Ecosystem Approach towards Qualitative Assessment of Urban Open Space in Ramna

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The thesis entitled "**Eco-System Approach Towards Qualitative Assessment of Urban Open Space in Ramna**" submitted by Shabab Raihan Kabir Roll No. 040201008P; Session: April 2002, is acceptable in partial fulfilment of the requirement for the degree of **Master of Architecture** on this day, 27 June 2009.

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Dedicated

To My Father and Mother

Shamsul Kabir,

Rokeya Akhter

&

to the Young.....who hold in their hands the shape of tomorrow.

Acknowledgements

[All praises to Almighty Allah, most Kind and Merciful]

Those to whom I am indebted are legion. To list any is to risk omitting many. They are

students and teachers,

writers and scientists,

architects, planners and engineers

colleagues and clients,

family and friends.

Many will recognize in these writings some personal contribution for this,

and to them, I am grateful.

The creative guidance and work of Professor Dr. Qazi Azizul Mowla, Professor Khaleda Rashid and Professor Md. Shamsul Kabir have been so telling, however, that they must be singled out for special thanks.

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Abbreviation

- BBS BANGLADESH BUREAU OF STATISTICS
- BIRDEM Bangladesh Institute of Research and Rehabilitation in Diabetes, Endocrine and Metabolic Disorders
- BSMMU BANGABANDHU SHEIKH MUJIBUR RAHMAN MEDICAL UNIVERSITY
- BUET BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY
- BRTA BANGLADESH ROADS AND TRANPORT AUTHORITY
- CBD CENTRAL BUSINESS DISTRICT
- DAB DOCTORS ASSOCIATION OF BANGLADESH
- DCC DHAKA CITY CORPORATION
- DoA DEPARTMENT OF ACHITECTURE
- DoE DEPARTMENT OF ENVIRONMENT
- dB DECIBEL
- DIT DACCA IMPROVEMENT TRUST
- DMP DHAKA METROPOLITAN PLAN
- DESA DHAKA ELECTRIC SUPPLY AUTHORITY
- DU DHAKA UNIVERSITY
- GIS GLOBAL INFORMATION SYSTEM
- GoB GOVERNMENT OF BANGLADESH
- LGED LOCAL GOVERNMENT ENGINEERING DEPARTMENT
- PWD PUBLIC WORKS DEPARTMENT
- RHD ROADS AND HIGHWAYS DEPARTMENT
- RajUK RAJDHANI UNNAYAN KARTEPAKKHA (*CAPITAL DEVELOPMENT AUTHORITY*)
- NASA NATIONAL AERONAUTICAL AND SPACE ADMINISTRATION
- SAARC SOUTH ASIAN ASSOCIATION OF REGIONAL CO-OPERATION
- TSC TEACHERS STUDENTS CENTRE
- WASA WATER AND SEWERAGE AUTHORITY

Ecosystem Approach towards Qualitative Assessment of Urban Open Space in Ramna

Abstract

Economic development with no environmental control leads to an ecological or environmental degradation which adversely affect the quality of life. The study identifies the major impacts of development activities on the urban environment in Ramna open space, Dhaka. An ecosystem is a distinct area in the biosphere, where living and non living things interact within and between each other to produce a sustainable environment. Ramna is assumed here as an ecosystem for analysis. Eco-architects have designed responsive spaces in the temperate climates based on eco-design concepts and it is believed that Bangladesh being in the tropical area is better placed to tap the ecological resources in their built environment design. Dhaka needs huge open spaces for urban sustainability including space needed for different public functions and recreational activities. Ramna being the largest and oldest of urban open spaces in Dhaka and being still capable of attracting activities is considered for studying with respect to its ecological status and the human response towards its environment. Though reduced in area due to various encroachments over time, the area has continued to attract more and more cultural and recreational events and has emerged as the cultural and recreational hub of the bustling metropolis. The objective of this study is to assess the status of urban open space in Ramna in terms of some qualitative yard stick.

Since it is assumed that the changing quality in terms of biomass of environment has a bearing on the users response, and as there is no such study so far on Dhaka's open spaces, the study would attempt at methodical analysis of the study area within a carefully defined 'design principles' and evaluated against yard stick provided by authors like Haysil and Yeang. The study is expected to stimulate discussion on the theoretical background to urban open spaces as ecological node and to serve as a design guideline of ideas for the contemporary urban designers. Dhaka is located in the geographic center of the country and the Ramna is in between the old and new Dhaka. The geomorphology of the Ramna area is intense and the character is defined by the lakes, ponds, green open spaces, Micro Ramna and Macro Ramna and by the dense built-form situated at a short distance around the open spaces. People moving all the day long in Ramna produce wastes and pollutions. Here in Ramna large and small plants and huge lake is considered as the habitat of diversity of spices of organisms, which has been evaluated to assess the users' response Vis a Vis the character of the 'Nature'.

In a nutshell, the eco-design is designing the built-environment as a system considering the ecological footprint of the area. The outlook on urban quality is changing nowadays, as a part of general shift in cultural values. The need for change is primarily a result of the continuous process of intensification of land use. Openness has become an important issue in Dhaka today. The purpose of this paper is to assess qualitative parameters of dynamics of the urban open space in Ramna, thereby enabling the designers to understand the contribution of open spaces in densely built environment like that of Ramna area. The study identified the causes of deteriorating urban environment at Ramna to that of the lack of public awareness towards their life style and pattern of living, nevertheless it concluded that outdoor spaces so to say open spaces of any type; spacious-non spacious, spectacular-non spectacular, formal-Informal that is in or around the settlements, shape or contribute towards the liveliness of a city- the effect is enhanced when it is green and there is biodiversity of local plants.

Chapter I

Introduction

1.1 Background of the Study
1.2 Objective of the Study
1.3 Rationale of the Study
1.4 Scope of the Study
1.5 Method of the Study
1.6 Organization of the Study

1.1 Background of the Study:

1.1.1 Backdrop of Research: An ecosystem is a distinct area in the biosphere, where living and non living things interact within and between each other to produce a sustainable environment (Ken Yeang, 2004). The condition in which an animal or a human being lives along with other species of plants and animals in an area affects its life. In fact outdoor spaces so to say open spaces of any type; spacious-non spacious, spectacular-non spectacular, formal-informal that surround us in our every day situation shape the major part of our lives (Mowla, 2005a). In spite of this the urban open spaces are shrinking and are becoming less accessible at an alarming rate. The urbanization bonanza and market forces are blind folding us to the reality of the many ways in which the world around us is diminishing and emaciating. As cities are growing at a very faster rate, so the huge open spaces become ever more important for the well being of the urban dwellers (Ken Yeang, 2004). This is, as we experience today, more true of Dhaka, hundreds of public open spaces of different sizes were either partly or fully lost to building structures (Mowla, 1999a). Like any other sustainable city, Dhaka needs a huge stock of open spaces for urban services or utilities and circulation besides space needed for different public function and recreational activities (Mowla, 2005 and Rubenstain, 1992). It is known that for a healthy city we need a right balance and proportion of built-up open spaces (Rubenstain, 1992). It is found that there is a correlation between biomass in an area and it has a soothing effect on the environment and the sustainability (Vroom and Meeus, Eds,1989) of urban open spaces in terms of the pattern of socio-recreational activities in that area (Haysil, 2002). With this backdrop, it may be said that the prime problem in our urban context is over heating, pollution and water-logging while governing ingredients in the natural environment are open spaces, woods and water bodies and the environmental variables are temperature, relative humidity, air velocity, precipitation, soil-moisture and biomes. Ramna being the largest and oldest of urban open spaces in Dhaka is considered here for studying in terms of it's ecological status and human response to the environment of Ramna.

Historically Ramna area went through different phases of transformation but it never lost its basic character of an urban socio-cultural and recreational centre. Though much reduced in area due to various encroachments, the area has continued to attract more and more cultural and recreational events and has emerged as the cultural and recreational hub of the busting metropolis (Mowla, 1999a).

1.1.2 The Problem Identification: Cities are not universal in character nor do they have universal requirements. Thus, the variation in shape, size, layout, treatment, and development of urban open spaces is an offshoot of physical, socio-cultural, political and economic factors. Time and historical layering also play an important role on the open space configuration of the city. Thus, different localities of a city have different set up of open space situation. The open spaces in Dhaka are grossly inadequate, socially and ecologically (Mowla, 2005a). The theme is that the existing lattice of open space must not be destroyed any more but revitalized. Staying within these basic parameters every city has to take effective strategy to develop its own urban open space system. Prudent and creative utilization of every single bit of open spaces could bring life to the city, accelerate economic growth, and improve environmental, ecological and social quality. To tackle the situation the city has to show innovative infrastructure development. Moreover, metropolitan areas often have diverse jurisdictions. So creative and heroic thinking is needed to change some of the jurisdictions (Khaleda, 2003).

The image of Dhaka is not derived from its concrete parts like building, roads etc. it is much deeper and more fluid, that is, its people, pattern of spaces and activities therein, the relationship between the living and nonliving part of its environment, time, space and the people. Any space in an urban area outside the buildings constitutes urban open space and the design and management of these spaces are crucial to urban sustainability and image. A common notion is that ecosystem or biodiversity or eco-design is something outside the city boundaries, whereas 'green open space', 'parks', 'gardens' etc are found within (Mowla 2005a). This Study presents a searching appraisal of the spatial structure of the development at Ramna Area of Dhaka. It, therefore, looks into the spatial configuration of these developments in relation to its Social, Physical and Biological contexts. Since it is assumed that the changing quality in terms of biomass of environment has a bearing on the users response and as there is no such study so far on Dhaka's open spaces, the study attempts at methodical analysis of urban open space in Ramna within a carefully defined 'design principles' and evaluated against '*sustainability checklist*' provided by Haysil (2002) and '*partitioned matrix*' approach adopted by Yeang (2004). The study is expected to stimulate discussion on the theoretical

background of urban open spaces as urban ecological node and serve as a model for the contemporary urban designers in organizing and distributing urban open spaces in the city.

1.2 Objective of the Study:

The objective of this research is as follows:

i. To assess the world scenario in the field of ecosystem approach towards qualitative assessment of urban open spaces i.e. to study the global standards and draw a framework to investigate in Dhaka's context.

ii. To investigate the effect of man-made and seasonal changing biomass (type and volume of vegetation) on various environmental parameters (air quality, water quality, soil quality, solar radiation, temperature, precipitation, wind etc.) and consequently its impact on user's response in the Urban Open Space of Ramna. A correlation between changing biomass and environmental parameters and user's response is investigated.

1.3 Rationale of the Study:

As cities grow ever more densely developed, so the remaining green spaces grow ever more important for the well being of the cities' inhabitants. At present Dhaka city is almost a jungle of concrete blocks, there is hardly any open space or water body left. To create accessible open spaces now mean many structures are to be torn down in different localities. This proposition is neither practical nor feasible. Thus it can be argued, the design of existing green and open spaces- for the most part, urban parks - should receive attention equal to that of the cities' buildings. However their status is required to be determined first.

The next important factor to remember is that the man himself is an important part of community and if the community is not in the state of balance the man himself will suffer as much as any other community. The most important factor in the list is perhaps the responsibility that the architect/ planner have for the long term development of built environment. This includes factors such as traffic planning for low emissions, urban typologies that promote compact solutions with high service levels while maintaining green and other spatial qualities, provision for mixed uses and integration of social classes and cultural groups. The available open spaces are required to be organized judiciously to maximize its response.

The eco-design ideas help to advance the concept of sustainable urban spaces and ways to organize them. In case of Ramna's urban open space, different phases of transformation did not alter its basic character much, as being the urban socio-cultural and recreational centre. Though reduced in area due to various encroachments, the area has continued to attract more and more cultural and recreational events. What are the attributes that have remained intact in spite of massive interference is evaluated. The hypothesis, that

besides other factors, there is a correlation between bio-mass and pattern of socio recreational activities, is studied in this dissertation.

1.4 Scope of the Study:

The study examines the current functions of open spaces, including the benefits and disadvantages of the present systems. Attempts have been made to asses the present use with a special focus of spatial consequences considering the time frame; it is too big a target. Therefore a smaller area, Ramna, has been selected for qualitative assessment. So, the scope for conducting the present research rests on the fact that to fill up the theoretical and empirical gap of knowledge in the following areas:

- Review the components of ecosystems and ecological imperatives, in the case of Ramna.
- Analysis and synthesis of the Ramna area in terms of the eco-sustainable design checklist.

1.4.1 Limitations of the Study: The present study does not aim to set up an integrated policy for the eco-sustainable design procedure in Dhaka city. It is intended to develop a research process, evaluating the potential role of eco-sustainable design concepts which provides appropriate guidelines to reconcile the better use of urban green open spaces. The important constrains to the scope of the research are time, budget, and appropriate data as well as adequate literature source. However, in this study, the scope has been limited to a manageable level by considering time and resource constraints. Since the performance of a space varies with diurnal and seasonal changes, collection of data for all conditions is beyond the scope of this study. The time frame for the study and the scarcity of required primary data from the field level are therefore the main obstacle. The study focuses on qualitative assessment of Ramna open space based on some ecological parameters.

1.4.2 Assumptions and Focus of Study: The study focuses on the search of the quantitative indicators and of open space condition of Ramna. It also examines the public concern and action on the basis of ecological imperatives or footprint. The studied area is evaluated with several eco-sustainable design check lists or ecological footprints (annexure-4) suggested by various authors (Ken Yeang, 2004; Mowla, 2005; Haysil, 2002).

1.5 Method of the Study:

Overall research design may be classified under three major phases i.e. i) Literature review to set the framework for analysis; ii) Quantitative survey to take relevant data from secondary sources and reinterpret for using in this research as a complimentary data; iii) Qualitative study, which is the main thrust of this research, was to obtain basic knowledge of ecosystems, urban open spaces and human responses to various situation. Interviews with the users were also a part of this qualitative process.

Method, therefore, employed a combination of literature review and field survey concerning the eco-sustainability of Ramna area, the largest and the oldest designed green open space of the city, in the case study site. After reconnaissance survey of Dhaka it was found that Ramna is the most dynamic of open spaces in Dhaka attracting maximum number of social events of the city. The observations were taken at two different climatic periods when corresponding social response is clearly evident. One between January to March 2005 during winter and spring of stable weather conditions, clear skies, low temperature and low relative humidity values, accompanied by low winds. The second measures were taken between July to September 2005 during rainy season conditions: heavy rain fall with cloudy skies, high temperature and high relative humidity values accompacied by high winds.

a. A literature survey has been done to set a framework for ecosystem approach towards qualitative assessment of urban open spaces.

b. i) Site survey and analysis were done over two representative climatic periods in a year (approx. January - March and July - September).
ii) Physical data were gathered on the changing pattern and quality of open spaces in the study area in terms of biomass, water bodies, and other active and passive elements contributing towards the quality of environment.

c. Final set of data were gathered to fine tune the correlations and findings.

Defining the Boundary: Ramna Area is one of the popular recreational areas and a recognized socio-cultural open space of Dhaka, which is in huge demand by its citizens. The study was done over the land of the green park which has an area of approximately 155 acres and the built structures of the adjacent areas. The field survey on this open space has categorized the site surroundings into three main laboratories for study.

Fig: 1.1: Study Laboratory Loop in the Study Area.

Educational, Historic and Public Zone:	**(Lab 01)**

Area: Central Shahid Minar, Carzon Hall, Bangla Academy, Central Library of DU to Shah Bagh with adjacent Suhrawardi Uddyan.

Services and Hospitality Zone:	**(Lab 02)**

Area: Sheraton Hotel to Sonargaon Hotel area; basically a services zone.

Administrative and Park Zone:	(Lab 03)

Area: Ramna Park, Hare road, Front of press club and PWD Building, Towards Mintu Road.

1.6 Organization of the Study:

The present study has been organized in six chapters. Chapter One presents state-of-art, background and justification of the research work along with the objectives, scope, rationale and method of the study.

Chapter Two includes the literature reviews which describe the findings about nature, built environment and ecology and overall earthscape. Reviews of the eco-planning concepts for the effecting urban open spaces are also discussed. In this discussion, tools for qualitative assessment are identified for using as a yardstick for this study. Here a framework for research is also established.

Chapter Three deals with evolution and growth of Urban Dhaka and also dealt with the historical evaluation of Ramna Area. The important features of Ramna and the encroachments by the city dwellers to this open green space are briefly presented in this chapter. It identifies the quantitative and qualitative indicators of open space responsiveness. In this section, the study focuses on two specific dimensions, the social and aesthetic responsiveness of open spaces.

Chapter Four checked the findings of the site survey against the urban ecology check list which was done over two representative climatic periods. The study identifies a number of attributes to check the ecological fitness of this area, which is termed as an urban ecology checklist or eco-footprint.

Chapter Five analyzed and synthesized the Ramna's open space in the context of built environment. The out door activities by the visitors, visible landscape, enclosure, recreational facilities, streetscape and footpath circumstances are discussed. Data were also collected from the Lab 01, 02 and 03, to assess the performance of open space in different context. This chapter compliments the previous chapter to assess the responsiveness indicators. This chapter also presented the eco-sustainable design check list and based on which, Ramna area is evaluated to assess its status. The study evolved a table that may serve as a checklist for sustainable design in future.

Chapter Six that is a concluding one, provides a summary of all findings and a discussion to conclude the research work and identify future research in this context. This chapter ends with some broad range of recommendations as a general guideline and conclusion of the study.

Chapter II

Literature Review

2.6 Qualitative Study and the Evaluation Criteria for Ecosystem of Urban Open Spaces
2.7 Review of the Planning Concepts Effecting Urban Open Spaces
2.8 Ecological Footprint and Theory of Partitioned Matrix
2.9 The Environmental Crisis – Need of Sustainable Open Space
2.10 Research Framework

2.1 Qualitative Study and Evaluation Criteria for Ecosystem of Urban Open Spaces:

Building upon the 'Background of the Study' section of chapter-I as the bases of literature review, it may be said that the ecological knowledge is a valuable technical input to the built environment design process. At first sight this attitude is a rather difficult one to grasp, a situation which is not aided by some muddled thinking which has been associated with it. But a great deal of understanding about Urban open space design can be gained by exploring the symbolism of ecology and conservation in open spaces, even if at the end we agree to differ that landscape design is, above all, design with plants. This is not necessarily true, as will be seen, though in practice most landscape schemes do use plants (Free, 1991).

There are specific skills in the design of open spaces, and the most successful schemes were often in the rare cases where the abilities of architect, urban designer and landscape architect were combined in one person. Ecology as a technical input into design is essentially a quite straightforward idea, especially when applied to urban situations. It says that everything is related to every thing else, therefore, the elements of urban open spaces are to be carefully selected (Mowla, 2008). In environmental design, which by definition is design for everyday surroundings, they also constitute the qualitative aspects of the design, as distinct from quantitative functional or technical characteristics. Such qualitative functions have great influence on the degree to which the environment imparts a sense of well-being. The choice of qualitative characteristics when designing for an existing built environment, where there is something clearly to fit to, or to contrast with, is easier than thinking up completely new ideas for new developments (Simonds,1978).

An ecosystem is any spatial part or organizational unit, which includes living organism and non-living substances, interacting to produce and exchange of materials between the living and nonliving parts. Without the sun, nothing would happen on this earth. Its light, its warmth and its power enable plants, animals and human beings to blossom, grow and flourish. Without its light there would be no colors. It provides the energy that keeps everything alive - an unimaginable 4270 billion kilowatt hour every day. It would take 480 years for the world to use up the electricity produced by one day of solar energy. Or put in another way: the sun sends the world's energy requirements for a whole year to the earth every three minutes

(Schaal, 1999). So why design something that is incongruent with 'Nature'? Nature is what we have, not made. It not only produces plants, soil, stone, water, air but also nourishes animals and man.

