ha or 988.422 acres
National Parks	More than Thousand hectors

Table 3. In 1984, according to Time-Saver Standard for Residential Development by Joseph De Chiara the parks are classified as follows:

Park Types	Size
Neighborhood Park-School (elementary)	> 2 acres
Neighborhood Park	3 - 5 acres
Community Park-School (junior high)	Minimum 35 acres
Community Park-School (senior high)	Minimum 50 acres
Community Park and Playfield	A separate play field requires area of 15 - 20 acres
Citywide or District Park	50 - 100 acres

Table 4. Check table format (Social / Human Features)

Elements	Dhaka South City Corporation (DSCC)			Dhaka North City Corporation (DNCC)			(Boundary of DNCC and DSCC)	
	S3	M3	L	S1	M1	EL	S2	M2
Gate	O	O	O	O	O	O	O	O
Bench	O	O	O	O	O	O	O	O
Table	×	×	O	×	×	×	×	×
Rain Shelter	O	×	×	O	×	×	×	×
Visitor's Shed	O	O	O	×	×	O	O	O
Artificial Waterfall	×	×	O	×	O	O	×	×
Vendor stall	×	O	O	×	O	O	×	×
Attraction	O	O	O	×	O	O	×	×
Sculpture	O	O	O	×	O	×	×	×
Orchid House	×	×	×	×	O	O	×	×
Net House	×	×	O	×	×	O	×	×
Snack corner	×	×	×	×	×	O	×	×

Toilet	×	O	O	×	O	O	O	O
Parking	×	×	O	×	×	O	×	×
Watch tower	×	×	×	×	×	O	×	×
Food and Beverage	×	×	O	×	×	O	×	×
Building	O	×	×	×	×	O	×	×
Rest Zone	×	×	×	×	×	×	×	×
Masque/ Temple	×	×	O	O	×	O	×	×
Bridge	×	×	O	×	O	O	×	×
Electric Pole	×	×	O	O	O	O	×	×
Children Play Zone	×	×	O	O	×	×	×	×
Water Supply Station	O	O	×	O	×	O	×	×
Nursery area	×	×	×	×	O	O	×	×
Picnic Area	×	×	×	×	×	O	×	×
Cactus House	×	×	×	×	×	O	×	×
Research Centre	×	×	×	×	×	O	×	×
Dustbin	×	×	O	O	O	O	×	×
Artificial lake	×	O	O	×	O	O	×	×
Music facilities	×	×	×	×	O	×	×	×
Medical Facilities	×	×	×	×	O	×	×	×
Walking way	O	O	O	O	O	O	O	O
Drinking Water	×	×	O	×	O	O	×	×
Sports Field	O	O	O	O	O	O	O	O
Excise Area	×	×	O	×	O	O	×	×
Amphitheater	×	×	O	×	O	×	×	×

S1= Uttara Sector 7no Park; **S2**=Panthokunjo Park; **S3**=Bhadur Sha Park; **M1**=Gulshan Lake Park; **M2**=Anawara Uddan Park; **M3**=Osmani Uddan Park; **L**=Dhanmondi Lake Park; **EL**=Botanical Garden Park.

O = Yes; × = No; this information collected though field survey, 2015

Table 5. Check table format (Natural Features)

Elements	**Dhaka South City Corporation (DSCC)**			**Dhaka North City Corporation (DNCC)**			**(Boundary of DNCC and DSCC)**	
	S3	**M3**	**L**	**S1**	**M1**	**EL**	**S2**	**M2**
Area Boundary	O	O	O	O	O	O	O	O
Wood Tree	O	O	O	O	O	O	O	O
Water body	×	O	O	×	O	O	×	×
Bamboo garden	×	×	×	×	×	O	×	×
Fruits Garden s	×	×	×	×	×	O	×	×

S1= Uttara Sector 7no Park; **S2**=Panthokunjo Park; **S3**=Bhadur Sha Park; **M1**=Gulshan Lake Park; **M2**=Anawara Uddan Park; **M3**=Osmani Uddan Park; **L**=Dhanmondi Lake Park; **EL**=Botanical Garden Park.

O = Yes; × = No; this information collected though field survey, 2015

Table 6. Respondents According to their Distance from Destination to Parks

Distance (km)	Visitor (Number and percentage)															
	S1		S2		S3		M1		M2		M3		L		EL	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
0 - 1	41	51.25	64	80	41	51.25	46	51.11	38	42.2	36	40	23	23	9	9
1.01 - 2.0	23	28.75	9	11.25	24	30	29	32.22	30	33.3	17	18.89	31	31	23	23
2.01 – 3.0	6	7.5	2	2.5	5	6.25	10	11.11	15	16.7	19	21.11	12	12	10	10
3.01 - 4.0	1	1.25	0	0	2	2.5	1	1.111	4	4.44	4	4.444	17	17	5	5
4.01 – 5.0	0	0	2	2.5	2	2.5	0	0	1	1.11	4	4.444	9	9	4	4
5.01-6.0	4	5	1	1.25	3	3.75	2	2.222	2	2.22	4	4.444	4	4	1	1
>6.01	5	6.25	2	2.5	3	3.75	2	2.222	0	0	6	6.667	4	4	48	48
Total	**80**	**100%**	**80**	**100%**	**80**	**100%**	**90**	**100%**	**90**	**100%**	**90**	**100%**	**100**	**100%**	**100**	**100%**

S1= Uttara Sector 7no Park; **S2**=Panthokunjo Park; **S3**=Bhadur Sha Park; **M1**=Gulshan Lake Park; **M2**=Anawara Uddan Park; **M3**=Osmani Uddan Park; **L**=Dhanmondi Lake Park; **EL**=Botanical Garden Park.