The tree is an organic-architectonic system consisting of a foundation, the roots, a column, the trunk and a spatial network of branches. In the case of deciduous trees leaves are an additional summer feature, covering the bare winter structure. The biodiversity contributes towards natural and social sustainability, plants and water is the true ingredients (Mowla, 2008). All the earth's oxygen was and will be produced by plants and trees. Plants consist of up to 95 % water, and man and other animals of up to 60-70 %. Water is in constant metamorphosis and circulation. It is the principle element of natural life, as every living thing on the earth derives from it. There are plain and plump trees, low, squat trees but also bizarrely expressionist and large baroque tree domes. There are narrow slender trees (cypresses, poplars). There are trees that strive steeply upwards and trailing trees. Leaf roofs, tree domes, forest cathedrals, groves. A tree has become involved with a spot on the earth; it has fixed itself there firmly. Here it will stay and grow, it is exposed to everything, wind, sun and snow, nesting birds, gnawing roe-deer, carving and sawing men: It is patient and pliant. This is what a designer needs, to organize a space that is functionally responsive (Rubenstein,1992; Mowla, 2008).

A comprehensive (multidisciplinary) approach of planning is needed for stable urban system (Ken Yeang, 2004, Mowla, 2003). The concept of ecosystem and biodiversity in the built environment design has been assessed and inferred that these can be successfully achieved at urban level by using place based environmental policy planning, that is local context and species needs due attention. Instead of confrontation we need cohabitation with nature for sustainable living. Open space are an important element of built environment which provide vibrancy and sustainability to a city. Ecological approach to design and manage these spaces is crucial to the sustainability of urban environment (Mowla, 2005a). Human response and interaction to an environment, therefore, forms the basis of qualitative study.

2.2 Review of the Planning Concepts Effecting Urban Open Spaces:

An ecological approach to the designing and handling open spaces are essential to the sustainability of our urban environment. Ecological footprint can be partially revived by the creation of Green grids or Ecological Urban Corridors, Ecological Urban Nodes or Green Pockets or Vegetated Roofs and Water Bodies (Mowla, 2005b).

2.2.1 Eco design and Planning: A common perception is that ecosystem or biodiversity or eco-design is something outside the city boundaries, whereas `green open space', 'parks', `gardens' etc are found within (Mowla, 2005a). The intensified pressure of population and the urbanization progression creates encroachment, leading to housing, circulation and other purposes on these open spaces.

Through analysis, thoughtful design and vigilant management of the development process and natural forces, even the largest structures can further the cause of a more harmonious assimilation

of the built and natural environments. Eco-design approach does not reject high technology, but it is based on an ecological moral imperative "take least from and dump least into the environment" (Mowla, 2005b). The environment desires to be in a state of equilibrium for sustainable living and the utility value of biodiversity which provides equilibrium can be divided into four categories: goods, services, information, and psycho-spiritual uses. First of all, biodiversity can be seen as a ***goods*** (or a resource) that can be consumed or useful by humans, and therefore should be protected. The second category is the wide variety of services offered to us by a healthy ecosystem (Table-1). Green plants, for example, replenish the oxygen in the atmosphere and eliminate carbon dioxide. Fungal and microbial life-forms in the soil decompose dead organic material and play a vital role in recycling plant nutrients. Table 01 lists some of these services.

Table 01: Ecosystem services and functions

Ecosystem Services	Function
Gas regulation	Regulation of atmospheric chemical composition
Climate regulation	Regulation of global temperature, precipitation, and other biologically mediated climatic processes at global or local levels
Disturbance regulation	Capacitance, damping, and integrity of ecosystem response to environmental fluctuations
Water regulation	Regulation of hydrological flows
Water supply	Storage and retention of water
Erosion control and sediment retention	Retention of soil within an ecosystem
Soil formation	Soil formation processes
Nutrient cycling	Storage, internal cycling, processing, and acquisition of nutrients
Waste treatment	Recovery of mobile nutrients and removal or breakdown of excess of xenic nutrients and compounds
Pollination	Movement of floral gametes
Biological control	Trophic-dynamic regulations of populations
Refugia	Habitat for resident and transient populations
Food production	That portion of gross primary production extractable as food
Raw materials	That portion of gross primary production extractable as raw materials
Genetic resources	Sources of unique biological materials and products
Recreation	Providing opportunities for recreational activities
Cultural	Providing opportunities for non-commercial uses

Source: Mowla, Q A. (2005b)

It includes not only the number of species but also the relationships that occur between living and non-living organisms and the biodiversity levels one considers when the concept of eco-design arises. The patterns branch of biodiversity refers to the spatial structure, allocation and movement (if any) of tile components. The third branch consists of the processes by which the biotic and abiotic components of an ecosystem interact (Table-2). This traces important interdependencies among the components and allows scientists and urban designers to predict how the **ecological "balance"** of the system might be disturbed by natural or human phenomena (Dansereau,1978; Soule, 1991). The

concept of right element in the right place and context, contributes towards sustainability of built environment (Mowla, 2005b).

Table 02: The attributes of eco-design and biodiversity

	Components	Patterns	Processes
Landscape	Community types and significant characteristics (eg, proportions, rarity, productivity, species diversity); hydrologic features; abiotic factors (eg, climate, soils, geology, elevation, slope, aspect); land use types	Overall variety, connectivity, and fragmentation: patch sizes, shapes, and distributions; patch adjacencies and Correlations	Disturbances (e.g., fires, floods, storms, landslides) and their characteristics (frequency, intensity, size, seasons); long-term changes in vegetation and hydrologic features; nutrient flows; land use trends
Community	Species types that are ecologically valuable, endangered, rare, sensitive, exotic, or limited in distribution; key habitat resources (snags, woody debris, outcrops, perennial streams)	Vegetation structure (e.g., density, layers, canopy closure, stand gaps); distribution of species and habitat resources	Smaller-scale disturbances and their characteristics; vegetation changes following disturbances (succession); productivity, herbivores, predation, and parasitism; nutrient flows; human uses and impacts
population	Absolute or relative size of populations	Number and distribution of populations; distance between populations, intent of individual ranges; migration patterns; population structures	Reproduction, mortality, and regeneration; movement abilities and characteristics; immigration, emigration, and interbreeding among populations
Genetic	Variety of gene forms (alleles); rare or destructive forms of genes	Diversity within individual populations; variations among populations	Rate of genetic change (due to chance, inbreeding or interbreeding)

Source: Mowla, Q.A. (2005b)

2.2.2 The Challenge and the Goal - Sustainability: Sustainability is a simple idea. It is based on the recognition that when resources are consumed faster than they are produced or renewed, the resource is depleted and eventually used up. In a sustainable world, society's demand on nature is in balance with nature's capacity to meet that demand.

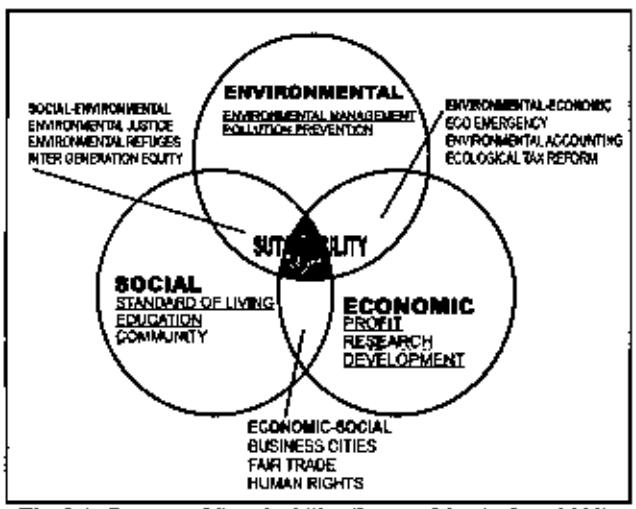


Fig: 2.1: Concept of Sustainability (Source: Mowla,Q.A. 2008).

When humanity's ecological resource demands exceed what nature can continually supply, we move into what is termed ecological overshoot. According to a report (*World Resources 2000-2001, People and*

Ecosystems: The Fraying Web of Life, World Resources Institute, the United Nations Environment Programme, the United Nations Development Programme, and the World Bank) in addition to the growing depletion of non-renewable resources such as minerals, ores and petroleum, it is increasingly evident that renewable resources, and the ecological services they provide, are at even greater risk. Examples include collapsing fisheries, carbon-induced climate change, species extinction, deforestation, and the loss of groundwater in much of the world (Mowla, 2008).

We depend on these ecological assets to survive. Their depletion systematically undermines the well being of people. Livelihoods disappear, resource conflicts emerge, land becomes barren, and resources become increasingly costly or unavailable (Fig 2.1). This depletion is exacerbated by the growth in human population as well as by changing lifestyles that are placing more demand on natural resources.

2.2.3 Environmentally Appropriate Processes: Globalization has given us the freedom to adapt to newer possibilities. When it comes to the Global options of materials and techniques of Constructions we need to make our approach more scientific, respecting to the law of nature through its ecological context in this age of accelerated degradation. Increasingly one is realizing that architectural processes and planning practices have ecological consequences that significantly degrade the environment.

Most materials have high energy consumption during their manufacture and extraction process (Embodied Energy). Implicit the measure of Embodied Energy of building materials are the associated environmental impacts. Large amount of ever increasing greenhouse gasses are produced by these modern building materials which damage the urban air quality and are responsible for climate change. In a sustainable development perspective, we must address the quality and sustainability of our use of natural resources and ecosystems, threats of global change, and the impact of production and use of energy, which is essential to our economies and to our way of life, and also centrally important in environmental problems. Selection of appropriate elements for organizing the built-environment is, therefore, essential for environmental sustainability (Mowla, 2008).

Table 3: The embodied energy and emissions of some of the important building materials:

Name	Embodied energy	CO_2 (g/ kg)	CO	NO	SO_2	CH_2	NMVOC	Dust
Reinforced Steel	16.3 MJ/Kg	1500	1.15	2.9	8.15	6.6	0.21	0.5
Primary Aluminium	204 MJ/Kg	11687	26.683	24.769	15.139	19.907	2.538	1.754
Portland cement	4.3 MJ/Kg	893	0.184	1.874	0.59	0.754	0.017	0.043
Inner paint	0.7 MJ/Kg	91	0.046	0.14	0.035	0.1	0.013	0.02
Glass wall	16.5 MJ/Kg	1011	0.705	12.77	1.135	2.599	0.09	0.112
RCC	2.4 MJ/Kg	258	0.153	0.534	0.157	0.0238	0.032	0.056
Mud Brick	2.4 MJ/Kg							
Wood	12 MJ/Kg	80						

The traditional architecture however always took advantage of the natural environment and searched for practical solutions for long term grains and better environmental adaptation. Unfortunately, architecture today seems to be a mere play of fanciful borrowed global faced treatments. Knowing well that these models do not fit into our ground realities, we are still bent upon building IGLOOS in the desert (Roy, 2003). We adopt meaningless measure like banning the use of timber. This has encouraged the use of alternative materials like plastics, aluminum and other metals whose production process throw much more pollutants in our environment (Table-3). In recent years, the construction industry world wide has witnessed a trend towards environmentally responsive facilities, called eco properties. These structures carry the environmental theme throughout, from the positioning of building to maximize the natural assets benefits, to the careful selection of construction materials. A green property uses resources wisely, incorporating energy, water recycling and waste reduction techniques into the daily operations. Emphasis is laid on energy efficiency, resource conservation and environmental commitment.

Every materials used in a typical modern building is the product of energy intensive processing – all consuming vast quantity of power in their manufacture (embodied energy). These materials have to be dug out from the ground, cut from the forest or fields, or created by human technology. All these processes use energy.

- For extraction of material
- Process and manufacture
- Transportation cost
- Energy for production of capital equipment
- Disposal of waste
- Maintenance

The manufacturing process also releases toxic affluent into water and hazardous chemicals into the atmosphere. The manufacture of Portland cement for example is responsible for on estimated 4% of the green house gases. It is interesting to note that the total energy consumed in building materials of a luxury hotel is about three times the energy consumed by a running hotel annually. Of course it is impossible to build with no environmental impact, but it's our responsibility to minimize the damage. Process of development therefore becomes important in the question of sustainability.

2.3 Ecological Footprint and Theory of Partitioned Matrix:

The ecological footprint is a resource management tool that measures how much land and water area a human population requires to produce the resources it consumes and to absorb its wastes, taking into account prevailing technology (annexure-4). Much of the body of analysis and synthesis within the realm of sustainable architecture has focused upon the physicality of the built environment, leaving the complex relationship between culture, climate and place largely undisturbed. For an architectural proposition to represent a truly sustainable design solution, reference to the cultural domain must be implicit.

In a world dominated by the culturally decontextualized homogeneity demanded by globalization, many contemporary architectural design propositions that purport to be *Sustainable*, ignore the specificity of the cultural dimension. It is clear that globalization is not only an economic condition but holds (anti) cultural aspirations deep within. In that sense, International Modernism provides a paradigm for globalization. Furthermore, International Modernism provides an iconography that *represents* globalization. The glass and steel tower – so beloved by modernism - has become the symbol of economic success, both at a corporate and nation-state scale. At its root, it is clear that International Modernism had very clear cultural aspirations. The form of dwelling cannot be understood only by a consideration of the technique and Material used. It is first of all necessary to be aware of how the principles of the local group are applied, and what kinds of work are performed by this group, and in which roles. There is much to learn from Architecture before it became an expert's art. The untutored builders in space and time demonstrate an admirable talent for fitting their buildings into their natural surroundings (Yeang, 2004).

Looking at the global economy today, one has to be increasingly aware of energy as a scarce resource; the need for architects to design for a sustainable future becomes a self-evident imperative. Here lies a likely trump card for affirming theoretical respectability: the design of energy-efficient enclosures has the potential to transform architectural design from being an uncertain, apparently whimsical craft, into a confident science. The theory for the design of the tall building might then be one that derives from energy conservation.

A 'green' approach means that a balance must be achieved between organic and inorganic components to achieve a balanced eco-system. Traditional approaches by architects tend to try to 'add on' environmental features and thus miss opportunities for 'passive' approaches which minimize the impact on the environment. Schemes should aim to create 'cities in the sky', in contrast to traditional high rise which merely stacks floors one on the other, creating compartmentalization. The challenge is to design in an organic and humane way with both horizontal and vertical integration. Ecological design is still in its infancy. It is complex; requiring understanding of the effects one factor has on another. Because of past experience of under funding and failure to maintain adequate management arrangements in the public sector, this type of approach might fail. It will be an uphill battle to persuade tenants that radical approaches will enhance their quality of life. Many planning authorities need convincing of the benefits of developing taller buildings.

Ken Yeang (2004) has been involved in the design of skyscrapers for the past 25 years. Why skyscrapers? And why green? Skyscrapers occur largely because of urban growth and rural migration. When that happens a city can only go sideways, eating into arable or other vegetative land. The way to save that arable land is to intensify cities by going upwards. He pointed out that, as Corbusier argued, skyscrapers have a smaller

footprint and can provide more open space. The United Nations uses the argument that it lowers transportation costs and thus energy consumption.

There are many definitions of green design. There are contradictions between existing technology and nature. The first starts with predetermined objectives whereas nature has a discernment of what is there rather than starting with fixed goals. Existing technology looks to process efficiency and mechanistic approaches while nature looks at systemic harmony and an organic, holistic approach. The aim is to try to bring this together. Architecture is like a prosthetic device - it is artificial, and man made. The present built environment is mostly inorganic. What is needed is to start with the ecological system and using organic with inorganic components to achieve a balanced ecosystem. Ken Yeang (2004) started to look at different ways of achieving this. One way is horizontal greening either through putting all the greenery in one place similar to traditional city squares. The alternative is vertical greening allowing migration of species through it. He went on to explain some of the issues and techniques that have to be followed. For instance, planting has to follow the solar path and requires hardy species - as is being considered for the Elephant and Castle scheme. It is important to understand the system of energy and environment. There are four basic categories to be considered: passive mode which avoids any electro-mechanical devices; mixed mode using some electro-mechanical devices; full mode perhaps using environmental controls; and finally productive mode, which involves the building being used to generate its own energy through photo-voltaics and other systems. With ecological design the strategy has to optimize all the passive options, before progressing to the mixed and other options.

Most ecological designers (Yeang, 2004; Haysil, 2002; Vestbro, 2002; Mowla, 2005a) define eco design as designing with minimal impact on the environment but it is a battle that you can never win. But there are ways to include biodiversity. One approach is the 'landscaped bridge' which immediately improves the environment, encouraging species to move in from nearby green areas. It involves working in a different way - it means putting the buildings in a park rather than building first and creating the park after. It is important to understand that ecological design requires an understanding of a site's carrying capacity. It involves 'sieve' mapping devices to achieve minimum impact on the existing natural environment. It requires analyzing the current species and vegetation and deciding what to bring in. As well as simply introducing nature, schemes must involve the systematic greening of the man-made environment.

Ecological design is a knowledge-based approach - analyze the information, evaluate it and change the design. One of the issues is recycling which must be used at every stage of construction- it should take into account replacement rates - and incorporate lifetime energy costing. It must include water recycling, perhaps using collectors and filters to make the rainwater potable. Thus ecological design is very complex. Separately laying different options of sustainable design and than overlaying all of them together to see the intersection

or overlapping areas of aspects and thereby assessing the eco sustainability is the short definition of 'partition matrix' approach of design (Mowla, 2008) to indicate how one factor impacts on another and the effect of architecture on the environment. It shows that you cannot change one thing without changing the others. There is still a need to develop ecological design criteria and global monitoring. Basically ecological design is in its infancy. Ecological designers are still experimenting with a range of systems and there is a long way to go. (Source: internet:http://webpages.ull.es/users/mach/PDFS/VOL4_2/VOL_4_2_b.pdf.)

2.4 The Environmental Crisis- Need of a Sustainable Open Space:

In the hot humid climate of Bangladesh open spaces including water bodies, both natural and man made, are more than an integral part of life and living. They play an important role in the physical and social activities performed by the inhabitants of the city. Green open spaces when articulated with water bodies become visually more attractive and climatically more responsive. Such spaces develop a natural sustainability of the city. Natural sustainability is rooted in retaining existing ecosystem and cultural relevance (Khaleda, 2003).

Like any other sustainable city, Dhaka needs a huge stock of open spaces for urban services or utilities and circulation besides space needed for different public functions and recreational activities. Open green Spaces in the city act like its lungs besides being used as active recreational and leisure areas for its citizens. Circulation areas also, though serving active purposes, provide some breathing spaces to the urbanities. Spaces provided for the utilities also serve some passive needs. We, therefore, must realize that open spaces have a direct impact on the urban environment and general physical, mental and social health of the urban dwellers (Mowla, 2002 b).

Unfortunately, developments within Dhaka city are aimed at accelerating only the direct economic return. Our developer have made the Word "development" synonymous with destruction of environment but it is not so. There will be need for constructions or cutting trees for development activities but that should be done in a planned manner with planned replenishment of the nature to keep the biomass in a balanced state. An appropriate balance of living and nonliving parts of the environment needs to be promoted to maintain a sustainable ecosystem, because a stable urban morphology is always alive (Mowla, 2005a).

Architects seem to think that the important thing is that buildings look ecological. We must consider a large number of environmental factors that concern the architect. When we talk about the environment friendly urban system the following factors should be included (Vestbro, 2002):

- Design for low health risks;
- Design for low energy use;
- Design that do not deplete the bedrocks;
- Designs using local materials (that do not generate long transport);
- Designs that are well adapted to climate;
- Designs adapted to changes (to avoid destruction and new building when uses change)
- Planning for the long term development of the built environment towards sustainability;

- Design that facilitates neighborly co-operation around environmental tasks;
- Designs that look environment friendly (to stimulate ecological thinking).

The first four factors do not require any further explanations. The problem is mainly to find out exactly which designs that provides for good health, little use of energy etc. In order to depletion of bedrock, all kinds' metals should be avoided, but if constructions are such that metal components can be recycled, then of course this renewable material can be used. In addition, building materials that use a lot of energy for its productions, such as cement, should be avoided, unless construction elements can easily be dismantled and reused. For this purpose, new construction techniques are required, e.g. disconnectable joints between construction elements (Holmstrom, 1997).

The Ramna area is the only open and green space of Dhaka, where most of the socio-cultural activities or events are concentrated, and spread through out the year. In contrast to the past, Ramna is now in a much squeezed form, but has to cater for much larger population.

2.5 Research Framework:

Ecological footprint is a tool to measure our ecological performance. Ecology as a technical input into design is essentially a quite straightforward idea, especially when applied to urban situations. Open space are an important element of built environment which provide vibrancy and sustainability to a city. The unplanned encroachments and promulgation of built forms contribute to deforestation, water logging, flooding, overheating, pollution of water, soil and air etc. We depend on these ecological assets to survive. Their depletion systematically undermines the well being of people. Livelihoods disappear, resource conflicts emerge, land becomes barren, and resources become increasingly costly or unavailable. Looking at the global economy today, one has to be increasingly aware of energy as a scarce resource; the need for architects to design for a sustainable future becomes a self-evident imperative. The available open spaces are, therefore, required to be organized judiciously to maximize its response. Biodiversity of place and contextual response in open space design and management has a bearing on the comfort feeling of the users. Ecological footprint and the theory of partition matrix as discussed in this chapter are therefore used in this study as the yardstick for analysis to achieve these goals.

The concept of ecosystem and biodiversity in the built environment design has been assessed and inferred that these can be successfully achieved at urban level by using place based environmental policy planning, that is local context and species needs due attention.

Chapter III

Dhaka and the Study Site

3.1 Historical Evaluation of Ramna Area
3.2 Ramna, the Study Area
3.3 Open Space system in Dhaka
3.4 Ramna According to the Checklist for Sustainability
3.5 Summary

3.1 Historical Evolution of Ramna Area:

3.1.1 The Evolution of Ramna: The history of Ramna starts about 1610 AD during Mughal rule. At that time two beautiful Mahallas (neighbourhood) were developed in the northern suburb of Dhaka city. One of them was the Mahalla Chistia and the other was Mahalla Shujatpur. It was basically a Mughal pleasure garden. New residential houses, gardens, mosques, tombs and temples were built in this area during that period. After the fall of the Mughal rule, Ramna gradually lost much of its glory (Mowla, 2003).

In the period of Dhaka's urban decline the Mughal pleasure gardens on the north, which were encroached by deep vegetation, were taken up for clearing by Charles Dawes, the Magistrate in 1825. He laid out a specious green. A large oval in Bagh-e-Badshahi or present Shah Bagh in Ramna was cleared and enclosed with a wooden railing, and round the perimeter a racecourse was laid out. At the extreme northwest, half a mile from the winning post, Dawes created a small hillock, thickly planted with superb fir trees, crowned with pavilion in the gothic style. Skinner, the Magistrate of Dhaka, again reclaimed the racecourse from overgrowing vegetation in 1840. The hillock still exists inside present Children's park but the pavilion has disappeared (Ahmed, 1986).

The selection of the site for Dhaka's first railway station at Phulbaria in 1885 marked a lasting impression on Dhaka's urban morphology. The station and the rail line practically demarcated the old (indigenous) and the new (European) developments. Another important development in the morphological evolution of Dhaka around 1905 had been the establishment of a new Civil Station, north of the railway line and around Ramna race course, laid over the former Bagh-e-Badshahi (Royal garden) of the Mughals. The massive development work, with imperial overtones, that began in the civil station with the partition failed to create a desired impact, as partition of Bengal was annulled after just 6 years in 1911 (Mowla & Reza, 2000 & Mowla, 2003).

After the partition of India in 1947, East Bengal government took possession of about two thirds of the Ramna area or old Civil station. It may be noted here that Ramna is historically a high-class area. Gardens were important elements for Mughal settlements, as the racecourse was for English settlements, and these

Fig: 3.1: Map of Dhaka 1924.

were always exclusive to the ruling elite. Many new buildings have infiltrated into this area since then, but the basic morphology of the area from the Mughal period till this day has remained largely unchanged. The area was and still is a major recreational area of the city with large open spaces containing parks, playing areas and clubs (Mowla, 2001b).

It was the Ramna Racecourse ground, where, Bangabandhu delivered his historic speech of 7th March 1971. This is also the place where Pakistan army surrendered on 16 December 1971 after the war of liberation. The huge ground, however, was converted after 1975 into a park with greens and walkways. At present, there is an entertainment zone for the children at one part of the park and on the remaining part 'Shadhinata Sthambha' is being constructed. Racecourse portion of the park was renamed as Suhrawardiuddyan.

Administration Ramna thana was established in 1921. Population size according to 1991 census is 195167 in number with male female ratio 58.32:41.68 respectively.

3.1.2 Unplanned Encroachment in Ramna Area:

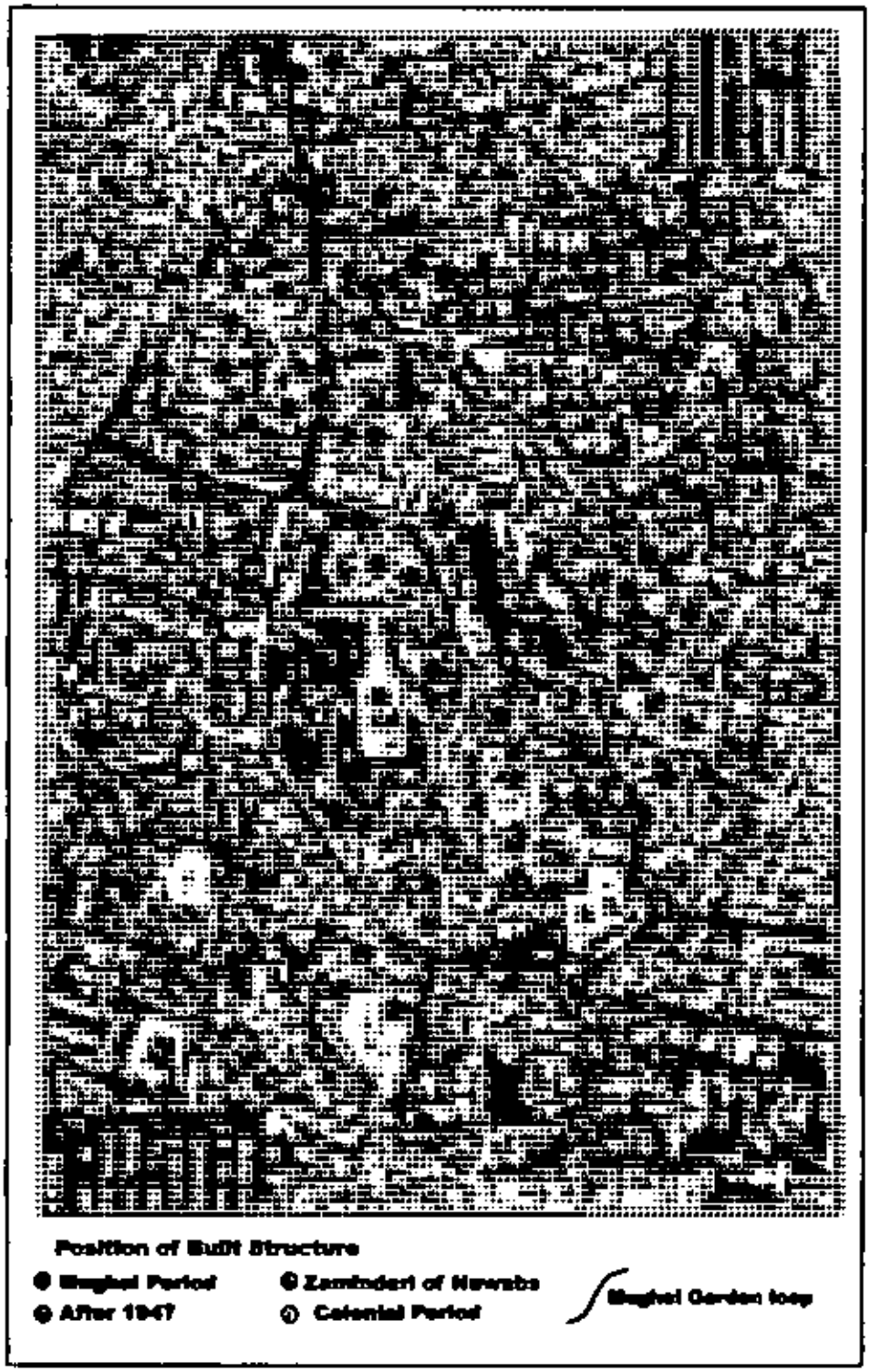


Fig: 3.2: Shows the periodical encroachment in the Ramna Area by built structures.

The Ramna area is the largest open and green space area of Dhaka city. The area is gradually becoming shorter by the unplanned encroachments and fragmented developments.

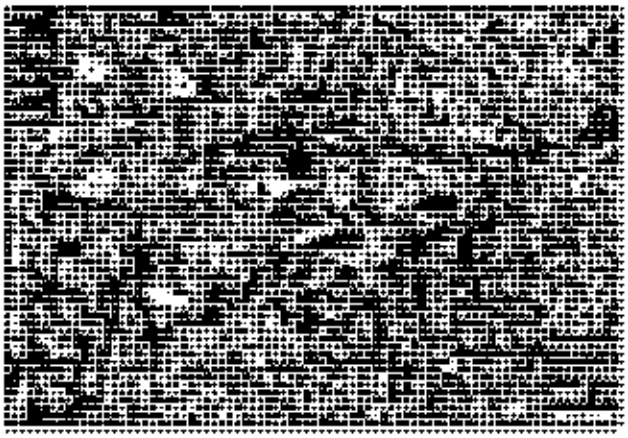


Fig: 3.3: Satellite View of Ramna Area, 2007 (Source: Google Earth: NASA).

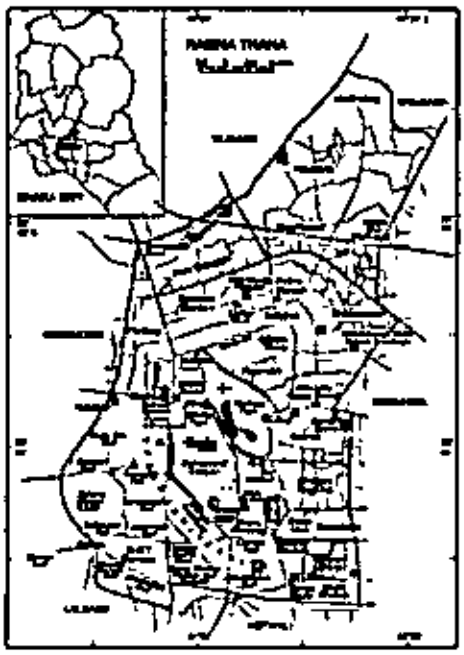


Fig: 3.4: Map of Ramna Thana (Source: Banglapedia).

The table-4 below shows the magnitude of buildings like mosque, mazars, tombs, educational institution, cultural organization, markets which were built in this area.

Table 04: Extent of Interventions in Ramna

Mosque	30		
Temple	3	Technical Institution	15
Church	02	Club	20
Tomb	07	Public Library	02
Eidgah	01	Cinema Hall	04
Mazar	01	Theatre Stage	03
University	02	Museum	02
College	06	Play Ground	08
Medical College	03	Swimming Pool	01
School	21	130 km of pucca roads	
Madrasa	01	40 km roads (semi pucca)	

(Number of Different Structures) source: Field Survey.

3.2 Ramna, the Study Area:

To meet the growing demand of a rapidly growing city, after Dhaka was made provincial capital, a new area of better administrative, educational, commercial and recreational was developed at the Ramna area in early fifties. Ramna is historically a high-class area. To the south of the Ramna run the old part of the city and the new part of the city connected to the north. This chunk of land is the buffer space in between the old and new part of Dhaka. Ramna, the open green spaces in the center act like its lungs besides being used as active recreational and leisure areas for its citizens. The following roads cris-cross the area and connect the different parts of the city: Shahabagh Road, Kazi Nazrul Islam Avenue, Captain Monsur Ali Sarani, Hair Road, Nawab AbdulGani Sharani and College Road. Old Ramna is now composed of i) Ramna Park and ii) Suhrawardiuddyan.

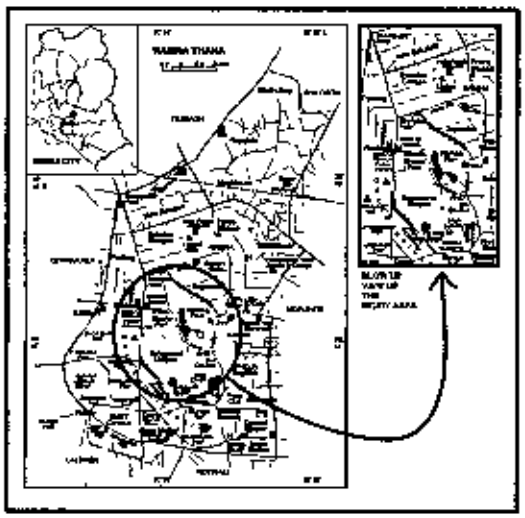


Fig: 3.5: Map of Ramna Thana of Dhaka and the blow up view of the study area.

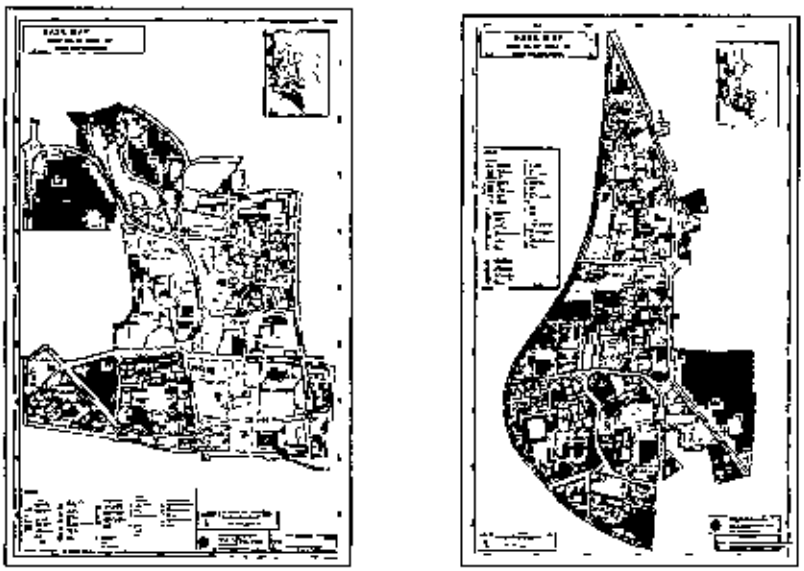


Fig: 3.6: GIS Map of Ward no. 56 and 57 (Source: Chief Urban Planner, Dhaka City Corporation).

3.2.1 Ramna Park:

It is one of the oldest parks of Dhaka representing our cultural heritage. This Park was established in 1949 over 63 acres of land of old Ramna Area of Mughal period. At present Public Works Department is responsible to manage and maintain the Ramna Park and Nursery.

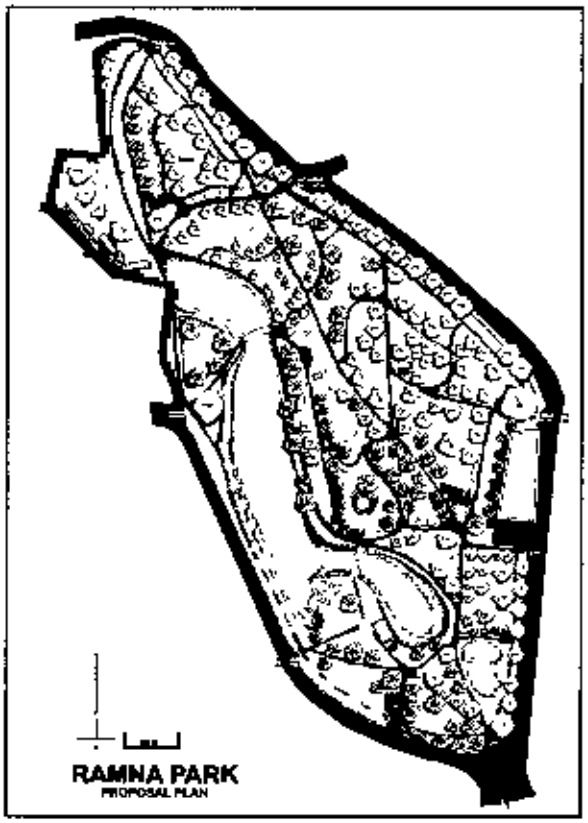


Fig: 3.7: Proposed Layout of Ramna Park, 2006, (Source: Department of Architecture, GOB)

Fig: 3.8: RCC chairs and CC pedestrian walk ways : increasing the ground coverage.

Fig: 3.9: Pedestrian path and benches filled up most of the area of the Park.

On the other hand, Dhaka City Corporation takes care of Ramna **Shishu Park**. It is **12 acres** out fit. At the foot of the Ramna Park's Banyan Tree function like welcoming rainy season, Bangla New Year Mela

different other programmes are organized. Besides, on different time of the year various exhibitions are organized here. In spite of its being infested with manifold problems, the park's massive area, and its quiet, soothing, cool, verdure environment has been a major attraction to the people of the city.

Fig: 3.10: Satellite view of Ramna Park and Suhrawardy Uddyan, 2007 (source: Google Earth).

3.2.2 Suhrawardy Uddyan:

It is located on the fringe of Dhaka University. Under the management of Arboury culture (PWD); this park is linked to the memories of the war of liberation. Established on **80 acres** of land, the total space of the garden has been considerably squeezed now. During 1996-2001 "Shikha Chirantan" (eternal flame) was erected here adjacent to the Shishu Park. On the other hand, on the ground besides the Teachers Students Center (TSC) hundreds of trees were felled to erect the "freedom tower" encompassing a large area. Though, compared to the size of Dhaka city population the number of park facilities is very inadequate the area like Suhrawardy Uddyan is being squeezed instead of maintaining and developing it.

3.3 Open Space system in Dhaka:

As urged in Dhaka Structure Plan (1995), Dhaka requires at least 20% of its area as open space. When at present the percentage of open space of DCC is 9 to 10%, creation of open spaces from existing stock of about 500 acres of DCC and PWD land would increase the percentage slightly (Nilufar, 1999, Mowla, 1989 & 2005). However, the land stock must be fully utilized for open spaces as the creation of other new open spaces is almost next to impossible (with the help of ENB'2008 ie. FAR rules small patches of open spaces may be created).

The guidelines on the open space system emphasize introduction of variety of open spaces of different sizes and offer a network of sidewalks, streets, spaces associated with public buildings, other outdoor spaces, playfields and neighborhood parks. The spaces are to be detailed to serve as an interconnected pedestrian

trail. Interconnection of outdoor spaces to open space would encourage pedestrian movement, maximize use and develop a web of open spaces. Through an interconnecting green space network, pedestrians are provided with the opportunity to describe and envision the city. The cramped look and lack of open space feeling are mitigated. Free pedestrian movement would compensate the non-availability of open spaces of certain localities, provide rational and economic trend. This approach is essential to streamline the existing practices and for the city dwellers to share a common language.