Table 7. Respondents According to their time from Destination to Parks

Time	Small Park			Medium Park			Large Park	Extra Large Park	Total
	S1	S2	S3	M1	M2	M3	L	EL	
Less than 10 Minutes	41	64	41	46	38	36	23	9	298
	51.25%	80%	51.25%	51.11%	42.20%	40%	23%	9%	
11-15 Minutes	23	9	24	29	30	17	31	23	186
	28.75%	11.25%	30%	32.22%	33.30%	18.89%	31%	23%	
16-20 Minutes	6	2	5	10	15	19	12	10	79
	7.76%	2.50%	6.25%	11.11%	16.70%	21.11%	12%	10%	
21-25 Minutes	0	0	2	1	4	4	17	5	33
	0%	0%	2.50%	1.11%	4.44%	4.44%	17%	5%	
26-30 Minutes	4	2	2	0	1	4	9	4	26
	6%	2.50%	2.50%	0%	1.11%	4.44%	9%	4%	
31-35 Minutes	5	1	3	2	2	4	4	1	22
	6.25%	1.25%	3.75%	2.22%	2.22%	4.44%	4%	1%	
Above 36 Minutes	0	2	3	2	0	6	4	48	65
	0%	2.50%	3.75%	2.22%	0%	6.67%	4%	48%	
Total (No. and %)	**80 (100%)**	**80 (100%)**	**80 (100%)**	**90 (100%)**	**90 (100%)**	**90 (100%)**	**100 (100%)**	**100 (100%)**	

S1= Uttara Sector 7no Park; **S2**=Panthokunjo Park; **S3**=Bhadur Sha Park; **M1**=Gulshan Lake Park; **M2**=Anawara Uddan Park; **M3**=Osmani Uddan Park; **L**=Dhanmondi Lake Park; **EL**=Botanical Garden Park.

Table 8. Gender of the Respondent

Name of Park	Variable	Frequency	Percent	Valid Percent	Cumulative Percent
S1	Male	58	72.5	72.5	72.5
	Female	22	27.5	27.5	100
	Total	80	100	100	
S2	Male	65	81.2	81.2	81.2
	Female	15	18.8	18.8	100
	Total	80	100	100	
S3	Male	56	70	70	70
	Female	24	30	30	100
	Total	80	100	100	
M1	Male	61	67.8	67.8	67.8
	Female	29	32.2	32.2	100
	Total	90	100	100	
M2	Male	64	71.1	71.1	71.1
	Female	26	28.9	28.9	100
	Total	90	100	100	
M3	Male	76	84.4	84.4	84.4
	Female	14	15.6	15.6	100
	Total	90	100	100	
L	Male	86	54.4	86	86
	Female	14	8.9	14	100
	Total	100	63.3	100	
EL	Male	87	55.1	87	87
	Female	13	8.2	13	100
	Total	100	63.3	100	

S1= Uttara Sector 7no Park; **S2**=Panthokunjo Park; **S3**=Bhadur Sha Park; **M1**=Gulshan Lake Park; **M2**=Anawara Uddan Park; **M3**=Osmani Uddan Park; **L**=Dhanmondi Lake Park; **EL**=Botanical Garden Park.

Table 9. Age of Respondent

Name of Park	Variable	Frequency	Percent	Valid Percent	Cumulative Percent
S1	Less or Equal to 20 years old	11	13.8	13.8	13.8
	21-25 years old	23	28.8	28.8	42.5
	26-30 years old	11	13.8	13.8	56.2
	31-35 years old	13	16.2	16.2	72.5
	36-40 years old	4	5	5	77.5
	More or equal to 41 years old	18	22.5	22.5	100
	Total	80	100	100	
S2	Less or Equal to 20 years old	12	15	15	15
	21-25 years old	3	3.8	3.8	18.8
	26-30 years old	21	26.2	26.2	45
	31-35 years old	9	11.2	11.2	56.2
	36-40 years old	6	7.5	7.5	63.8
	More or equal to 41 years old	29	36.2	36.2	100
	Total	80	100	100	
S3	Less or Equal to 20 years old	14	17.5	17.5	17.5
	21-25 years old	27	33.8	33.8	51.2
	26-30 years old	15	18.8	18.8	70
	31-35 years old	5	6.2	6.2	76.2

Name of Park	Variable	Frequency	Percent	Valid Percent	Cumulative Percent
	36-40 years old	9	11.2	11.2	87.5
	More or equal to 41 years old	10	12.5	12.5	100
	Total	80	100	100	
M1	Less or Equal to 20 years old	9	10	10	10
	21-25 years old	8	8.9	8.9	18.9
	26-30 years old	15	16.7	16.7	35.6
	31-35 years old	6	6.7	6.7	42.2
	36-40 years old	12	13.3	13.3	55.6
	More or equal to 41 years old	40	44.4	44.4	100
	Total	90	100	100	
M2	Less or Equal to 20 years old	13	14.4	14.4	14.4
	21-25 years old	50	55.6	55.6	70
	26-30 years old	13	14.4	14.4	84.4
	31-35 years old	4	4.4	4.4	88.9
	36-40 years old	4	4.4	4.4	93.3
	More or equal to 41 years old	6	6.7	6.7	100
	Total	90	100	100	
M3	Less or Equal to 20 years old	4	4.4	4.4	4.4
	21-25 years old	10	11.1	11.1	15.6
	26-30 years old	14	15.6	15.6	31.1
	31-35 years old	29	32.2	32.2	63.3
	36-40 years old	10	11.1	11.1	74.4
	More or equal to 41 years old	23	25.6	25.6	100
	Total	90	100	100	
L	Less or Equal to 20 years old	26	16.5	26	26
	21-25 years old	26	16.5	26	52
	26-30 years old	15	9.5	15	67
	31-35 years old	11	7	11	78
	36-40 years old	9	5.7	9	87
	More or equal to 41 years old	13	8.2	13	100
	Total	100	63.3	100	
EL	Less or Equal to 20 years old	17	10.8	17	17
	21-25 years old	29	18.4	29	46
	26-30 years old	27	17.1	27	73
	31-35 years old	13	8.2	13	86
	36-40 years old	9	5.7	9	95
	More or equal to 41 years old	5	3.2	5	100
	Total	100	63.3	100	

S1= Uttara Sector 7no Park; **S2**=Panthokunjo Park; **S3**=Bhadur Sha Park; **M1**=Gulshan Lake Park; **M2**=Anawara Uddan Park; **M3**=Osmani Uddan Park; **L**=Dhanmondi Lake Park; **EL**=Botanical Garden Park.

Table 10. Occupation

Name of Park	Variable	Frequency	Percent	Valid Percent	Cumulative Percent
S1	Private job	13	16.2	16.2	16.2
	Govt.job	4	5	5	21.2
	Housewife	14	17.5	17.5	38.8
	Business	15	18.8	18.8	57.5
	Student	21	26.2	26.2	83.8
	Others	12	15	15	100
	Total	80	100	100	
S2	Private job	23	28.8	28.8	28.8
	Govt.job	9	11.2	11.2	40
	Housewife	13	16.2	16.2	56.2
	Business	20	25	25	81.2
	Unemployment	4	5	5	86.2
	Student	11	13.8	13.8	100
	Total	80	100	100	
S3	Private job	10	12.5	12.5	12.5
	Housewife	14	17.5	17.5	30
	Business	14	17.5	17.5	47.5
	Unemployment	4	5	5	52.5
	Student	38	47.5	47.5	100
	Total	80	100	100	
M1	Private job	30	33.3	33.3	33.3
	Govt.job	13	14.4	14.4	47.8
	Housewife	17	18.9	18.9	66.7
	Business	8	8.9	8.9	75.6
	Unemployment	1	1.1	1.1	76.7
	Student	21	23.3	23.3	100
	Total	90	100	100	
M2	Private job	19	21.1	21.1	21.1
	Govt. Job	1	1.1	1.1	22.2
	Business	7	7.8	7.8	30
	Student	63	70	70	100
	Total	90	100	100	
M3	Private job	12	13.3	13.3	13.3
	Govt.job	11	12.2	12.2	25.6
	Business	55	61.1	61.1	86.7
	Student	8	8.9	8.9	95.6
	Others	4	4.4	4.4	100
	Total	90	100	100	
L	Private job	24	15.2	24	24
	Govt.job	5	3.2	5	29
	Business	29	18.4	29	58
	Student	39	24.7	39	97
	Others	3	1.9	3	100
	Total	100	63.3	100	
EL	Private job	22	13.9	22	22
	Govt.job	9	5.7	9	31
	Housewife	5	3.2	5	36
	Business	12	7.6	12	48
	Unemployment	4	2.5	4	52
	Student	31	19.6	31	83
	Others	17	10.8	17	100
	Total	100	63.3	100	

S1= Uttara Sector 7no Park; **S2**=Panthokunjo Park; **S3**=Bhadur Sha Park; **M1**=Gulshan Lake Park; **M2**=Anawara Uddan Park; **M3**=Osmani Uddan Park; **L**=Dhanmondi Lake Park; **EL**=Botanical Garden Park.

Table 11. Transport facilites

Name of Park	Variable	Frequency	Percent	Valid Percent	Cumulative Percent
S1	On foot	28	35	35	35
	Bus	25	31.2	31.2	66.2
	Rickshow	20	25	25	91.2
	Auto rickshow	7	8.8	8.8	100
	Total	80	100	100	
S2	On foot	76	95	95	95
	Motor bike	2	2.5	2.5	97.5
	Rickshow	2	2.5	2.5	100
	Total	80	100	100	
S3	On foot	44	55	55	55
	Bus	18	22.5	22.5	77.5
	Motor bike	2	2.5	2.5	80
	Rickshow	16	20	20	100
	Total	80	100	100	
M1	On foot	71	78.9	78.9	78.9
	Bus	11	12.2	12.2	91.1
	Others	8	8.9	8.9	100
	Total	90	100	100	
M2	On foot	27	30	30	30
	Bus	54	60	60	90
	Motor bike	2	2.2	2.2	92.2
	Rickshow	2	2.2	2.2	94.4
	Auto rickshow	2	2.2	2.2	96.7
	Others	3	3.3	3.3	100
	Total	90	100	100	
M3	On foot	44	48.9	48.9	48.9
	Bus	41	45.6	45.6	94.4
	Motor bike	1	1.1	1.1	95.6
	Rickshow	2	2.2	2.2	97.8
	Others	2	2.2	2.2	100
	Total	90	100	100	
L	On foot	59	37.3	59	59
	Bus	34	21.5	34	93
	Rickshow	4	2.5	4	97
	Auto rickshow	3	1.9	3	100
	Total	100	63.3	100	
EL	On foot	16	10.1	16	16
	Bus	63	39.9	63	79
	Motor bike	1	0.6	1	80
	Rickshow	12	7.6	12	92
	Auto rickshow	6	3.8	6	98
	Others	2	1.3	2	100
	Total	100	63.3	100	

S1= Uttara Sector 7no Park; **S2**=Panthokunjo Park; **S3**=Bhadur Sha Park; **M1**=Gulshan Lake Park; **M2**=Anawara Uddan Park; **M3**=Osmani Uddan Park; **L**=Dhanmondi Lake Park; **EL**=Botanical Garden Park.

Table 12. Comment on transport facilities

Name of Park	Variable	Frequency	Percent	Valid Percent	Cumulative Percent
S1	Good	58	72.5	72.5	72.5
	Satisfactory	6	7.5	7.5	80
	Bad	1	1.2	1.2	81.2
	Worse	1	1.2	1.2	82.5

	Excellent	14	17.5	17.5	100
	Total	80	100	100	
S2	Good	78	97.5	97.5	97.5
	Satisfactory	2	2.5	2.5	100
	Total	80	100	100	
S3	Good	58	72.5	72.5	72.5
	Satisfactory	16	20	20	92.5
	Bad	2	2.5	2.5	95
	Worse	4	5	5	100
	Total	80	100	100	
M1	Good	56	62.2	62.2	62.2
	Satisfactory	34	37.8	37.8	100
	Total	90	100	100	
M2	Excellent	30	33.3	33.3	33.3
	Good	45	50	50	83.3
	Satisfactory	13	14.4	14.4	97.8
	Worse	2	2.2	2.2	100
	Total	90	100	100	
M3	Good	54	60	60	60
	Satisfactory	32	35.6	35.6	95.6
	Bad	4	4.4	4.4	100
	Total	90	100	100	
L	Good	66	41.8	66	66
	Satisfactory	24	15.2	24	90
	Bad	6	3.8	6	96
	Worse	1	0.6	1	97
	Excellent	3	1.9	3	100
	Total	100	63.3	100	
EL	Good	24	15.2	24	24
	Satisfactory	62	39.2	62	86
	Bad	13	8.2	13	99
	Worse	1	0.6	1	100
	Total	100	63.3	100	

S1= Uttara Sector 7no Park; **S2**=Panthokunjo Park; **S3**=Bhadur Sha Park; **M1**=Gulshan Lake Park; **M2**=Anawara Uddan Park; **M3**=Osmani Uddan Park; **L**=Dhanmondi Lake Park; **EL**=Botanical Garden Park.