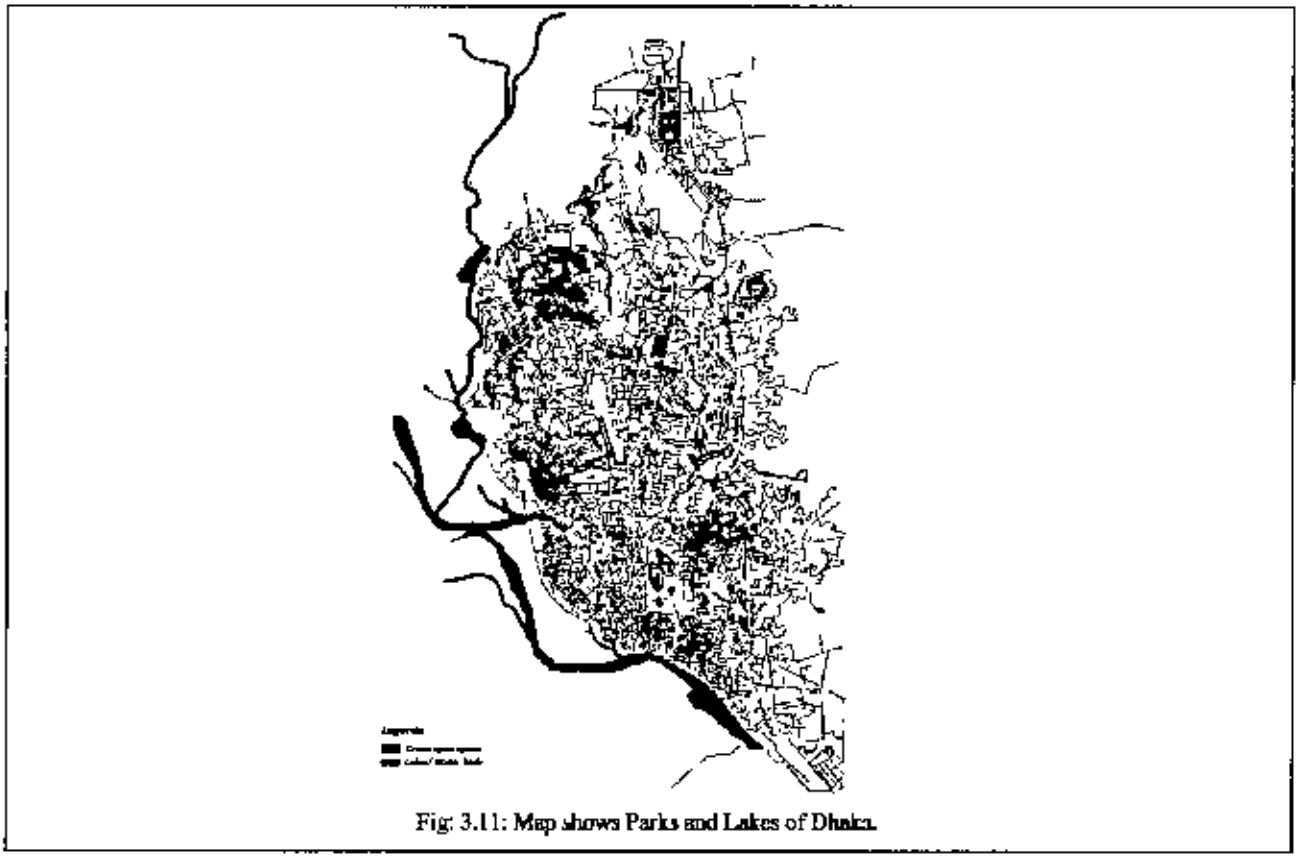


Fig: 3.11: Map shows Parks and Lakes of Dhaka.

A network of open space (Fig: 3.11) taking into account of the water bodies and transportation routes should give rise to a system of development. Provision of jogging tracks, footpaths and pedestrian bridges accentuate functional values of water bodies. Inter linking of khals, tributaries and lakes, where possible, would further accentuate the urban landscape. Buildings are very much creative entity, and people have a right to appreciate, share and enjoy their vicinity. Visual and physical linkages would develop the connective tissue of neighborhoods and community life (Mowla, 2005a).

Thus low lying areas, ponds and ditches are filled up continuously to make room for buildings. Due to decline of open spaces and water bodies frequent flooding and water clogging are occurring (Mowla, 2005). Under physical environmental consideration there is a great need of an open space system as it would improve general urban climate especially natural ventilation conditions, outdoor shading and pleasant areas

for rest, reduce noise (as hard surfaces reverberate), natural dust and air pollution from transport, factory etc., control flood and retain rain water, protect flora and fauna (Khaleda, 2003).

3.4 Ramna According to the Check List for Sustainability:

Based on the principles, architects worked out a comprehensive guide for sustainable design was established. The design guide includes a table that may serve as a checklist for sustainable design (Hayashil,2002). The character of the built environment in Ramna as per the check list is as follows:

3.4.1 Nature:

1. **Reduction of heat gain / loss:**
   - The area has lot of large shading trees and the paved concrete surfaces are less than other part of the Dhaka city, resulting in lower temperature.
   - The vehicular heat emissions are also found lower due to the vegetation effect. Most buildings are old (above 35-45years) and used for institutional purposes.
   - The wall thicknesses of these buildings are 10" or more in depth.
   - Absence of huge glass curtain wall in the building façade or the tall glass building makes them eco friendly.
   - Uses of mechanical handling units are lower than in other areas. Per acres usage is lower because of large open space.
   - Indoor temperature keeps lower than 28degC due to the vegetation effect.
2. **Utilization of day light:**
   - Most buildings have small openings and the maximum height (sill to lintel level) of the window is 4'-6".
   - Absence of very tall buildings allows more unobstructed light.
   - Most buildings do not have the clear storey lighting. Buildings, A few Buildings have the clear storey type opening in the Dhaka University campus.
   - Most of the Buildings width is more than 50'-0". Light rays can travel up to about 25' through an opening; as such working light is adequate.
3. **Maximum use of natural ventilation:**
   - The sizes of the openings are found smaller in the buildings located in this area.
   - Inlet sizes of the opening are found 4'-0"X4'-6", 5'-0"X4'-6", 6'-0"X4'-6"etc.
   - Presences of inlet and outlet openings in the building are not sufficient.
   - Cross ventilation is investigated only in the buildings of Dhaka University campus.
   - Buildings which are recently constructed in this area are designed with air tight glass curtain wall (Example: Department of Architecture Building, GOB).
   - Though adjacent to park having adequate natural breeze, the buildings are not well ventilated due to their design inadequacies.

4. **Effective use of soil and vegetation:**
    - Vegetation stabilizes the soil.
    - Wind and rain carry exposed topsoil to the sewerage line and creates blockages.
    - Surface erosion occurs occasionally, but it is relatively low in Ramna.
    - Extensive excavation, filling or grading are found in new construction destroying fertile top soil.
    - Chemical fertilizer is used for plants growth which reduces the bacterial contains in soil.
    - Most of area is covered with large shading trees. A large number of it was planted 40-60 years ago.
5. **Discrete use of wood-based materials:**
    - In building construction woods are only used to make doors, windows (old structure) and their frames.
    - Wooden particle boards are recently used in interior space.
    - Woods are also used in making Furniture.
    - Less use of wood/ natural materials.
6. **Conservation of water resources:**
    - People are take bath and wash clothes in Ramna lake.
    - The habitat of the water based biomass is decreasing day by day in the lake water because the chemical composition of that place is not in balance due to the use of detergents and soap.
    - Ponds near Kali temple is filled up with waste materials.
    - Only few ponds inside the university campus are fairly well maintained by the authority.
    - Conservation of water resources is not yet started.
7. **Effective use of natural energy:**
    - No solar cell is fond in the area except used by the science faculty of DU for their research work.
    - No use of wind for producing power.
    - No use of water for producing electricity.

3.4.2: Resource / Energy

1. **Development of high efficient system**
    - High tech equipments are very rarely used in functioning of the building interiors.
    - Only lifts are provided in case of high rise building.
    - Very recently generator and substation are being provided.
    - No use of extraordinary fire fighting.
    - Use of central air conditioning system is very rare (only in National Museum, Shahbag).

- Very little in number- heat emitted outdoors is negligible.

2. **Use of durable materials:**
   - Most of the buildings are R.C.C. framed structure in this area.
   - Few old buildings were constructed using technology of that time. But the calculated factors of safety of these old structures are very high.
   - A lot Tin shades are also located here, that reflect heat.
   - Uses of Aluminum are increasing.
   - Ceramic and homogeneous tiles are recently used as floor finish.
   - Paved tiles are used in paving the footpath.
   - Calculated time for building structure is 50years and more. These materials need high energy for manufacturing.
3. **Use of environmental friendly material :**
   - Wood is not the main construction material here.
   - Building materials those are used in construction are highly expensive.
   - Huge amount of energy is needed to produce them.
   - Without electricity cement can not be produced.
   - No use of environmental friendly material.
4. **Use local material :**
   - Brick is a locally produced materials but not in much use in Ramna.
   - Cement clinkers are imported from abroad
   - We can not produce steel in Bangladesh. A few steel mills produce steel and scraps.
   - No construction materials are collected from Ramna.

3.4.3 Life style:

1. **Lifetime buildings management:**
   - Layout that allow for rooms to accommodate a variation of uses.
   - Layout that allow for rooms subdivision through the addition or removal of internal walls.
   - Layout that allow for future extensions.
   - Layout that permit easy changes of doors, windows and walls.
   - Layout that permits variation in the location of installation such as pipes electrical appliances etc.
   - If the building last over life spans and more they ought to be adaptable to changes.
   - Then adaptability should be strived for in order to avoid wasteful destructions and new constructions.

- Above type of life time building managements are not found in this area although some old buildings are into new and different uses.

2. **Material life span balancing :**

- Free Market Economy and the trend of consumer society encourage one time and non-recyclable materials and they do not preserve the consumer's right.
- Although technology is being upgraded fast, the design of material also change in same pace.
- Demolished building materials are very rarely recycled.

3. **Reuse and renovation of buildings:**
    - With the passing of time, users requirements are chaining and to honor to these requirements and future needs, old structures need to modifications.
    - These modifications can be done in interior or in exterior spaces too. Examples are seen in this area - Curzon Hall now used as educational building, Bardhoman house turned into Bangla Academy building etc.
    - Reuse and renovation has been habitually done in this area.

4. **Means and system for easy renewal:**
    - The government policy does not show interest in this type of development.
    - Every step is time consuming in case of renewal works.
    - Means and system for easy renewal is not found.

3.4.4 Human aspects:

Use of human friendly materials:

- Materials that are used in construction are safe to human life.
- The production system of material is not human friendly. When the bricks burn without natural gas the huge amount of Carbon Monoxide (CO) is produced.
- Paint contains Lead (Pb) which is injurious to health.
- Production system is also injurious to human heath even causes death.

Preservation of traditional skill:

- New technical methods are not very popular in this area and in the region too.
- Labours especially from Chapainawabganj (in Rajshahi Division of Bangladesh) are very skilled for masonry work and ornamentation.
- Even in the tall buildings bamboo are used in the place of steel scaffolding.
- Mixed application of both the traditional and the technical methods are applied in building construction.
- Traditional method sustained.

Proposing new life styles:

- In every planning each planner proposed some of his Ideas and Views which have a very positive thinking in changing the life style of the people of that area.
- Some times these thinking are really very positive and such are very worst.

Town / Community

Preservation of history and tradition:

- Old structure especially those are historically involved with many stories must be conserved.
- These conservations must be in architecturally, archeologically and anthropologically treated.
- According to the sustainability paradigm it is, however, essential to respect traditions.
- Traditional building techniques have often proved more sustainable than modern construction.
- Some preservation features in old structure are present in Ramna area.

Landscape / waterscape preservation:

- Natural landscape must be protected and keep it without disturbance when the development work is going on.
- Water body is natural resource for any kind of existences.
- Any disturbance created by development cause disorder in regular activities.
- From the very past total Ramna area was found tormented in name of development without the preservation of its landscape and water bodies.

Giving consideration to land and climate:

- Local climatic considerations to save energy and give building an ecological expression.
- But in present architects are depending upon the electro-mechanical solutions rather than climatic solution in designing new buildings.
- There are many examples of new buildings in Ramna which are going through electro-mechanical solutions for cooling, acoustical control and ventilation.

3.5 Summary:

The urban matrix of Dhaka city, capital of Bangladesh, is not a outcome of any broad based planning; its structure has evolved through stages. Dhaka City has experienced a long transformation with respect to land uses, functions and importance in the regional context. The city has taken somewhat multi-nuclei form with haphazard land use patterns. The variation in shape, size, layout, treatment, and development of urban open spaces is an offshoot of physical, socio-cultural, political and economic factors. Ramna as an open space in this city starts during Mughal rule, than it was a pleasure garden but now it is an urban need. Dhaka requires at least 20% of its area as open space, whereas, at present the percentage of open space of DCC is 9 to 10%.

Local planning experts suggest at least 1 acre of parks and open spaces per 1000 population for cities of Bangladesh. By this measure Dhaka city needs 3900 acres i.e. 11% land area for parks and play fields. In Dhaka only 5% land in old Dhaka and 12% in new Dhaka is green and open (DMDP, 1995). It suggests that natural vegetation is the primary and sometimes last representative of nature in the city and that vegetation contributes to the sense of place and sustainability. Open space must be considered as a public good when attempts to measure its value are made. As the open space stock in Dhaka is minimal, it requires more attention of the policy planners. Open green Spaces in the city act like its lungs besides being used as active recreational and leisure areas for its citizens. Whatever open space is available in Dhaka must be judiciously managed and used, to extract maximum benefit out of them. Ramna being the oldest and the largest of the meager open spaces scattered across the Dhaka city and also being able to attract huge urban events and activities, draws special attention for analysis of its, as well as of Dhaka's sustainability.

Chapter IV

Qualitative Assessment of Ramna's Urban Open Space based on Quantitative Parameter

4.1 Quantitative indicator of open space situation:
4.2 An Urban Ecology checklist of Ramna:
4.3 Eco Foot Print of the Ramna Study Area:
4.4 Geo-Climate of Ramna
4.5 Summary:

4.1 Quantitative indicator of open space situation:

The natural features, lush green spaces and water bodies surrounding the habitations that once made James Taylor write after his visit of 1824, "Dhaka looks like the Venice of the orient", are no longer there. While comparing Dhaka and Calcutta cities, Prof. N. Islam wrote, "Calcutta has more parks, open spaces, trees and these are better maintained. Most of its ponds and other water bodies are also better kept". Lack of consciousness and initiative in terms of ecology, environment and socio-cultural aspects by both public and private sectors has given rise to:

- Rapid decline of open spaces and water bodies
- Speeding up of inaccessibility to the open spaces and water bodies.

The total amount of open spaces including roads, footpaths, parks, play fields, lakes, ponds etc. constitute about 17% -18% of the area of the Dhaka city (Daily Janakantha, March 05, 2002). Over the last 30 years or so the open spaces of Dhaka are fast diminishing. If the present trend continues, of the numbered parks, little open spaces, few trees, ponds and water bodies nothing will be left in Dhaka city. Though the banks of the Buriganga River are heavily built up and devoid of green spaces and most of its tributaries are filled up or encroached by illegal structures, it still has profound impact on the citizens of Dhaka. Many people go there for jogging, leisurely walks and other recreational purposes.

4.2 An Urban Ecology checklist of Ramna:

Dhaka is now a mega city of over 10 million people. The average growth rate has decreased from 7% to 2% but the urbanization rate has exceeded 6%. In the past the city was clean, the air was fresh to breathe, fewer traffic and the river was the main way to transport and lifeline for attraction and now Ramna is the only major public open space in this city. The Ramna area has accommodated a number of administrative, educational and a few commercial activities resulting in environmental degradation. We have number of attributes to check the ecological fitness of this area, which we may call an urban ecology checklist.

4.2.1 Air Quality at Ramna Area:

"...the air in the city is different in that it carries a heavy load of solid, liquid and gaseous contaminants." (Lowry, 1971). An eco-city would reduce that load to as near zero as possible. Extensive use of vegetation is an integral part of the urban fabric that would ensure that dust and pollutants were filtered out. There would not be a 'heat island' and its net effect on the climate would no longer be disruptive.

The key factors that affect the air quality are the following in order of overall significance:

- Transport pollutants (NO_x, Co, CO_2, VOC_s)
- Power generation from fossil fuels (cause of urban smoke)
- Chimneys discharge (housing, factories, incinerators)
- Mining, chemical and metallic industrial activities
- Waste disposal pumps
- Airborne dust raised by wind
- Building operation dust and dirt
- Agriculture, animal and food production (allergens)

Air pollution is now a common complaint in Dhaka City. Mostly the exhaust from the vehicles plying on the city streets is responsible for air pollution. Black smoke coming out from the discharge is intolerable to breathe. It burns eyes and throat. The city dwellers are being slow poisoned by lead concentration in the city air- ten times higher than the government safety limit.

Air, is an integral part of the physical environment of Ramna that help sustain life of both plant and animal kingdoms including human beings. The different connecting roads pass through it. A huge mass of motorize vehicles move along these roads every day. Petrol, diesel, octane etc, the motor fuel produce a huge amount of harmful gases and Suspended Particulate Matters (SPM). The Department of Environment (DoE) report shows that the total load of SPM and harmful gases (CO, HC, NOx, SOx) in the Ramna Area air is high, however there is a diminishing vegetation effect on these pollutants. The pollution is higher in January-March period than in July-September period of the survey.

The Environmental pollution report of 98 of the DoE describes that the SPM in the air ranges between 1000 and 2000 microgram or four to five hundred percent higher than the acceptable level in Dhaka. The highest acceptable level of Sulphur dioxide (SO_2) is 60 microgram per cubic meter of air. But it has been recorded at 300 to 500 microgram in Dhaka. Bangladesh Atomic Energy Commission reports that automobiles in Dhaka emit 100 kg lead, 3.5 tons SPM, 1.5 tons Sulphur dioxide, 14 tons hydrocarbon and 60 tons carbon monoxide a day. Sample studies show that it is lower near vegetated areas.

Table 5: Pollutant by vehicle type Emission Estimates (%) in Dhaka City.

	TSP	NOx	CO	HC	SOx
2 wheeler-2 stroke	6.7	4.8	14.1	9.7	6.0
2 wheeler-4 stroke	0.6	0.2	6.1	7.5	9.05
3 wheeler-2 stroke	64.5	1.6	38.6	49.5	7.07

(Baby taxis)					
Large tempos-2 stroke	7.4	0.2	4.4	5.7	0.9
3 wheeler- 4 stroke	0.3	0.1	2.8	3.5	4.4
4 wheeler-4 stroke	15.6	11.2	33	22.7	14.1
(cars)					
Buses	2.2	51.4	0.6	0.8	36.4
Trucks	2.8	30.4	0.3	0.6	21.4

Source: (Draft mission report of 1998 – Air quality Management, Policy and vehicle emission control, World Bank, Dhaka)

When we enter into the Ramna Area from the busy traffic road of Kazi Nazrul Islam Avenue the air quality found much better than the other part the Dhaka city. The large trees like Asok, Batt, Rain tree, cools the air by casting shadows. The Hair road and Captain Monsur Ali Road are best example of shaded trees. A huge amount of vehicular movement takes place throughout the day in this area and pollutes the air. Table-5 presents the percentage of different harmful gases released by different types of motorized vehicles in Dhaka city.