Table 13. Distance of parks

Name of Park	Variable	Frequency	Percent	Valid Percent	Cumulative Percent
S1	Less or Equal to 2 Km	39	48.8	48.8	48.8
	3 to 5 Km	6	7.5	7.5	56.2
	6 to 8 Km	7	8.8	8.8	65
	Equal to 9 Km	11	13.8	13.8	78.8
	More than 9 km	17	21.2	21.2	100
	Total	80	100	100	
S2	Less or Equal to 2 Km	76	95	95	95
	3 to 5 Km	1	1.2	1.2	96.2
	6 to 8 Km	1	1.2	1.2	97.5
	More or equla to 9 Km	2	2.5	2.5	100
	Total	80	100	100	
S3	Less or Equal to 2 Km	58	72.5	72.5	72.5
	3 to 5 Km	5	6.2	6.2	78.8
	6 to 8 Km	3	3.8	3.8	82.5
	More or equla to 9 Km	14	17.5	17.5	100
	Total	80	100	100	
M1	Less or Equal to 2 Km	84	93.3	93.3	93.3
	3 to 5 Km	4	4.4	4.4	97.8

	6 to 8 Km	2	2.2	2.2	100
	Total	90	100	100	
M2	Less or Equal to 2 Km	38	42.2	42.2	42.2
	3 to 5 Km	30	33.3	33.3	75.6
	6 to 8 Km	5	5.6	5.6	81.1
	More or equla to 9 Km	17	18.9	18.9	100
	Total	90	100	100	
M3	Less or Equal to 2 Km	35	38.9	40.2	40.2
	3 to 5 Km	21	23.3	24.1	64.4
	6 to 8 Km	5	5.6	5.7	70.1
	More or equla to 9 Km	26	28.9	29.9	100
	Total	87	96.7	100	
L	Less or Equal to 2 Km	50	31.6	50	50
	3 to 5 Km	18	11.4	18	68
	6 to 8 Km	11	7	11	79
	More or equla to 9 Km	21	13.3	21	100
	Total	100	63.3	100	
EL	Less or Equal to 2 Km	23	14.6	23	23
	3 to 5 Km	29	18.4	29	52
	6 to 8 Km	5	3.2	5	57
	More or equla to 9 Km	43	27.2	43	100
	Total	100	63.3	100	

S1= Uttara Sector 7no Park; **S2**=Panthokunjo Park; **S3**=Bhadur Sha Park; **M1**=Gulshan Lake Park; **M2**=Anawara Uddan Park; **M3**=Osmani Uddan Park; **L**=Dhanmondi Lake Park; **EL**=Botanical Garden Park.

Table 14. Purpose of the visit

Name of Park	Variable	Frequency	Percent	Valid Percent	Cumulative Percent
S1	Jogging	9	11.2	11.2	11.2
	Physical exercise	14	17.5	17.5	28.8
	Study tour	55	68.8	68.8	97.5
	Others	2	2.5	2.5	100
	Total	80	100	100	
S2	Jogging	18	22.5	22.5	22.5
	Physical exercise	20	25	25	47.5
	Study tour	40	50	50	97.5
	Others	2	2.5	2.5	100
	Total	80	100	100	
S3	Jogging	4	5	5	5
	Physical exercise	16	20	20	25
	Tourism	4	5	5	30
	Study tour	27	33.8	33.8	63.8
	Business	2	2.5	2.5	66.2
	Others	27	33.8	33.8	100
	Total	80	100	100	
M1	Jogging	42	46.7	46.7	46.7
	Physical exercise	16	17.8	17.8	64.4
	Study tour	24	26.7	26.7	91.1
	Others	8	8.9	8.9	100
	Total	90	100	100	
M2	Physical exercise	3	3.3	3.3	3.3
	Tourism	6	6.7	6.7	10
	Study tour	20	22.2	22.2	32.2
	Others	61	67.8	67.8	100
	Total	90	100	100	
M3	Jogging	6	6.7	6.7	6.7
	Physical exercise	4	4.4	4.4	11.1

	Tourism	7	7.8	7.8	18.9
	Study tour	57	63.3	63.3	82.2
	Others	15	16.7	16.7	98.9
	22	1	1.1	1.1	100
	Total	90	100	100	
L	Jogging	7	4.4	7	7
	Physical exercise	3	1.9	3	10
	Tourism	6	3.8	6	16
	Study tour	78	49.4	78	94
	Business	1	0.6	1	95
	Others	5	3.2	5	100
	Total	100	63.3	100	
EL	Jogging	2	1.3	2	2
	Tourism	5	3.2	5	7
	Study tour	90	57	90	97
	Business	1	0.6	1	98
	Others	2	1.3	2	100
	Total	100	63.3	100	

S1= Uttara Sector 7no Park; **S2**=Panthokunjo Park; **S3**=Bhadur Sha Park; **M1**=Gulshan Lake Park; **M2**=Anawara Uddan Park; **M3**=Osmani Uddan Park; **L**=Dhanmondi Lake Park; **EL**=Botanical Garden Park.

Table 15. Visiting the park before

Name of Park	Variable	Frequency	Percent	Valid Percent	Cumulative Percent
S1	Yes	61	76.2	76.2	76.2
	No	19	23.8	23.8	100
	Total	80	100	100	
S2	Yes	74	92.5	93.7	93.7
	No	5	6.2	6.3	100
	Total	80	100	100	
S3	Yes	69	86.2	86.2	86.2
	No	11	13.8	13.8	100
	Total	80	100	100	
M1	Yes	90	100	100	100
M2	Yes	83	92.2	92.2	92.2
	No	7	7.8	7.8	100
	Total	90	100	100	
M3	Yes	84	93.3	93.3	93.3
	No	6	6.7	6.7	100
	Total	90	100	100	
L	Yes	86	54.4	86	86
	No	14	8.9	14	100
	Total	100	63.3	100	
EL	Yes	72	45.6	72	72
	No	28	17.7	28	100
	Total	100	63.3	100	

S1= Uttara Sector 7no Park; **S2**=Panthokunjo Park; **S3**=Bhadur Sha Park; **M1**=Gulshan Lake Park; **M2**=Anawara Uddan Park; **M3**=Osmani Uddan Park; **L**=Dhanmondi Lake Park; **EL**=Botanical Garden Park.

Table 16. Frequency of use of parks

Name of Park	Variable	Frequency	Percent	Valid Percent	Cumulative Percent
S1	Daily	32	40	40	40
	Weekly	17	21.2	21.2	61.2
	Monthly	21	26.2	26.2	87.5
	Yearly	10	12.5	12.5	100

	Total	80	100	100	
S2	Daily	34	42.5	42.5	42.5
	Weekly	33	41.2	41.2	83.8
	Monthly	9	11.2	11.2	95
	Yearly	4	5	5	100
	Total	80	100	100	
S3	Daily	31	38.8	38.8	38.8
	Weekly	30	37.5	37.5	76.2
	Monthly	10	12.5	12.5	88.8
	Yearly	9	11.2	11.2	100
	Total	80	100	100	
M1	Daily	64	71.1	71.1	71.1
	Weekly	20	22.2	22.2	93.3
	Monthly	4	4.4	4.4	97.8
	Yearly	2	2.2	2.2	100
	Total	90	100	100	
M2	Daily	41	45.6	45.6	45.6
	Weekly	19	21.1	21.1	66.7
	Monthly	16	17.8	17.8	84.4
	Yearly	14	15.6	15.6	100
	Total	90	100	100	
M3	Daily	32	35.6	35.6	35.6
	Weekly	33	36.7	36.7	72.2
	Monthly	12	13.3	13.3	85.6
	Yearly	13	14.4	14.4	100
	Total	90	100	100	
L	Daily	61	38.6	61	61
	Weekly	23	14.6	23	84
	Monthly	4	2.5	4	88
	Yearly	12	7.6	12	100
	Total	100	63.3	100	
EL	Daily	20	12.7	20	20
	Weekly	9	5.7	9	29
	Monthly	17	10.8	17	46
	Yearly	54	34.2	54	100
	Total	100	63.3	100	

S1= Uttara Sector 7no Park; **S2**=Panthokunjo Park; **S3**=Bhadur Sha Park; **M1**=Gulshan Lake Park; **M2**=Anawara Uddan Park; **M3**=Osmani Uddan Park; **L**=Dhanmondi Lake Park; **EL**=Botanical Garden Park.

Table 17. Visiting with.....

Name of Park	Variable	Frequency	Percent	Valid Percent	Cumulative Percent
S1	Alone	32	40	40	40
	Spouse	2	2.5	2.5	42.5
	Spouse and children	4	5	5	47.5
	Other family member	23	28.8	28.8	76.2
	Friends	19	23.8	23.8	100
	Total	80	100	100	
S2	Alone	45	56.2	56.2	56.2
	Spouse and children	4	5	5	61.2
	Other family member	7	8.8	8.8	70
	Friends	12	15	15	85
	Colleagues	6	7.5	7.5	92.5
	Others	6	7.5	7.5	100
	Total	80	100	100	
S3	Alone	40	50	50	50
	Other family member	4	5	5	55

	Friends	36	45	45	100
	Total	80	100	100	
M1	Alone	44	48.9	48.9	48.9
	Spouse	2	2.2	2.2	51.1
	Spouse and children	3	3.3	3.3	54.4
	Other family member	12	13.3	13.3	67.8
	Friends	24	26.7	26.7	94.4
	Colleagues	2	2.2	2.2	96.7
	Others	3	3.3	3.3	100
	Total	90	100	100	
M2	Alone	32	35.6	35.6	35.6
	Other family member	3	3.3	3.3	38.9
	Friends	49	54.4	54.4	93.3
	Colleagues	6	6.7	6.7	100
	Total	90	100	100	
M3	Alone	55	61.1	61.1	61.1
	Other family member	1	1.1	1.1	62.2
	Friends	26	28.9	28.9	91.1
	Colleagues	8	8.9	8.9	100
	Total	90	100	100	
L	Alone	49	31	49	49
	Spouse	3	1.9	3	52
	Spouse and children	2	1.3	2	54
	Other family member	4	2.5	4	58
	Friends	42	26.6	42	100
	Total	100	63.3	100	
EL	Alone	12	7.6	12	12
	Spouse	22	13.9	22	34
	Spouse and children	5	3.2	5	39
	Other family member	8	5.1	8	47
	Friends	47	29.7	47	94
	Colleagues	5	3.2	5	99
	Others	1	0.6	1	100
	Total	100	63.3	100	

S1= Uttara Sector 7no Park; **S2**=Panthokunjo Park; **S3**=Bhadur Sha Park; **M1**=Gulshan Lake Park; **M2**=Anawara Uddan Park; **M3**=Osmani Uddan Park; **L**=Dhanmondi Lake Park; **EL**=Botanical Garden Park.

Table 18. Availability of food

Name of Park	Variable	Frequency	Percent	Valid Percent	Cumulative Percent
S1	Available	13	16.2	16.2	16.2
	Satisfactory	4	5	5	21.2
	Scare	63	78.8	78.8	100
	Total	80	100	100	
S2	Available	13	16.2	16.2	16.2
	Satisfactory	4	5	5	21.2
	Scare	63	78.8	78.8	100
	Total	80	100	100	
S3	Available	13	16.2	16.2	16.2
	Satisfactory	4	5	5	21.2
	Scare	63	78.8	78.8	100
	Total	80	100	100	
M1	Available	38	42.2	42.7	42.7
	Satisfactory	51	56.7	57.3	100
	Total	89	98.9	100	
M2	Scarce	90	100	100	100

M3	Satisfactory	2	2.2	2.2	2.2
	Scare	88	97.8	97.8	100
	Total	90	100	100	
L	Available	44	27.8	44	44
	Satisfactory	10	6.3	10	54
	Scare	46	29.1	46	100
	Total	100	63.3	100	
EL	Available	8	5.1	8	8
	Satisfactory	22	13.9	22	30
	Scare	70	44.3	70	100
	Total	100	63.3	100	

S1= Uttara Sector 7no Park; **S2**=Panthokunjo Park; **S3**=Bhadur Sha Park; **M1**=Gulshan Lake Park; **M2**=Anawara Uddan Park; **M3**=Osmani Uddan Park; **L**=Dhanmondi Lake Park; **EL**=Botanical Garden Park.

Table 19. Food Quality

Name of Park	Variable	Frequency	Percent	Valid Percent	Cumulative Percent
S1	Low	3	3.8	3.8	3.8
	Very low	47	58.8	58.8	62.5
	Satisfactory	16	20	20	82.5
	Good	14	17.5	17.5	100
	Total	80	100	100	
S2	Low	68	85	85	85
	Very low	12	15	15	100
	Total	80	100	100	
S3	Low	18	22.5	22.5	22.5
	Very low	1	1.2	1.2	23.8
	2	4	5	5	28.8
	Satisfactory	57	71.2	71.2	100
	Total	80	100	100	
M1	Low	14	15.6	15.6	15.6
	Very low	74	82.2	82.2	97.8
	4	2	2.2	2.2	100
	Total	90	100	100	
M2	Low	14	15.6	15.6	15.6
	Very low	74	82.2	82.2	97.8
	4	2	2.2	2.2	100
	Total	90	100	100	
M3	Low	3	3.3	3.3	3.3
	Very low	71	78.9	78.9	82.2
	Satisfactory	16	17.8	17.8	100
	Total	90	100	100	
L	Low	34	21.5	34	34
	Very low	21	13.3	21	55
	Satisfactory	26	16.5	26	81
	Good	19	12	19	100
	Total	100	63.3	100	
EL	Low	48	30.4	48	48
	Very low	33	20.9	33	81
	Satisfactory	15	9.5	15	96
	Good	4	2.5	4	100
	Total	100	63.3	100	

S1= Uttara Sector 7no Park; **S2**=Panthokunjo Park; **S3**=Bhadur Sha Park; **M1**=Gulshan Lake Park; **M2**=Anawara Uddan Park; **M3**=Osmani Uddan Park; **L**=Dhanmondi Lake Park; **EL**=Botanical Garden Park.