Actually above situation in condition with respect to air pollution exists in overall Dhaka but it is much better in because of huge stock of vegetation that dust and pollutants were filtered out. The survey of May 2000 revealed that the species of plants/trees were 124 in member. The micro-climate with abundant local trees has been found to be more efficient in maintaining both a lower air temperature and pollution during the day. Obstruction of solar radiation by tree canopy and the reduction of air temperature by means of evaporation were significant in producing a thermally agreeable microclimate. Ahmed's (1995) studies also confirm that when temperature increases in the other parts of the city this area remains cool.

The level of CO_2 absorption by plants relates to the rate of woody growth. Table-6 below shows the absorption per square meter planted area. Such data could be used to determine the approximate amount planting required to absorb certain amount of CO_2, with an aim to ensure sustainability of the development (i.e. CO_2 emission equals CO_2 absorption).

Most of the trees in Ramna area are medium and small in size - small trees are higher in quantity than medium trees. So CO_2 absorption level by small and medium trees in Ramna varies from 04 - 1.4 kg/m^2/year.

Table 6: Examples of CO_2 absorption for various plants

Plant Type	CO_2 Absorption (kg/m^2/year)
Trees (average)	1.0
Trees (large)	1.9
Trees (medium)	1.4
Trees (small)	0.4

Source : (Steemers, 1993)

Table 7: CO_2 Emission in kg/kWh for delivered energy for various fuel types in Ramna.

Fuel Type	CO_2 Emission (kg/kWh)
Gas	0.192
Dry Leaf	0.031
Other Solid	0.421
Petroleum	0.302

(Source: DCC, RHD, LGED, BRTA, DTCB, DMP, STP, BANGLADESH COUNTRY REPORT, HABITAT COMMITTEE, ECONOMIC REPORT OF BANGLADESH, WORLD BANK REPORT 2003)

4.2.1(a) Air Pollution by Man Made Structure at Ramna Area:

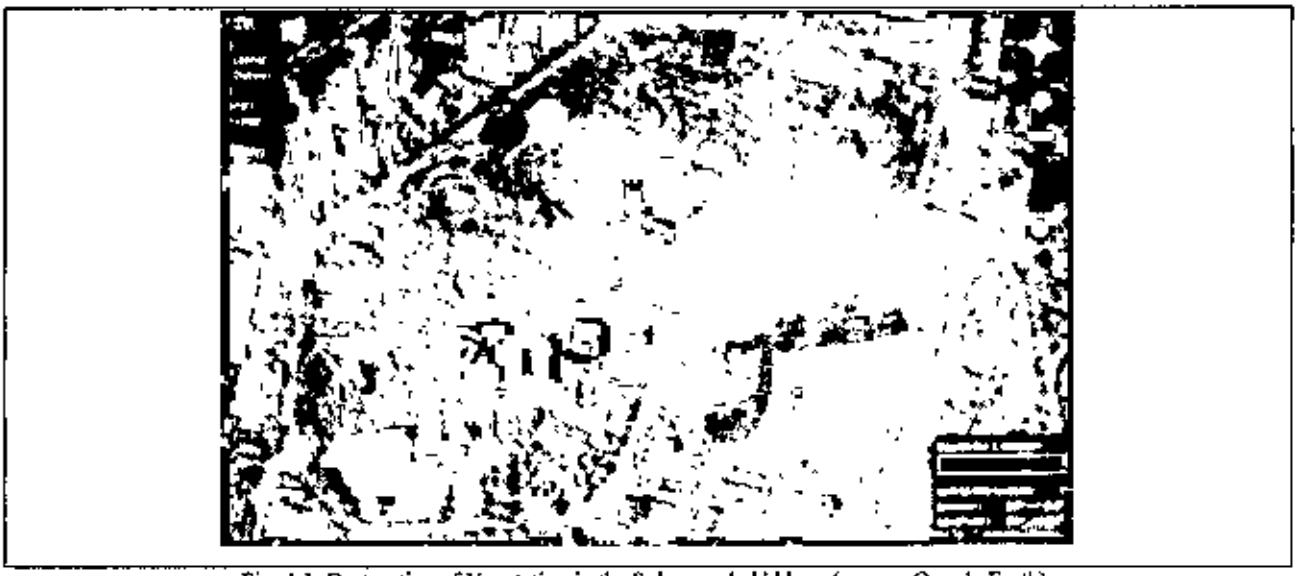


Fig: 4.1: Destruction of Vegetation in the Suhrawardy Uddyan (source: Google Earth).

Few years ago, the Government of Bangladesh decided to build a monument named Shadhinata Sthaambha to celebrate our independence. To build this Structure and plaza they need to cut down a lot of trees. The Institute of Engineers, Bangladesh was permitted a plan to construct a high rise building here, which is almost complete and is severely affecting the green character and the microclimate of the area. Shadhinata Sthambha has a similar effect.

4.2.2 Water (Water Body) Quality at Ramna Area:

An eco-city would neither pollute nor waste its water and would purify and recycle and supply it back to nature. Dhaka is surrounded by a river system; these surface water sources around Dhaka directly or indirectly receive a large quantity of waste from the city. The river Buriganga flows by the side of the densely populated area of the old city. Dumping of waste to the river by the members of public owners of the industries is rather indiscriminate. Ramna lake is no better. Innumerable municipal drains carrying sewage and sullage find their way into the water bodies in and around Dhaka city. The indiscriminate discharge of domestic sewage, industrial effluents, open dumping of solid wastes are becoming a great concern from the point of water-environment degradation.

Fig: 4.3: Concrete Piles to protect erosion of soil, Ramna Lake.

Rainfall induced flooding and water logging due to poor drainage system is a common phenomenon in Dhaka City. Unplanned growth, indiscriminate filling of low-lying areas, unwise closer of natural drainage and navigational canals, unauthorized encroachment by squatter settlements aggravate the worse situation of flooding and water logging in Dhaka City.

Fig: 4.4: Lake Water is pollater by the washer men.

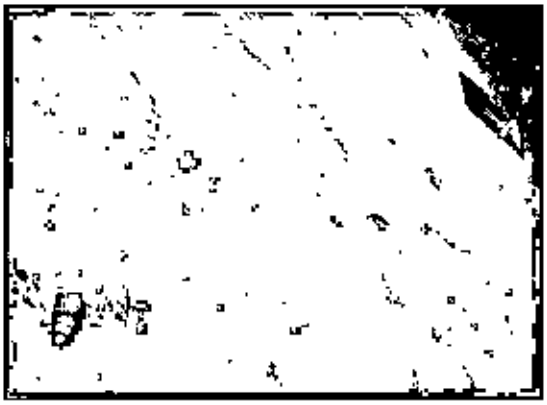


Fig: 4.5: Water Pollution by waste materials at Ramna.

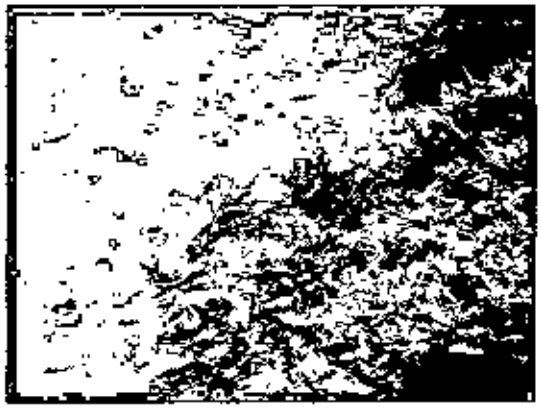


Fig: 4.6: View of polluted water of the pond near Kali Temple.

In Ramna we find a very beautiful lake but it was encroached upon in the North West side to build Dhaka Club building. A pond is also located at the southern corner of Suhrawardi Uddan. People ply boats, take bath, and wash in this lake and pond and the water of this lake and pond is polluted by man himself. The different types of waste material like plastic bottles, poly bags, papers are found floating in the lake water. The fish and aqua warm cannot sustain because the use of the soap and detergent when people take bathing and washing. For a sustainable lake, environment species of food chain and various trophic levels need careful considerations. Ipil- Ipil, Water Lily, and Lotus are aquatic species of plants that may be recommended in lake, because these plants have extensive root system with rapid growth and a very good capacity for nutrient absorption. This will protect the lake from entrophication. Besides this Ipil-Ipil is a good fish feed. Among the fish varieties, Ruhi, Silver Curp, Grass Crup eats upper level food and purifies water. Sarputy and Rajpury are environment friendly species because they eat wastage in water like rotten leaves, insects and organic materials. However, Nilotica, Kalabaus, Magur, Mrigal, common curp type of omnivorous species should be restricted (Mowla, 2005b).

4.2.3 Soil Condition at Ramna Area:

An eco-city would require a sustainable agricultural or plantation system as part of its planning and function. Southern Ramna or present Suhrawardi uddyan was a barren (actually trees were not allowed to grow) open space with few trees in seventies.

The Bangladesh Government after independence, decided to plant it with deep vegetation. PWD took the initiative to plant saplings of alien plants, which would not grow naturally. For the growth of these saplings they used different types of chemical fertilizers and created a bad impact on the soil. Here we also found that no grass grew under the shaded tree like Bakul tree (it's a natural process). Alien trees have a bad impact on the soil and the environment, which does not support local flora and fauna for the ecological cycle.

Fig: 4.7: No grass grows under the Bakul Tree at Ramna Park.

Fig: 4.8: Deep Shadow also the cause of no grass.

4.2.4 Fire (Energy) Produce at Ramna Area:

Field surveys show that, in the Ramna about 50% of the energy use and CO_2 emissions are associated with transport, about 25% with building and another 25% with different activities. An effective strategy for clean air is to minimize energy consumption in these three areas. Pollution resistant plants may also be grown to tackle the problem. The buildings in the area may also adopt ecological means (Table-8). Energy is an aspect that links a wide range of human and design considerations:

- Pollution (global, regional and global)
- Sun (solar gains, over shadowing, and power generation)
- Wind (natural ventilation, turbulence and power generation)
- Day Light (minimizing artificial light, visual comfort)
- Comfort (overheating, passive control)
- Health (pollution, toxius, sick building syndrome)

The temperature reduction capabilities of a single medium size tree by evapotranspiration are found to reduce shaded area temperature by 2degC to 3 degC. The latent heat transfer from wet grass can result in 6-8 degC cooler surfaces than exposed soft surface (Enam, 1994).

Table- 8: Average reduction in surface temperature for east and west facing light colored walls with various types of landscape plants providing shade or cover.

Landscape element	Average Temperature Reduction (ATR) during day with no direct sun light (degF)	ATR during day with direct sun light (degF)
Large tree moderate size	6.4	24.5
Shrubs	7.6	24.3
Tree /hedge combination	10	28
Moderately thin creeper	8	13.8
Moderately thick creeper	7.5	16

Based on data recorded on a warm summer day. (Parker, 1981).

Each of these aspects plays a role in determining the overall quality of the urban environment. Energy use is thus an issue that will be discuss often in the context of urban planning issues. In Ramna a huge stock of energy is needed for the administrative, commercial, recreational and educational purposes. The different

rides of children's park consume a lot of power of electricity everyday. Institute of Engineers Bangladesh and some other offices are using air conditioning systems with accelerated heavy watts per day. At night the total park area needs heavy watts per day. To create enough power for electricity we many use solar panel here that would reduce the pressure on consumption of power and people get relieved from load shading. The local inhabitants, university kitchens, office kitchens etc consume huge amount of natural gas.

4.2.4a Energy Use per Transport Sector at Ramna Area:

Road transport accounts for the largest fraction of transport energy use. Passenger transport in Ramna amounts to 53% of the total transport with buses. Buses are responsible for 69% of the total energy used for transport (Table-9).

Table 9: Breakdown of delivered energy for passenger travel in Ramna.

Sector	Fraction of Energy
Cars	25%
Motorcycles	1%
Buses	53%
Taxies	8%
Rickshaws	13%

(Source: DCC, RHD, LGED, BRTA, DTCB, DMP, STP, BANGLADESH COUNTRY REPORT, HABITAT COMMITTEE, ECONOMIC REPORT OF BANGLADESH, WORLD BANK REPORT 2003)

4.1.4b Journey Distance and Frequency of Transport Use at Ramna Area:

The mode of transport depends on the distance of the journey in Ramna as can be seen in the table-10. The most noticeable trends are that as the distances increase so vehicular journeys become more frequent and walking is reduced.

Table 10: Journey distance and frequency of transport use at Ramna Area.

	% of Journeys		
Mode	1km	3km	5km
Car	15%	30%	40%
Rickshaw	35%	30%	20%
Bus	15%	15%	25%
Walking	35%	25%	15%

(Source: DCC, RHD, LGED, BRTA, DTCB, DMP, STP, BANGLADESH COUNTRY REPORT, HABITAT COMMITTEE, ECONOMIC REPORT OF BANGLADESH, WORLD BANK REPORT 2003)

4.2.5 Biomass Situation at Ramna Area:

Historically, the sum total of living matter or biomass in a region is drastically reduced when human setup an urban centre there. Biomass is defined as the weight of a species population per unit area and the concept was first developed in 1937 by Walter Pickles and obviously bio-mass can be determined for each link of a food chain or for each stratum of a community. The amount of living material expressed in terms of numbers per unit area present in the ecosystems or a trophic level at any given time is called the standing crop, which is often measured in terms of dry weight, and this standing crop is called biomass. When numbers of animals

and bio-mass or rates of animals per unit area are discussed, the production potentials of a given area or volume of a given habitat become important. From analytical studies, it was found that production efficiency decline rapidly from lower to higher trophic levels in the pyramids of numbers. The environment is disturbed and many species are lost, still it is better than any other areas in Dhaka (Fig. 4.9). A number of Species of birds, animals, reptiles, trees and shrubs in Ramna were lost forever (Annexture: 5). They were as follows:

Table 11: Lost Speels from Ramna

Reptiles:	BIRDS
1. MALAYAN BOX TURTLE / DIBA CASIM 2. BLACK POND TURTLE / KALO KAITTA 3 INDIAN TENT TURTLE / MAJARI KAITTA 4. YELLOW TURTLE / HOLDE KAITTA 5 INDIAN BLACK TURTLE / KALO SHILA KACHIMOP 6 PEACOCK- MARKED SOFTSHELL TURTLE / DHUM KASIM 7. INDIAN MUD TURTLE / CHHP KASIM 8 WALL LIZARD, TUKTOO / SANDA 9. BENGAL MONITOR / KALO GUI SAP 10 YELLOW MONITOR / SONA GUI 11. ROCK PYTHON / AGOGAR 12 COMMON VINE SNAKE / SUTANALI SNAKE 13 RAT SNAKE / DHANRAJ 14 COMMON BONOE BACK TREE SNAKE / BETH ACHRA 15 RAT SNAKE / HELENA DUDHRAJ 16 COMMON WOLF SNAKE / SADHARON GARGINNI 17. MARSH SNAKE / DORA SAP 18 MONOCELLATE COBRA / GOKRA 19 BANDED KRAIT / SANKHINI 20 RUSSELL'S VIPER / CHADRO BO	21. INDIAN PIED HORNBILL / PAKRA DHANESH 22. RUFOUS BELLED WOODPECKER / KAPISH KATH THOKRA 23 GREAT BLUE KINGFISHER 24 RED HEADED TROGON 25 LARGE INDIAN PARAKEET 26 FOREST EGAL OWL 27. BROWN FISH OWL 28 JUNGLE NIGHTJAR 29 PURPLE WOOD PEGION 30 KING VULTURE 31. TIGER BITTAN 32 TAWNY FISH OWL 33. BROWN FISH OWL 34 GREY NIGHTJAR

(Source: Iucn :the world conservation union, 2003)(Refer to Annexure:5)

Fig: 4.9: Big Birds are still seen flying over the Ramna Area.

4.2.6 Food Compilation at Ramna Area:

An eco-city would make the maximum possible use of opportunities to grow food plants within its normal boundaries. Thus streets would have the minimum amount of hard paved surfaces. Street trees and plants would be chosen for their productive potentials as well as their aesthetics. Fruit trees might line the streets. Buildings would incorporate greenhouses and hydroponics as a matter of course. It is not impossible to imagine a city, which was an exporter of food. Dhaka's soil is suitable for different types of fruit trees.

During the field survey in Ramna area many fruit bearing trees were found. By planting various types of fruit bearing trees in this site we can easily meet up fruit crisis of the city people besides creating a food chain supporting other flora and fauna of the area.

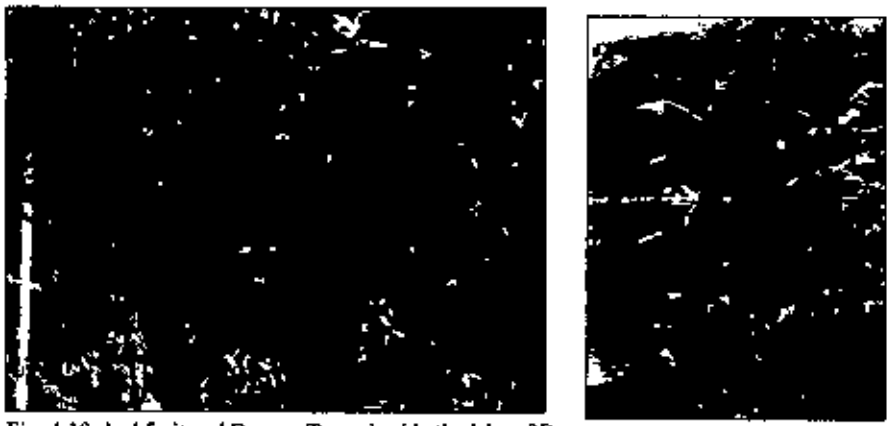


Fig: 4.10: Jackfruit and Banana Trees, beside the lake of Ramna.

4.2.7 Biodiversity Position at Ramna Area:

The Convention on Biological Diversity is one of the outcomes of the UNCED or the EARTH SUMMIT held in RIO DE JANEIRO in 1992. Major commitments of the contracting parties to the convention included its implementation through the preparation of respective National Biodiversity Strategy and Action Plans (NBSAPs). Many of our neighbouring countries have already prepared it; many are implementing their NABSPs and many have even gone for its revision based on feedbacks so far. Bangladesh supports a sizeable wealth of biodiversity, including some 113 species of mammals, 628 spices of birds, 126 spices of reptiles, 22 spices of amphibians, 708 spices of fresh water and marine fish, 400 spices of mollusks, and over 5000 spices of vascular plants (source: IUCN, UNDP, GEF). Many of these spices are globally threatened. Each year, some one million waterfowl migrate to Bangladesh in winter, including such globally endangered species as the Spoon-billed Sanpiper, Asian-Dowitcher, Normann's Greenshanks and Spotted Redshank, etc.

4.2.8 Habitat Formulation at Ramna Area:

An ecocity would be planned and evolved to create diverse habitats and relate its activities to the global web of life. A broad range of habitat types are found in Bangladesh, including

- Tropical evergreen forests

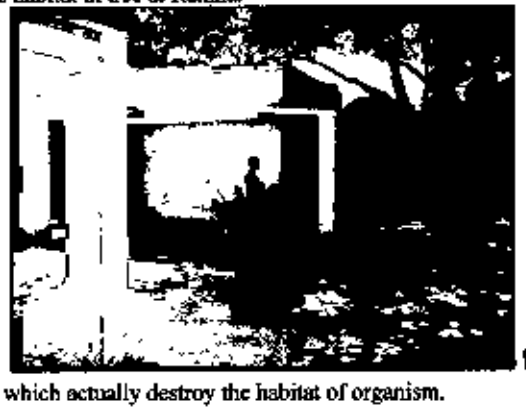
- Moist deciduous forests (Sal Forests)
- Mangrove forests
- Riparian and coastal wetlands
- The littoral and sub littoral
- Benthic communities of Indian Ocean

Over 50% of Bangladesh can be classified as wetlands. Bangladesh supports the largest remaining mangrove forest in the world, the Sundarbans. Here in Ramna we find large and small trees and plants and huge lake considered as the habitat of many different spices of organisms. For the restoration and revitalization of the plantation and lake, it needs to take care that no linkage of surface drainage discharging storm water into the lake nor any alien trees are planted. Other wise we cannot ensure the sustainable habitat for the organisms in lake water and park around.