Table 20. Availability of Drinking water

Name of Park	Variable	Frequency	Percent	Valid Percent	Cumulative Percent
S1	Scare	80	100	100	100
S2	Scare	80	100	100	100
S3	Scare	80	100	100	100
M1	Scare	70	77.8	77.8	77.8
	Available	6	6.7	6.7	84.4
	Satisfactory	14	15.6	15.6	100
	Total	90	100	100	
M2	Scarce	90	100	100	100
M3	Scare	86	95.6	95.6	95.6
	Satisfactory	4	4.4	4.4	100
	Total	90	100	100	
L	Scare	37	23.4	37	37
	Available	41	25.9	41	78
	Satisfactory	21	13.3	21	99
	Not Satisfactory	1	0.6	1	100
	Total	100	63.3	100	
EL	Scare	77	48.7	77	77
	Available	8	5.1	8	85
	Satisfactory	15	9.5	15	100
	Total	100	63.3	100	

S1= Uttara Sector 7no Park; **S2**=Panthokunjo Park; **S3**=Bhadur Sha Park; **M1**=Gulshan Lake Park; **M2**=Anawara Uddan Park; **M3**=Osmani Uddan Park; **L**=Dhanmondi Lake Park; **EL**=Botanical Garden Park.

Table 21. Comments on Security

Name of Park	Variable	Frequency	Percent	Valid Percent	Cumulative Percent
S1	Excellent	20	25	25	25
	Good	25	31.2	31.2	56.2
	Satisfactory	19	23.8	23.8	80
	Bad	16	20	20	100
	Total	80	100	100	
S2	Good	2	2.5	2.5	2.5
	Satisfactory	51	63.8	63.8	66.2
	Bad	22	27.5	27.5	93.8
	Worse	5	6.2	6.2	100
	Total	80	100	100	
S3	Good	37	46.2	46.2	46.2
	Satisfactory	12	15	15	61.2
	Bad	27	33.8	33.8	95
	Worse	4	5	5	100
	Total	80	100	100	
M1	Excellent	90	100	100	100
M2	Good	2	2.2	2.2	2.2
	Satisfactory	16	17.8	18	20.2
	Bad	31	34.4	34.8	55.1
	Worse	40	44.4	44.9	100
	Total	89	98.9	100	
M3	Good	8	8.9	8.9	8.9
	Satisfactory	42	46.7	46.7	55.6
	Bad	20	22.2	22.2	77.8
	Worse	20	22.2	22.2	100
	Total	90	100	100	
L	Excellent	1	0.6	1	1

	Good	46	29.1	46	47
	Satisfactory	41	25.9	41	88
	Bad	12	7.6	12	100
	Total	100	63.3	100	
EL	Excellent	4	2.5	4	4
	Good	13	8.2	13	17
	Satisfactory	54	34.2	54	71
	Bad	22	13.9	22	93
	Worse	7	4.4	7	100
	Total	100	63.3	100	

S1= Uttara Sector 7no Park; **S2**=Panthokunjo Park; **S3**=Bhadur Sha Park; **M1**=Gulshan Lake Park; **M2**=Anawara Uddan Park; **M3**=Osmani Uddan Park; **L**=Dhanmondi Lake Park; **EL**=Botanical Garden Park.

Table 22. Specific features attraction

Name of Park	Variable	Frequency	Percent	Valid Percent	Cumulative Percent
S1	Green space	53	66.2	66.2	66.2
	Cultural feature	27	33.8	33.8	100
	Total	80	100	100	
S2	Green space	58	72.5	72.5	72.5
	Cultural feature	22	27.5	27.5	100
	Total	80	100	100	
S3	Green space	51	63.8	63.8	63.8
	Cultural feature	29	36.2	36.2	100
	Total	80	100	100	
M1	Green space	63	70	70	70
	Cultural feature	27	30	30	100
	Total	90	100	100	
M2	Green space	56	62.2	62.2	62.2
	Cultural feature	34	37.8	37.8	100
	Total	90	100	100	
M3	Green space	48	53.3	53.3	53.3
	Cultural feature	42	46.7	46.7	100
	Total	90	100	100	
L	Green space	112	70.9	71.3	71.3
	Cultural feature	45	28.5	28.7	100
	Total	157	99.4	100	
EL	Green space	118	74.7	75.2	75.2
	Cultural feature	39	24.7	24.8	100
	Total	157	99.4	100	

S1= Uttara Sector 7no Park; **S2**=Panthokunjo Park; **S3**=Bhadur Sha Park; **M1**=Gulshan Lake Park; **M2**=Anawara Uddan Park; **M3**=Osmani Uddan Park; **L**=Dhanmondi Lake Park; **EL**=Botanical Garden Park.

Table 23. Satisfaction on environment

Name of Park	Variable	Frequency	Percent	Valid Percent	Cumulative Percent
S1	Yes	66	82.5	82.5	82.5
	No	14	17.5	17.5	100
	Total	80	100	100	
S2	Yes	57	71.2	71.2	71.2
	No	23	28.8	28.8	100
	Total	80	100	100	
S3	Yes	32	40	40	40
	No	48	60	60	100
	Total	80	100	100	
M1	Yes	90	100	100	100

M2	Green space	56	62.2	62.2	62.2
	Cultural feature	34	37.8	37.8	100
	Total	90	100	100	
M3	Yes	37	41.1	41.1	41.1
	No	53	58.9	58.9	100
	Total	90	100	100	
L	Yes	88	55.7	57.1	57.1
	No	66	41.8	42.9	100
	Total	154	97.5	100	
EL	Yes	120	75.9	76.9	76.9
	No	36	22.8	23.1	100
	Total	156	98.7	100	

S1= Uttara Sector 7no Park; **S2**=Panthokunjo Park; **S3**=Bhadur Sha Park; **M1**=Gulshan Lake Park; **M2**=Anawara Uddan Park; **M3**=Osmani Uddan Park; **L**=Dhanmondi Lake Park; **EL**=Botanical Garden Park.

Table 24. Face any trouble

Name of Park	Variable	Frequency	Percent	Valid Percent	Cumulative Percent
S1	Yes	56	70	70	70
	No	24	30	30	100
	Total	80	100	100	
S2	Yes	80	100	100	100
S3	Yes	80	100	100	100
M1	Yes	30	33.3	33.3	33.3
	No	60	66.7	66.7	100
	Total	90	100	100	
M2	Yes	88	97.8	97.8	97.8
	No	2	2.2	2.2	100
	Total	90	100	100	
M3	Yes	61	67.8	67.8	67.8
	No	29	32.2	32.2	100
	Total	90	100	100	
L	Yes	54	34.2	54	54
	No	46	29.1	46	100
	Total	100	63.3	100	
EL	Yes	72	45.6	72	72
	No	28	17.7	28	100
	Total	100	63.3	100	

S1= Uttara Sector 7no Park; **S2**=Panthokunjo Park; **S3**=Bhadur Sha Park; **M1**=Gulshan Lake Park; **M2**=Anawara Uddan Park; **M3**=Osmani Uddan Park; **L**=Dhanmondi Lake Park; **EL**=Botanical Garden Park.

Table 25. Would you like to visit again?

Name of Park	Variable	Frequency	Percent	Valid Percent	Cumulative Percent
S1	Yes	80	100	100	100
S2	Yes	66	82.5	82.5	82.5
	No	14	17.5	17.5	100
	Total	80	100	100	
S3	Yes	72	90	90	90
	No	8	10	10	100
	Total	80	100	100	
M1	Yes	90	100	100	100
M2	Yes	89	98.9	98.9	98.9
	No	1	1.1	1.1	100
	Total	90	100	100	
M3	Yes	55	61.1	61.1	61.1

	No	35	38.9	38.9	100
	Total	90	100	100	
L	Yes	94	59.5	94	94
	No	6	3.8	6	100
	Total	100	63.3	100	
EL	Yes	96	60.8	96	96
	No	4	2.5	4	100
	Total	100	63.3	100	

S1= Uttara Sector 7no Park; **S2**=Panthokunjo Park; **S3**=Bhadur Sha Park; **M1**=Gulshan Lake Park; **M2**=Anawara Uddan Park; **M3**=Osmani Uddan Park; **L**=Dhanmondi Lake Park; **EL**=Botanical Garden Park.

Table 26. Feeling about current visit?

Name of Park	Variable	Frequency	Percent	Valid Percent	Cumulative Percent
S1	Excellent	27	33.8	33.8	33.8
	Good	47	58.8	58.8	92.5
	Satisfactory	6	7.5	7.5	100
	Total	80	100	100	
S2	Good	30	37.5	37.5	37.5
	Satisfactory	48	60	60	97.5
	Bad	2	2.5	2.5	100
	Total	80	100	100	
S3	Good	76	95	95	95
	Satisfactory	3	3.8	3.8	98.8
	Bad	1	1.2	1.2	100
	Total	80	100	100	
M1	Excellent	20	22.2	22.2	22.2
	Good	33	36.7	36.7	58.9
	Satisfactory	37	41.1	41.1	100
	Total	90	100	100	
M2	Good	36	40	40	40
	Satisfactory	54	60	60	100
	Total	90	100	100	
M3	Excellent	10	11.1	11.1	11.1
	Good	39	43.3	43.3	54.4
	Satisfactory	37	41.1	41.1	95.6
	Bad	4	4.4	4.4	100
	Total	90	100	100	
L	Excellent	6	3.8	6.1	6.1
	Good	57	36.1	57.6	63.6
	Satisfactory	36	22.8	36.4	100
	Total	99	62.7	100	
EL	Excellent	17	10.8	17	17
	Good	41	25.9	41	58
	Satisfactory	40	25.3	40	98
	Bad	2	1.3	2	100
	Total	100	63.3	100	

S1= Uttara Sector 7no Park; **S2**=Panthokunjo Park; **S3**=Bhadur Sha Park; **M1**=Gulshan Lake Park; **M2**=Anawara Uddan Park; **M3**=Osmani Uddan Park; **L**=Dhanmondi Lake Park; **EL**=Botanical Garden Park.

Table 27. Staying time inside the parks

Name of Park	Variable	Frequency	Percent	Valid Percent	Cumulative Percent
S1	Less or Equal to Half an Hour	13	16.2	16.2	16.2
	51 hours to 1 hour	38	47.5	47.5	63.8

	1.01 to 1.50 hours	9	11.2	11.2	75
	More or equal to 1.51 hours	20	25	25	100
	Total	80	100	100	
S2	Less or Equal to Half an Hour	35	43.8	43.8	43.8
	51 hours to 1 hour	25	31.2	31.2	75
	1.01 to 1.50 hours	4	5	5	80
	More or equal to 1.51 hours	16	20	20	100
	Total	80	100	100	
S3	Less or Equal to Half an Hour	10	12.5	12.5	12.5
	51 hours to 1 hour	18	22.5	22.5	35
	1.01 to 1.50 hours	10	12.5	12.5	47.5
	More or equal to 1.51 hours	42	52.5	52.5	100
	Total	80	100	100	
M1	Less or Equal to Half an Hour	26	28.9	28.9	28.9
	51 hours to 1 hour	39	43.3	43.3	72.2
	1.01 to 1.50 hours	15	16.7	16.7	88.9
	More or equal to 1.51 hours	10	11.1	11.1	100
	Total	90	100	100	
M2	Less or Equal to Half an Hour	54	60	60	60
	51 hours to 1 hour	24	26.7	26.7	86.7
	1.01 to 1.50 hours	8	8.9	8.9	95.6
	More or equal to 1.51 hours	4	4.4	4.4	100
	Total	90	100	100	
M3	Less or Equal to Half an Hour	20	22.2	22.2	22.2
	51 hours to 1 hour	32	35.6	35.6	57.8
	1.01 to 1.50 hours	14	15.6	15.6	73.3
	More or equal to 1.51 hours	24	26.7	26.7	100
	Total	90	100	100	
L	Less or Equal to Half an Hour	16	10.1	16	16
	51 hours to 1 hour	28	17.7	28	44
	1.01 to 1.50 hours	11	7	11	55
	More or equal to 1.51 hours	45	28.5	45	100
	Total	100	63.3	100	
EL	Less or Equal to Half an Hour	6	3.8	6	6
	51 hours to 1 hour	19	12	19	25
	1.01 to 1.50 hours	2	1.3	2	27
	More or equal to 1.51 hours	73	46.2	73	100
	Total	100	63.3	100	

S1= Uttara Sector 7no Park; **S2**=Panthokunjo Park; **S3**=Bhadur Sha Park; **M1**=Gulshan Lake Park; **M2**=Anawara Uddan Park; **M3**=Osmani Uddan Park; **L**=Dhanmondi Lake Park; **EL**=Botanical Garden Park.