Fig: 4.11: Dry up portion of the Lake where living species of water are lost.

Fig: 4.12: White ant made habitat in tree at Ramna.

a.



b

Fig: 4.13: The different built structures at Ramna which actually destroy the habitat of organism.

4.2.9 Ecolinks Interact at Ramna Area:

This clearly relates to the above points. 'Ecolinks' is a term refers to the condition where ecological region is linked to another. Ramna is an isolated area, giving rise to an island effect in terms of ecology. An animals and seeds and severs functional ecosystem linkages. Even Ramna park and the suhrawardi uddyan are also bisected by wide roads, effecting its ecolife. An eco-city would be planned in relation to its entire region (and beyond) within an inviolable network of 'ecological corridors'. Such corridors need to be introduced into the planned redevelopment of existing cities.

4.2.10 Waste Produce at Ramna Area:

There is no such thing as waste in nature. People move all day long in Ramna and produce waste like polybags, packets of dry foods, plastic bottles, papers etc. The dropped leaves of trees are collected by the lower income group of the society for cooking foods by burning the dry leaves.

Fig: 4.14: Dry Leaves are collected by the poor people for cooking fuel.

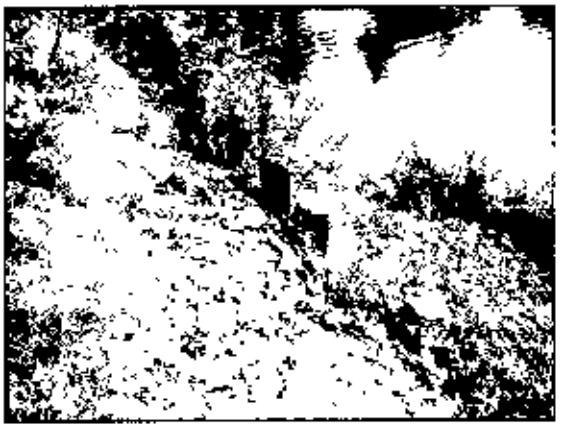


Fig: 4.15: Waste Materials (Poly bags) are stored beside the lake.

Fig: 4.16: Collection of dry leaves and other waste materials.

The pollution may be considered as any act, which defiles the earth matrix, the air, the soils, or the water supply and thus disrupts the fragile balance of life.

4.3 Eco Foot Print of the Ramna Study Area:

The environment is the sum of all external condition and influences affecting the life and development of organisms. It consists of air, water, food and sunlight, which are the basic needs of all living beings and plant life, to carry on their life functions (Next Chapter provides an eco-footprint analysis on Ramna). The environment also includes other living things as well as temperature, wind, radiation etc. Organism has three basic physiological requirements to meet if they are to live as individual and perpetuate the species. These are- Nourishment of the species, Recuperation i.e. coming up to natural standard and Reproduction. These basic psychological requirements have their ecological counter parts in proper food (nourishment), adequate shelter and safety (recuperation) and the right type of environment in terms of space/ housing/ territory conducive for reproduction. In past 100 years Ramna lost its own environmental character severely due to heavy disturbances showing no respect to its living organisms.

4.3.1 Field Investigation in Ramna Area:

The important characteristic of this area is that it is extensively covered by vegetative surfaces and has a distribution of a large number of mature trees. Offices and various other institutional buildings with an average building height of 5 storeys are surrounding this park. The following sections describe observation sites and present the findings from the field investigations on micro-climate conducted in this area. The street pattern in this area does not have characteristics of orthogonal grid layout nor was there any identifiable geometric inter-relationship between the streets in the area. Ahmed's (1995) data logging areas were revisited to take fresh readings and comparing them with the old ones.

a. Data Logging from Hare Road:

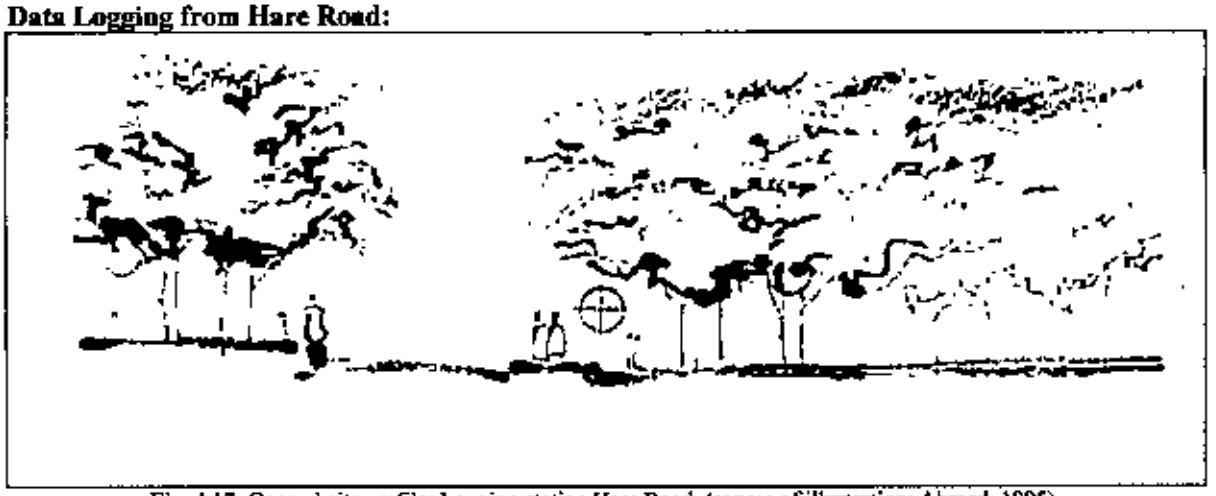


Fig. 4.17: General site profile: Logging station Hare Road. (source of illustration: Ahmed, 1995).

This observation site was located on Hare road, which was lined with a number of mature spreading tree and close proximity to the park area. Although the site is fairly covered with trees, vegetal covering beyond this site and toward the east is progressively diminished. Hence this site can be considered as a northern most

boundary of the area with fairly high distribution of vegetal covering. The temperature and the humidity data were logged in this point.

b. Data Logging from the Ramna Park Inside:

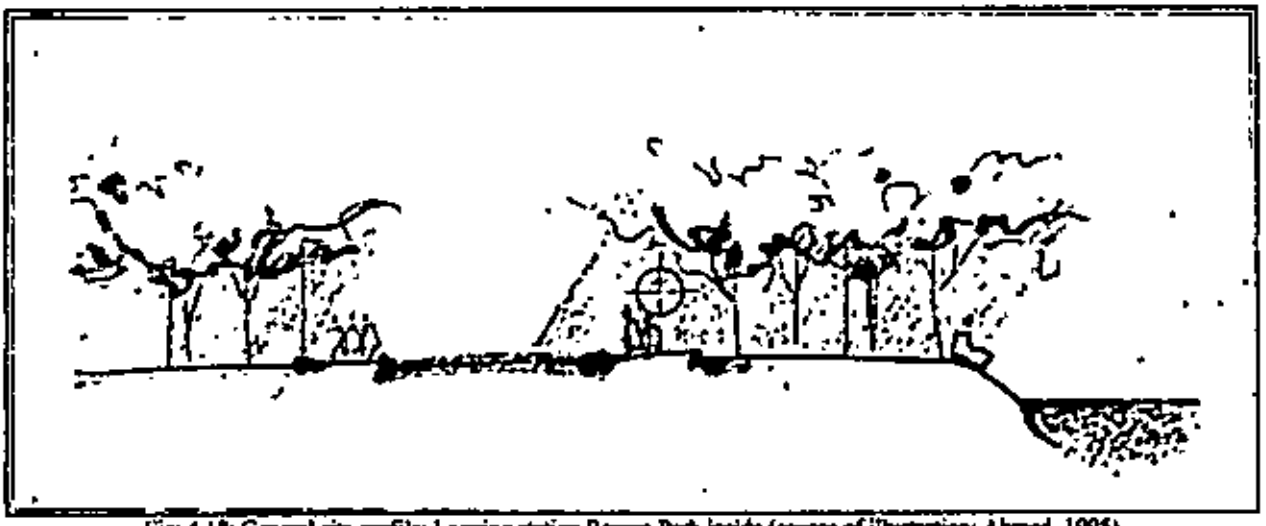


Fig: 4.18: General site profile: Logging station Ramna Park inside (source of illustration: Ahmed, 1995)

There was no buildings in close proximity to the data logging site, which was essentially a street lined with trees. The Ramna Lake was close to this logging station. Apart from the street and the pavements, the surface area of the site was generally covered with grass and there were abundant trees in the area. A temperature logging device was installed in this station.

c. Data Logging from the Curzon Hall Area:

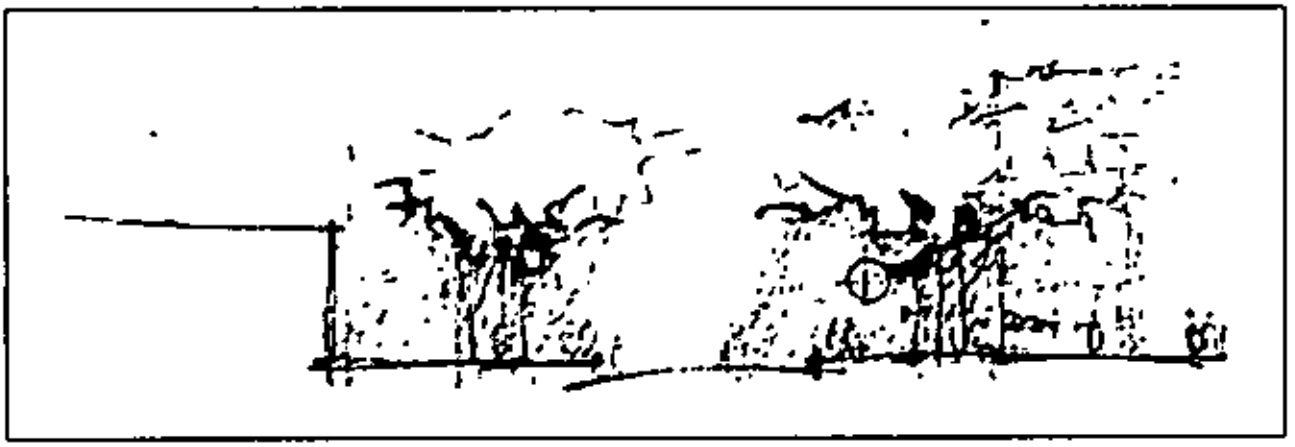


Fig: 4.19: General site profile: Logging station Curzon Hall (source of illustrations: Ahmed, 1995).

The site was closely located near the Curzon Hall (Dhaka University Science Faculty) and the southern part of the study area. The road was lined with a number of mature trees which formed a canopy over the street. The general characteristics of the fabric of this area were consistent with the rest of the Ramna area, where

apart from the roads and side walks, the surface area had a vegetal covering. The buildings were often widely spaced and did not form a uniform canyon wall. A temperature logging device was installed in this site.

d. Data Logging from the Abdul Gani Road:

Fig: 4.20: General site profile: Logging station Abdul Gani road (source of Illustrations: Ahmed, 1995).

The street was East-west oriented and it was in the south eastern perimeter of the area. There were trees lining both sides of the street, as well as along the centre. The trees along the street were of relatively low height (25'-30') with a narrower crown in comparison with the trees in other streets of this area. Here also a temperature logging device was installed.

4.3.2. Field Result: Air temperature in Ramna Area:

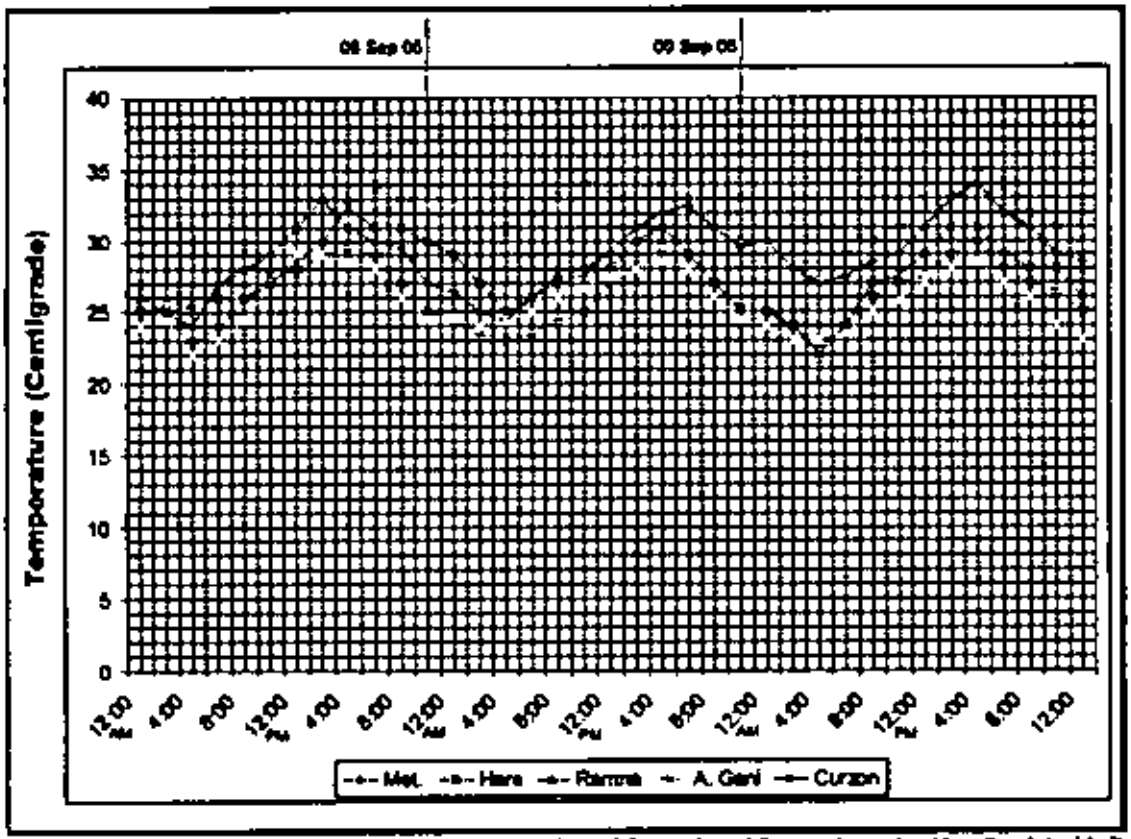
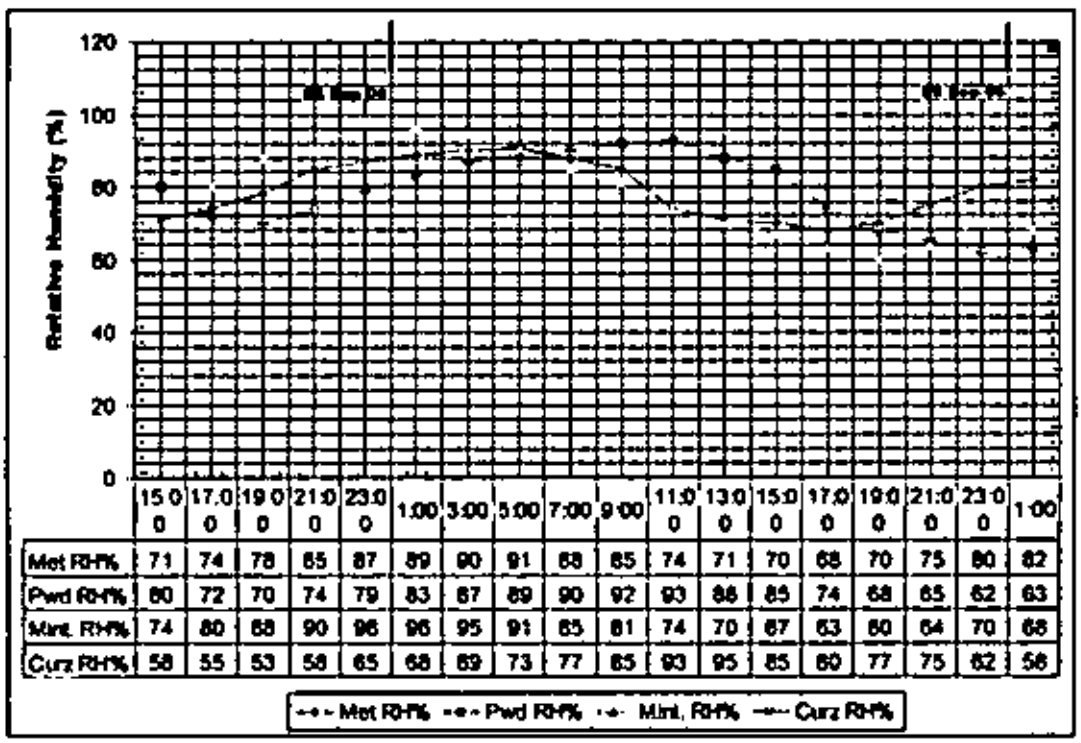


Fig: 4.21: Field Result: Air temperature in Ramna Area (data collected from selected four station point: Hare Road, Inside Ramna Park, Abdul Gani Road and Curzon Hall of DU Area during the month of September, 2006)

At the metrological station, measurements were carried out at a level close to the ground (1.5m), where as the field observation was at a higher level (3.5m), while the metrological recording was being done in an exposed area in Ramna. It takes for the air layer at a higher level to reach the same temperature as the air layer at a lower level by means of convection. The roughness created by the tree foliage substantially reduces the air velocity, hence reducing turbulent mixing of air layers (at different temperature) within that area. As with the turbulence mixing, the conductivity and thermal diffusivity of the air mass increases. The cooling effect of the large green park on the urban air temperature was most pronounced within a close proximity of the green park The cooling effect produced by the evaporation processes taking place in the plant canopy depends on the certain environmental factors i.e. air temperature, relative humidity, available moisture in the soil, air velocity and on the amount of leaf area (Oke, 1978). As similar environmental conditions prevailed at all stations during the observation period, it was the gross leaf area around that particular observation site in the park which accounts for the difference in ambient temperature. At all observation sites, for clear sky conditions, relative higher air temperature regime was observed between 2:00 p.m. and 5:00 p.m., where maximum temperature often reached 32°C. It is important to note that, maximum temperature recorded Thus it is apparent that trees in the urban landscape can provide reasonably comfortable for a city such as Dhaka. at these sites are with in higher limits of the comfort range without air motion and under shaded conditions.

4.3.3. Field Result: Relative Humidity in the Ramna Area:



	15:00	17:00	19:00	21:00	23:00	1:00	3:00	5:00	7:00	9:00	11:00	13:00	15:00	17:00	19:00	21:00	23:00	1:00
Met RH%	71	74	78	85	87	89	90	91	88	85	74	71	70	68	70	75	80	82
Pwd RH%	80	72	70	74	79	83	87	89	90	92	93	88	85	74	68	65	62	63
Mint. RH%	74	80	88	90	96	96	95	91	85	81	74	70	67	63	60	64	70	68
Curz RH%	58	55	53	58	65	68	89	73	77	85	93	95	85	80	77	75	82	56

Fig: 4.22: Field Result: Relative Humidity in the Ramna Area(data collected from selected four station point: Hare Road, Inside Ramna Park, Abdul Gani Road and Curzon Hall of DU Area during the month of September, 2006).