Table 28. Transport Cost

Name of Park	Variable	Frequency	Percent	Valid Percent	Cumulative Percent
S1	Less or Equal to 10 Tk	39	48.8	48.8	48.8
	11 to 20 Tk	6	7.5	7.5	56.2
	21 to 30 Tk	7	8.8	8.8	65
	31 to 40 Tk	11	13.8	13.8	78.8
	More or equal to 40 Tk	17	21.2	21.2	100
	Total	80	100	100	
S2	Less or Equal to 10 Tk	79	98.8	98.8	98.8
	11 to 20 Tk	1	1.2	1.2	100
	Total	80	100	100	
S3	Less or Equal to 10 Tk	44	55	55	55
	11 to 20 Tk	8	10	10	65
	21 to 30 Tk	2	2.5	2.5	67.5
	31 to 40 Tk	7	8.8	8.8	76.2
	More or equal to 40 Tk	19	23.8	23.8	100
	Total	80	100	100	
M1	Less or Equal to 10 Tk	82	91.1	91.1	91.1
	11 to 20 Tk	4	4.4	4.4	95.6
	21 to 30 Tk	2	2.2	2.2	97.8
	31 to 40 Tk	2	2.2	2.2	100
	Total	90	100	100	
M2	Less or Equal to 10 Tk	43	47.8	47.8	47.8
	11 to 20 Tk	25	27.8	27.8	75.6
	21 to 30 Tk	9	10	10	85.6
	31 to 40 Tk	8	8.9	8.9	94.4
	More or equal to 40 Tk	5	5.6	5.6	100
	Total	90	100	100	
M3	Less or Equal to 10 Tk	46	51.1	51.1	51.1
	11 to 20 Tk	4	4.4	4.4	55.6
	21 to 30 Tk	6	6.7	6.7	62.2
	31 to 40 Tk	3	3.3	3.3	65.6
	More or equal to 40 Tk	31	34.4	34.4	100
	Total	90	100	100	
L	Less or Equal to 10 Tk	59	37.3	59	59
	11 to 20 Tk	9	5.7	9	68
	21 to 30 Tk	11	7	11	79
	31 to 40 Tk	2	1.3	2	81
	More or equal to 40 Tk	19	12	19	100
	Total	100	63.3	100	
EL	Less or Equal to 10 Tk	24	15.2	24	24
	11 to 20 Tk	11	7	11	35
	21 to 30 Tk	7	4.4	7	42
	31 to 40 Tk	6	3.8	6	48
	More or equal to 40 Tk	52	32.9	52	100
	Total	100	63.3	100	

S1= Uttara Sector 7no Park; **S2**=Panthokunjo Park; **S3**=Bhadur Sha Park; **M1**=Gulshan Lake Park; **M2**=Anawara Uddan Park; **M3**=Osmani Uddan Park; **L**=Dhanmondi Lake Park; **EL**=Botanical Garden Park.

Table 29. Staying Cost

Name of Park	Variable	Frequency	Percent	Valid Percent	Cumulative Percent
S1	Less or Equal to 10Tk	31	38.8	38.8	38.8
	11 to 20 Tk	14	17.5	17.5	56.2
	21 to 30Tk	16	20	20	76.2

	31 to 40 Tk	7	8.8	8.8	85
	More or equal to 41 Tk	12	15	15	100
	Total	80	100	100	
S2	Less or Equal to 10Tk	73	91.2	91.2	91.2
	11 to 20 Tk	1	1.2	1.2	92.5
	21 to 30Tk	2	2.5	2.5	95
	31 to 40 Tk	4	5	5	100
	Total	80	100	100	
S3	Less or Equal to 10Tk	44	55	55	55
	11 to 20 Tk	17	21.2	21.2	76.2
	21 to 30Tk	7	8.8	8.8	85
	31 to 40 Tk	7	8.8	8.8	93.8
	More or equal to 41 Tk	5	6.2	6.2	100
	Total	80	100	100	
M1	Less or Equal to 10Tk	74	82.2	82.2	82.2
	11 to 20 Tk	9	10	10	92.2
	21 to 30Tk	5	5.6	5.6	97.8
	More or equal to 41 Tk	2	2.2	2.2	100
	Total	90	100	100	
M2	Less or Equal to 10Tk	13	14.4	14.4	14.4
	11 to 20 Tk	48	53.3	53.3	67.8
	21 to 30Tk	13	14.4	14.4	82.2
	31 to 40 Tk	4	4.4	4.4	86.7
	More or equal to 41 Tk	12	13.3	13.3	100
	Total	90	100	100	
M3	Less or Equal to 10Tk	35	38.9	38.9	38.9
	11 to 20 Tk	25	27.8	27.8	66.7
	21 to 30Tk	20	22.2	22.2	88.9
	31 to 40 Tk	10	11.1	11.1	100
	Total	90	100	100	
L	Less or Equal to 10Tk	58	36.7	58	58
	11 to 20 Tk	23	14.6	23	81
	21 to 30Tk	7	4.4	7	88
	31 to 40 Tk	8	5.1	8	96
	More or equal to 41 Tk	4	2.5	4	100
	Total	100	63.3	100	
EL	Less or Equal to 10Tk	34	21.5	34	34
	11 to 20 Tk	10	6.3	10	44
	21 to 30Tk	12	7.6	12	56
	31 to 40 Tk	11	7	11	67
	More or equal to 41 Tk	33	20.9	33	100
	Total	100	63.3	100	

S1= Uttara Sector 7no Park; **S2**=Panthokunjo Park; **S3**=Bhadur Sha Park; **M1**=Gulshan Lake Park; **M2**=Anawara Uddan Park; **M3**=Osmani Uddan Park; **L**=Dhanmondi Lake Park; **EL**=Botanical Garden Park.