As a general observation the humidity Peaks measured at all sites in this area were inversely related to the temperature peaks, hence at lowest temperatures highest humidity level were recorded and at high temperatures lowest humidity levels were registered. The maximum and minimum relative humidity recorded in this area was higher than those recorded at the metrological station. However the observation sites the lowest humidity level was often 50% during midday. In all cases humidity levels were as high as 100% early in the morning and were actually 8%-10% higher than the recordings at the meteorological station. High average relative humidity in this micro climate can be attributed to the transpirational processes that take place in the vegetal mass. Relative humidity higher than meteorological values were particularly observed during the night, owing to the nocturnal evaporation often observed in urban areas (Oke, 1978).

a. Air flow:

From the field investigations, it can be summarized that air flow was not a reliable resource for cooling in areas with high vegetal cover, as the surface roughness at the urban boundary level considerably reduces air velocity at pedestrian level. However trees with sufficient clear height (ground to underside of the crown) may improve flow conditions at pedestrian level. Shading provided by the tree canopy significantly reduces relatively gains hence the need of air flow, in terms of comfort requirement, is markedly reduced. It is also important to note that despite weak air flows, when obstructed by hard building surfaces local turbulence were produced with velocities higher than that of approach flow. Thus in situations with weak flows pedestrian spaces can be designed close to such building surfaces.

Studies have shown that urban parks and green areas in cities can create a cool island, the intensity of which depends on the type and quality of the vegetation; (Civoni, 1991; Spronken-Smith and Oke, 1998). Most of the studies concentrated on the positive effect of the green areas on the urban climate. The potential cooling effect, as well as the negative climatic effect of urban parks is particularly important in urban areas located in hot climates, where an urban heat island develops.

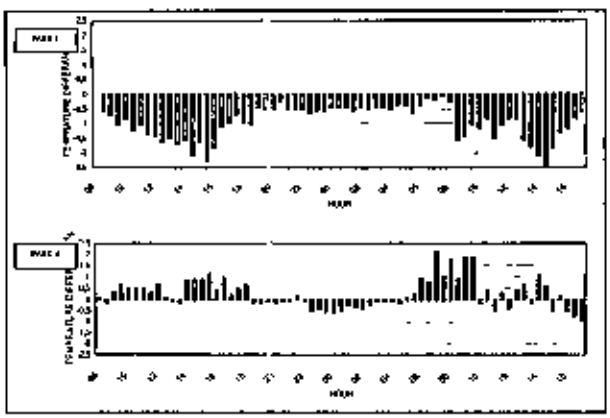


Fig: 4.23: Showing the temperature variations along the day in between two Parks. Park A= with medium size trees, Park C= with large shading trees.

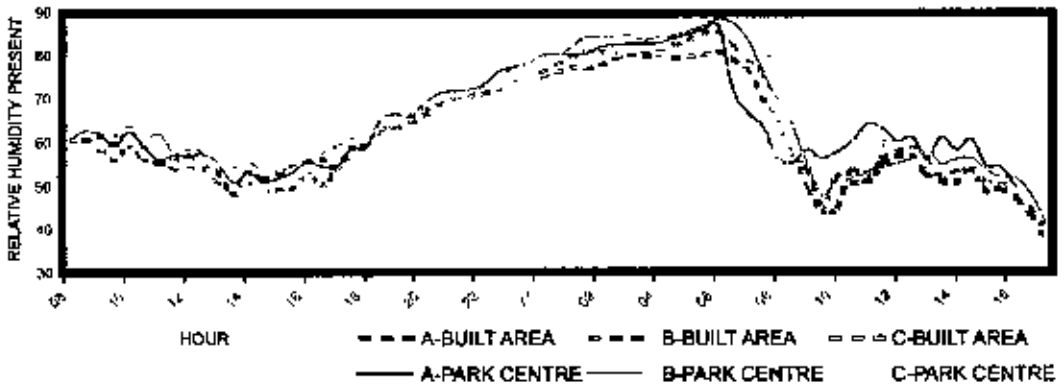


Fig: 4.24: Showing the RELATIVE HUMIDITY variations along the day in between three Park Centres.

The study emphasizes the fact that a well-treed Ramna park is cooler than its surrounding built-up environment in hot and humid weather conditions. However, the study points out that park (front of parliament building, Sher-E-Bangla Nagar) with grass and only a few low trees can be warmer than the built-up area during the day, and slightly cooler than the built- up area during the night. This can be explained by the lack of shading inside park in comparison to the urban canyon street. This park was also found to be more humid than the built-up environment. The combination of high temperature and high relative humidity values creates a negative influence on human comfort sensation.

It is clear that urban parks with trees will develop a cool island and therefore will be more comfortable for humans than the built-up environment. This study points out that despite the cooling effect of the urban park, at certain times the park with medium size trees can have a negative effect on human comfort sensation due to reduction of wind speed and an increase in relative humidity. However, during the night this park type was very humid and suffered from lack of ventilation, and therefore has a negative effect on human climatic comfort sensation. Urban Parks with high and wide canopy trees have the maximum cooling effect during the hottest hours of the day and have a positive effect on human climatic comfort.

4.4. Geo-Climate of Ramna

4.4.1. Climatic Condition at Ramna Area: The elements and components constituting the landscape of cities affect the regional climate through a complex interaction generating distinct microclimates. Although there are numerous processes occurring in urban climate system, each having their own mechanistic interpretation such as, relative exchanges, evaporative processes, they are essentially derivations from the regional climate. Appreciation of the environmental characteristics at a regional scale can contribute towards a proper environmental evaluation at an urban scale. The climate of the Ramna area is characterized as mild Tropical with hot humid features. The wet season lasts June to September. Light cold is common from December to February. Ramna lies within the monsoon climate zone at an elevation of 1.5 to 13 meters (5 to 43 ft) above mean sea level (Haque, 2007). Like rest of Dhaka city it has an annual average temperature of

25°C (77°F) and monthly means varying between 18°C (64°F) in January and 29°C (84°F) in August. Nearly 80% of the annual average rainfall of 1,854 mm (73 in) occurs between May and September(Haque, 2007). Wind velocities are high during wet season.

Dhaka is located in the geographic center of the country and the Ramna is in between the old and new Dhaka. The temperature profile of the city, based on the measurements made at the Meteorological Office, indicates a clear congruity with the regional pattern, where highest temperature are recorded in March, April and May, reaching a maximum temperature of 35.4° C in April. In the monsoon and post monsoon period, from June to October the temperature remain steady at an average of 28.3°C. In winter season, the temperature drops to an average temperature of 20.7°C, while minimum recorded was 11.0°C in January. Although over heating is a major environmental concern for Dhaka for most of the period, the combination of the environmental factors in the ambience during those periods dictates the nature of problems, i.e. over heating with dry or humid conditions.

4.4.2 Water Quality and Hydrogeology of Ramna: The fluctuation of the water level of Ramna is largely correlated with the rainfall during wet season and the withdrawal of water for built form. The water level of Macro Ramna has decreased during recent years; however, the causes of this phenomenon have not yet been fully investigated. It is assumed that high-rise apartment buildings on the eastern side of Ramna are the main cause of the dropping the level of ground water. The hydrology of the lake of Ramna is complex. For a complete interpretation of the observed phenomena and management of the water regime, a comprehensive study of the hydrogeology of the region is deemed necessary.

4.5 Summary:

Dhaka's average growth rate has decreased from 7% to 2% but the urbanization rate has exceeded 6%. In the past the city was clean, the air was fresh to breathe, fewer traffic and the river was the main way to transport and lifeline for attraction and now Ramna is the only major public open space in this city. The geomorphological character of the region is defined by the lakes, ponds, green open spaces and by the dense built form situated at a short distance around the open spaces. People move around through out the day in Ramna and produce wastes and pollutions. Historically, the sum total of living matter in a region is drastically reduced when human setup an urban centre there. An eco-city attitude would reverse this trend, increasing the effective biomass as part of an ecosystem. Here in Ramna we find large and small trees and plants and huge lake considered as the habitat of many different spices of organisms. The important characteristic of this area is that it is extensively covered by vegetative surfaces and has a distribution of a large number of mature trees. The climate of the Ramna area is characterized as mild Tropical with hot humid features. Wind velocities are high during wet season. Studies have shown that urban parks and green areas in cities can create a cool island, the intensity of which depends on the type and quality of

the vegetation. Urban Parks with high and wide canopy trees have the maximum cooling effect during the hottest hours of the day and have a positive effect on human climatic comfort.

An eco society is considered to be a society that cares for sunlight, air, water, land, greenery and other natural blessings, energy and generation of waste, which endeavors to return to natural cycle. The waste that is ultimately discarded after treatment minimizes the burden on the environment (Mowla, 2008). This statement provides the checklist for qualitative assessment of ramna's ecosystem.

In nut shell, Ramna experience show that trees grouped together create a refreshing park or oasis in a city and also cools nearby neighborhoods. Grouped trees can protect each other from sun and wind, making them more likely to grow to maturity and live longer. The findings in this research confirm studies done by Ahmed (1995) and Mowla (1989 and 2008). It also confirms that cooling effect range of green parks is about 150m to 200m from the park edge depending on surrounding urban morphology. The quantitative survey identifies certain 'attractive' zones while certain zones are also noted for their 'unattractiveness' and these corresponds with the nature of plantation and biodiversity.

Chapter V

Qualitative Analysis and Synthesis of Ramna's Urban Open Space

Qualitative Analysis and Synthesis of Ramna's Urban Open Space

Having set the framework for analysis in the chapter II and III and identifying areas of interest in the Ramna area, the qualitative analysis and synthesis of Ramna's open space is set. The laboratories set for the study corresponds with the data logging areas of chapter IV.

5.1 The Challenge and the Goal:

The architect does not have a role only for the design of new buildings. In the developed part of the world, most of the buildings are already in place. Here the architect has the new and challenging task to take care of the existing building stock, for instance by taking responsibility for refurbishment, reconstructions and adaptations to the new demands for sustainable development. In quantitative terms, such measures are considerably more important for the environment than the design of new buildings. The most important factor in the list is perhaps the responsibility that the architect/ planner have for the long-term development of built environment. This includes factors such as traffic planning for low emissions, urban topologies that promote compact solutions with high service levels while maintaining green and other spatial qualities, provision for mixed uses and integration of social classes and cultural groups. One important factor for sustainable development is to make plans that facilitate neighbourly co-operation such as collective housing or neighbourhood units with spaces for community cooperation.

5.2 Attractiveness of Ramna:

In an ordinary day in Ramna, pedestrians pass by on the side walks, poor children play on the ground, people sit on benches and steps, the hawker makes his rounds with his goods, passerby's greet each other on the sidewalks, groups engage in conservation. This mix of out door activities is influenced by a number of physical conditions. Physical environment is of varying degree and is manifested in many different ways. Outdoor activities, and physical conditions that influence them, is the subject matter of this study. Greatly

simplified, outdoor activities in open spaces can be divided in to three categories. Each of which places very different demands on the physical environment: necessary activities, optional activities, and social activities.

Necessary activities- include those that are more or less regular affair like going to school or to work, shopping, waiting for a bus or a person, running errands, distributing mail- in other words, all activities in which those involved are to a greater or lesser degree required to participate. These activities will take place throughout the year, under nearly all conditions, and are more or less independent of the exterior environment. The participants have no choice.

Optional activities- that is, those pursuits that are participated in, if time and place make it possible are quite another matter. This category includes such activities as taking a walk, breath of fresh air, standing around enjoying life or sitting and bathing. In streets and city spaces of poor quality, only the bare minimum of activity takes place. In good environment, a completely different, broad spectrum of human activities is possible.

Social activities- are all activities that depend on the presence of other public spaces. Social activities include children at play, greetings and conservations, communal activities of various kinds and finally- as the most wide spread social activity-passive contacts, that is simply seeing and hearing other people. Different kinds of social activities occur in many places: in dwellings: in private out door spaces, gardens, and balconies; in public buildings; at places of work; and so on; but in this context only those activities that occur in publicly accessible spaces are examined. These activities could also be termed "resultant" activities.

5.2.1 Intensity of Use in Ramna:

At present the land of Ramna is under-used (not proper use as city's open space) by the city dwellers, the condition of present use being substandard, while maintenance is poor. Absence of law and order encourage vandalism and attract undesirable activities. The questions arises that whose needs could potentially be met in this area? Answer of this question, there are two broad groups or categories of potential users that has been identified - they are:

i. **People Living in the Neighbourhood Area:** The area is an open space for the inhabitants of the surrounding neighbourhoods. A large number of people living in the neibourhoods of Ramna and Suhrawardy Uddyan are students, teachers, ministers, government and non government officials of whom approximately 25 percent are under 20 years of age, while 65 percent are between 20 to 65 years, and the rest are older than 65. The need for a neighbourhood park is evident from the survey for all age groups on each day of the week.

The density of population in the neighbourhoods has recently gone up as a result of new urban development, but the available and planned outdoor space still falls short of official standards. The average user of this site is a male adult sometimes accompanied with children, who came to walk, sit and look around. Women and children visitors to Ramna are relatively small.

Fig: 5.1: Ramna at noon (a hawker selling moa: a food item).

ii. Visitors from Outside the Neighbourhood: This category mainly consists of tourists and hawkers from all over the city and beyond. As a part of their visit to the city they enjoy this attractive open green environment. The largest group in this category are the visitors to the cultural places located in the area like National Museum, the University buildings, Art College, Shishu Park, Engineers Institution and also the Hospitals. The visitors to public events, periodically organized in this spot, also belong to this category. The flow of motorized traffic around the site is an obstacle for pedestrian access. It always proves difficult to optimize both types of access.

5.2.2 Calendar of Events at Ramna:

Before and after the independence Ramna is the place of cultural activities of the city dwellers (Table : 12). In this region people inherited a rich culture that has evolved for hundreds of years. Culture is learned and depends on being brought up within a framework- a cultural space, wherever people congregate and act in ways associated with particular activities, values and social relation. People learn culture. The day to day ways of life of a group of people of a certain geographical boundary is known as the culture of that people. Many national cultural events take place in Ramna every year. A huge number of people participate and enjoy in these events regularly (Table 13). Events are as follows:

Table: 12 Yearly Events

• Pahela Baishak (1st day of Bengali Year) • Ekushey February (International Mother Tongue Day) • Independence Day • Victory Day • Book Fair • Film Festival • Drama Festival • Valentines Day	• Procession • Protest • Concerts • Cinema screening • Debates and meetings • Jatras • Exhibition • Cultural program • Students meetings • Rabindra and Nazrul Jayanti Rally

(Source: Bangladesher Songskrity by Syed Alf Ahsan)

Fig: 5.2: First day of Bengali year: Shahbag Area.

Fig: 5.3: First day of Bengali year: front road of Ramna Park.

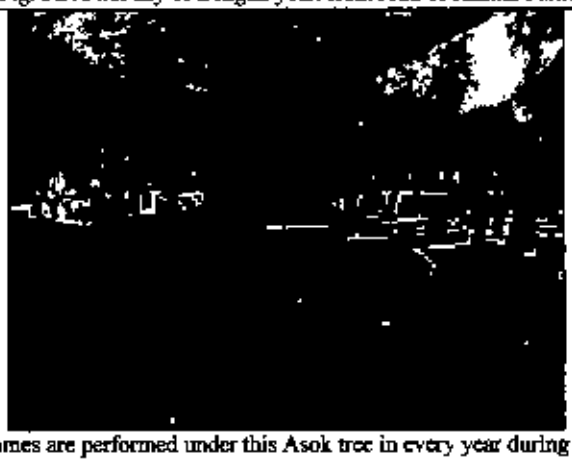


Fig: 5.4: Cultural programmes are performed under this Asok tree in every year during the first day Bengali year.

Table 13: The activated events in different site of Ramna by the people.

Place	Events/ Activities	Spaces	Results/Needs	Proposal
Shahbag (Lab 01)	Pahela Baishak 1st day of Bengali Year	On the Streets & Footpath	Overcrowed No Particular Space	Crowd Mangement Planning
	Sale of Flower Sale of Art Works	Beside and on the Footpath	Blocking the space	Replace The site
	Human Chain	On the Street	Always create traffic congestion	Motivate the people

Others: Police control room occupies area a south-east corner at the Shahbbag. It needs relocation

Place	Events/ Activities	Spaces	Results/Needs	Proposal
National Museum (Lab 01)	Music, Dance, Cultural program, Exhibition etc	Auditorium and Exhibition Hall	High Rent Limited access	Create more public access to the plaza and to make use of the front open space

Others: Sculpture in the front open space of the museum can have free access.

Place	Events/ Activities	Spaces	Results/Needs	Proposal
Public Library (Lab 01)	Art film festival, Drama, Music, Dance, Cultural program, Debate, Exhibition etc	Auditorium and on the open space	Film show can not run regularly, shortage of space	Preparation of technical support like digital media centre, archives, viewing room etc,

Others: Unplanned extensions and relocation of WASA building from the opposite side of the road.

Table 14: Activity Scenario and need assessment

Place	Events/ Activities	Spaces	Results/Needs	Proposal
Institute of Fine Arts (Lab 01)	• Exhibitions • Outdoor installation • Festival rally • Wall and street • Painting • Selling of books, handicrafts, pottery, etc. • food shops	Zainul Gallery, outdoor courtyard, streets and footpath	Lack proper management, blocking the footpath, lack of proper sitting facilities.	More Plantation need. Exhibition space must be modified.
Dhaka University Library (Lab 01)	Meeting Place, gathering of couples	Surrounded open area of the building.	Poor condition, Crime Zone.	Need the area management and discipline.
Modhur Canteen (Lab 01)	Political Gathering of the students	Surrounded open space	Poor condition, Crime Zone.	Create proper access.
TSC of DU (Lab 01)	1.cultural program 2. Debates 3. Kabita utshab 4. Concert 5. Patha Natta 6. Meeting 7. Watching TV (big screen)	Surrounded open space, Streets, court yard, DUS, Footpath. Auditorium	Average condition, Recreation Zone, Need Conservation, Traffic congestion.	Create proper entry and exit, Small auditorium needs renovation.

- Others: Lac of parking facilities, risky street crossing.

5.2.3 The Visible Landscape at Ramna:

Visual population or clutter, is an offence against the landscape, and thus against society—for the landscape is society's home. To pollute the visible environment is an act of obscenity, of corruption. The limits of what and how much may be added to, subtracted from, left standing in, or dumped upon the landscape is a matter of fitness and propriety.

Billboards and Signs: At Ramna often billboards are closely spaced and they are not obliterating the scenery but even block each other. Though zoning controls are needed to protect view and vistas, and to preserve the quality of the roadway and the adjacent neighborhoods.

Fig: 5.5: Billboards near Dhaka Club stands just like a wall and get more emphasis in Dhaka's urban environment than other elements.

Fig: 5.6: Billboards obstruct view of the Ramna park.

Where the tourist information is needed, when at approaches to Ramna area, an attended roadside station can replace and better serve the purpose than thousands of square feet of roadside advertising scattered along the way.

Overhead Wires and Utility Poles: The utility poles and overhead lines are understandably a swelling outcry that all wires be put underground. There is no longer an excuse for the installation of unsightly poles or overhead wiring. For small fraction of building construction costs, all power and telephone distribution lines can be buried in underground conduits where they are out of sight, easily accessible for pulling and repair, and protected from winds, falling limbs, and the weather. The community appearance of Ramna area is greatly improved thereby. The less obvious they are the better. As a rule they should be kept away from areas where people congregate and from routes where people travel.

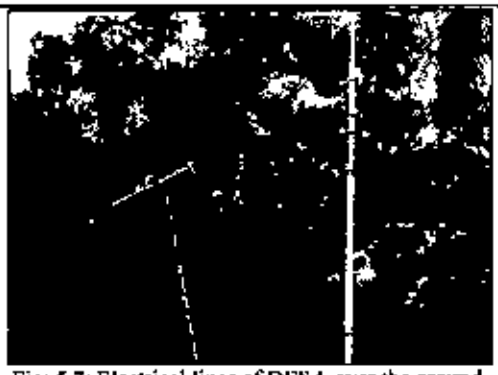


Fig: 5.7: Electrical lines of DESA over the ground.

b. **Junk, Trash and Garbage:** By tradition we have carted our refuse off to dump it some where "out beyond" in rotting, rusting heaps. The lumber, paper, fibers, glass, raw garbage is generally grouped together in the category of the solid waste. In Dhaka on an average each of us throws away in one day more than 2 kgs of trash and garbage. (The total amount of collected garbage in Dhaka city is 3500 tons/per day (Source: JICA).

Fig: 5.8: Trash and garbage found in the Park.

Fig: 5.9: Garbage trays are keeping left over the footpath.

Fig: 5.10: Repair Work needs repair.

5.3 Accessibility to Ramna:

5.3.1 Enclosure and Accessibility:

We always try to make barriers to protect a place from visitors; it may be park or play fields. Now it is a culture of competition that who will make the highest fortification. These trends come from the ownership of a space and everybody wants a defined boundary of his land. Property demarcation, insecurity are the reason of having boundary walls. In a psychological sense boundary walls increase the feeling of protection. It is a general observation that anti-social activities and crimes take place near boundaries and dark areas outside range of public eye. The studied area has lot of examples of crimes cause of the fortified boundary wall. Yet crime can occur anywhere- at bus stops, in workplaces, on streets, at school

gates, in community centres, at shops and even in living room. Boundaries that curtail vision and undermine access do not stop crime.

The Ramna Park, Suhrawardy Uddan and National Eidgah are grilled all around. This seriously obstructs both visual and physical accessibility and also the barier of wind flow to the living zone. Public buildings with notable green open spaces are also bounded by solid boundaries or grilled with a restrictive gateway. Most of the open spaces present in this Ramna area are not visible from the sidewalks or roads and are also inaccessible. The road islands, road dividers are also grilled and covered with billboards on all sides. The disabled citizens are really disabled in public spaces.

Fig: 5.11: Footpath in front of Bangla Academy.

Fig: 5.12: Boundary wall of Shishu Park.

Fig: 5.13: Footpath in front of P.W.D. office. with

Fig: 5.14: Enclosure less Suhrawardi Uddan, space defined enclosure or without enclosure makes different taste.

5.3.2 Recreational Facilities at Ramna area:

At present Dhaka city is almost a jungle of concrete blocks, there is hardly any open space or water body left. Barrier free open spaces especially when nearer to roads, bus stops, shopping and other facilities and within affordable walking distance they function effectively. Central Shaheed Minar, neither grilled nor walled up, has about 250 users every afternoon (Nilufar, 1999).

To create such open spaces now mean many structures are to be torn down in different localities. This proposition is neither practical nor feasible. Accessible greens/lawns, gardens, open air theaters adjacent to the sidewalks not only would ease the movement but would also contribute to the possibilities for inhabitants, ordinary citizens, elderly and children alike to rest, relax or play. Spaces need not be created

exclusively for recreation and leisure rather it may be incorporated with compatible elements and activities.

Fig: 5.15. Ramna at morning: people do their regular physical exercise.

For example a raised platform surrounding a tree on the footpath at PWD gate, Segunbagicha is a resting place for many passer bys. The national Eidgah is now used by the many people for taking rest and gossiping. The front plaza of Public Library and Institute of fine arts is the first choice for many young people for changing their views and ideas.

Fig: 5.16: Young people take rest and gossip in front of the Institute of Fine Arts.

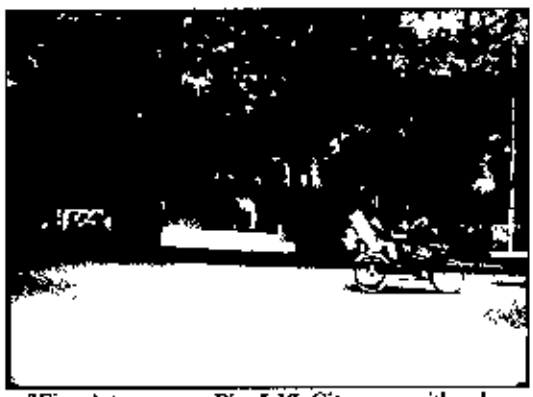


Fig: 5.17: Cityscape with colours.

5.3.3 Streetscape and Footpath of the Ramna Area:

Fig: 5.18: Roads and Footpath layout at DU.

Number of routes, its linkages, accessibility to spaces and permeable boundaries are essential central elements of responsive urban open spaces. For pedestrian permeability immediate open spaces i.e. outdoor spaces of buildings must be considered first to achieve visual and physical accessibility. When associated open spaces of public offices, shopping centers, museums etc. right by the side of the foot paths are bounded by walls the whole vicinity loses the feeling of openness and also visual and physical accessibilities are stopped.

Here at different areas of Ramna we have found the variation in size of footpaths, some places it are wide enough and some are very narrower to walk. In most of the Ramna area footpaths are covered with large tree canopies. Due to this reason side walks are very enjoyable here for the people of different age's group during day time. The footpaths and sidewalks serve several functions besides facilitating movement.

Hawkers sit with their belongings in baskets or spread over the footpath. At times makeshift stalls providing meals are also visible, where eating and drinking tea are going on. Use of the sidewalks for personal commercial purposes is rampant. They also are the meeting places for many, especially when indoor spaces are reduced to match affordability of the vast majority. Thus footpaths bring some kind of public togetherness and public life. It has been found that in Dhaka city, the urban dwellers popularly use both the streets and open spaces for different activities. Pedestrian movement is seriously hampered due to narrow width of sidewalks and encroachment by vendors.

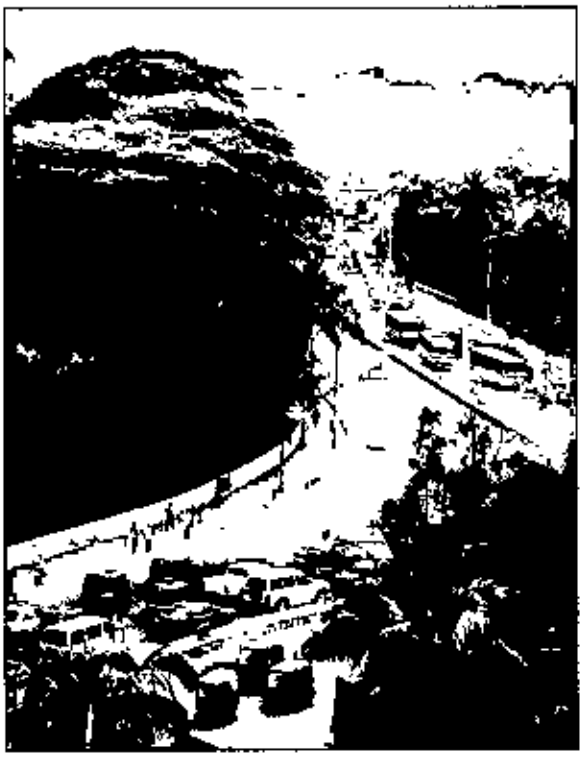


Fig: 5.19: Arial view from a corner near Captain Monsur Ali Road.

Fig: 5.20: Shows different activities by blocking footpath.

5.4 Findings from Lab 01, 02 & 03:

The field work on Ramna open space has been divided into following three main categories like:

Educational, Cultural and Public Zone: (Lab 01)
Central Shahid Minar, Curzon Hall, Bangla Academy, Central Library of DU to Shah Bagh.

Commercial Activity Zone: (Lab 02)
Sheraton Hotel to Sonargaon Hotel area.

Administrative and Green living Zone: (Lab 03)
Ramna Park, Front of press club and PWD Building, Towards Mintu Road,

Different contextual survey data are collected from these three Labs. Gathered Data's are presented here chronologically.

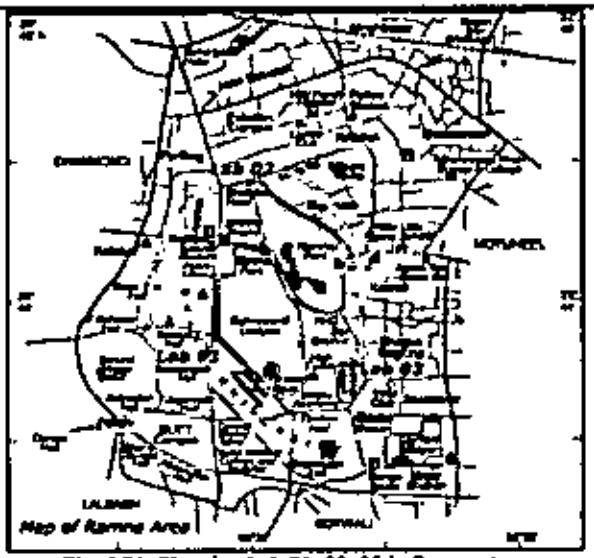


Fig: 5.21: Showing Lab 01, 02, 03 in Ramna Area

Collected Data (Site: *Central Shahid Menar Area*) are as follows (Urban Lab 01):

1. Space type: Public (Central Shahid Minar: Monument for the mother language martyrs).
2. Use Type: This area is extensively used during the month of February and December and also used around the year for public cultural functions.

3. Entry Type: Pedestrian accommodation and vehicular accessibility both are found to this site.
4. Built Structure Type: R.C.C. structures and huge paved surfaces are present.
5. Ground Coverage: 40% area with built forms and pavements.
6. Green / Vegetation: 60% area vegetated with large and medium size shading trees.
7. Pedestrian Use (footpaths and roads): 100% (calculated pressure of passerby aligned with the paved area) during the month of February and only 25% (calculated pressure of passerby aligned with the paved area) uses are found rest of the year.
8. Vehicular Movement: 35% (calculated pressure of transports aligned with the road surface area) traffic movements at peak hour (8:00 a.m.-2:00 p.m.) of the day mostly are cars and rickshaws.
9. Boundary Wall: Not present around the monument (Shahid minar).
10. Visibility / Permeability: widely visible area without any visible obstruction.
11. Activity: Cultural activities are very positive. Homeless people are sleeping and taking rest under the shaded area of the large trees and the plaza area.
12. Influence: Pressure of students and patients (Dhaka Medical Hospital) are present.
13. Sectional View: Highly segregated levels are present, sectional variation of levels are differing from 0'-0" to 8"-0" maximum.

Fig: 5.22: Open Plaza front of the Central Shahid Minar.

Fig: 5.23: Level changes are found at the Plaza of Central Shahid Minar.

Fig:5.24: Front Plaza and Footpath, Central Shahid Minar.

Fig: 5.25: Spontaneous public amenities beside Central Shahid Minar.

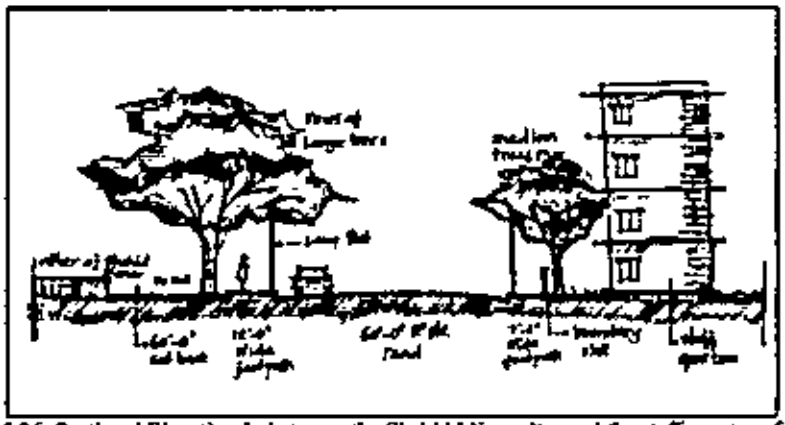


Fig: 5.26: Sectional Elevation in between the Shahid Minar altar and the staff quarter of DU.

Fig: 5.27: Front of the entry gate of Dhaka Medical College.

Fig: 5.28: Road, Footpath and unpaved ground in front of the Central Shahid Minar.

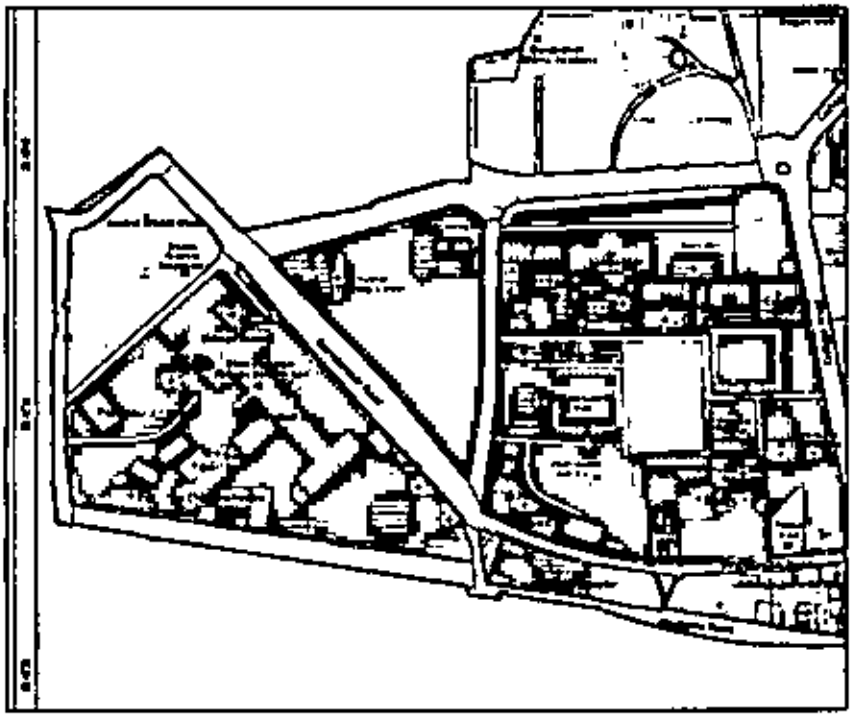


Fig: 5.29: GIS Area map of Central Shahid Minar and the adjacent area. (Source: Chief Urban Planner, DCC).

(Data is collected from the field survey. These are justified and analyzed through the satellite view and GIS map of that locality and also from the different book review.)

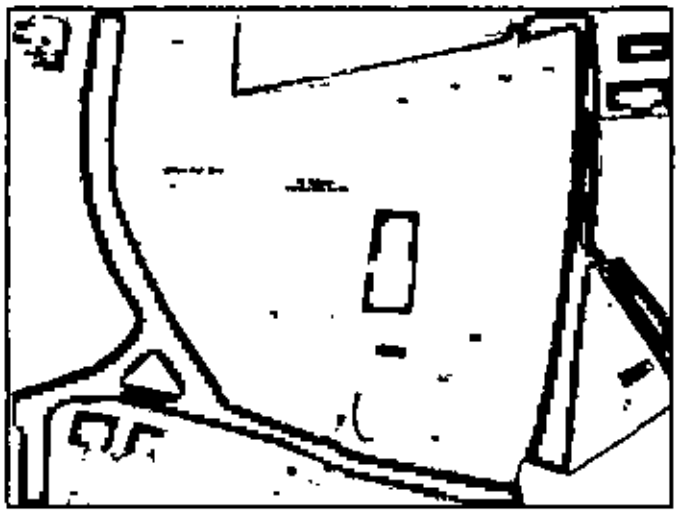


Fig: 5.30: Approach road towards Central Shahid Minar area from TSC and Jagannath Hall of DU : GIS Area map (Source: Chief Urban Planner, DCC).

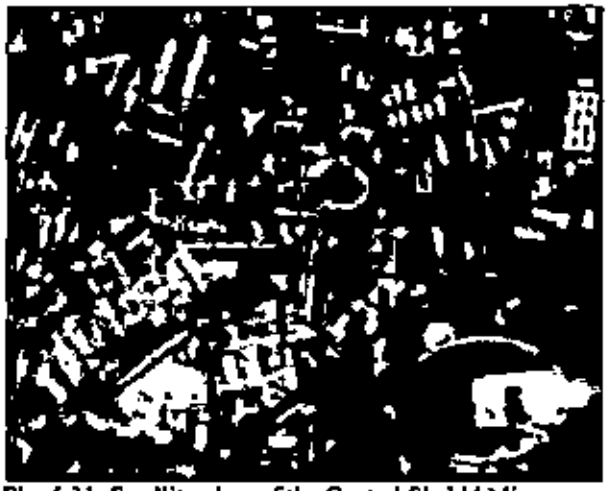


Fig: 5.31: Satellite view of the Central Shahid Minar area.

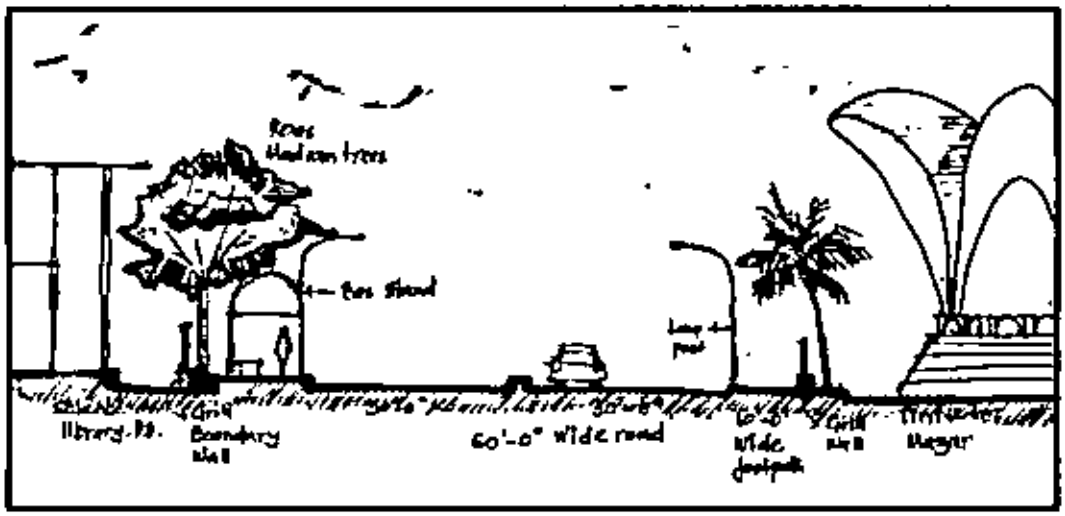


Fig: 5.32: Sectional Elevation near Tin Netar Mazar (Tomb of three Leaders).

Fig: 5.33: Tin Netar Majar (Tomb of three Leaders), a huge RCC structure heavily protected by steel fence.

Fig: 5.34: Preserved Dhaka Gate near Doel Chattar.

On the southern part of the Ramna Area and adjacent corner of Carzon Hall, there is round about or a node point of Dhaka which is locally called **Doel Chatter**. The abstract figure of two birds taking bath, were constructed over a circular base and water nasals were set around these two sculpture to make water flow when necessary.

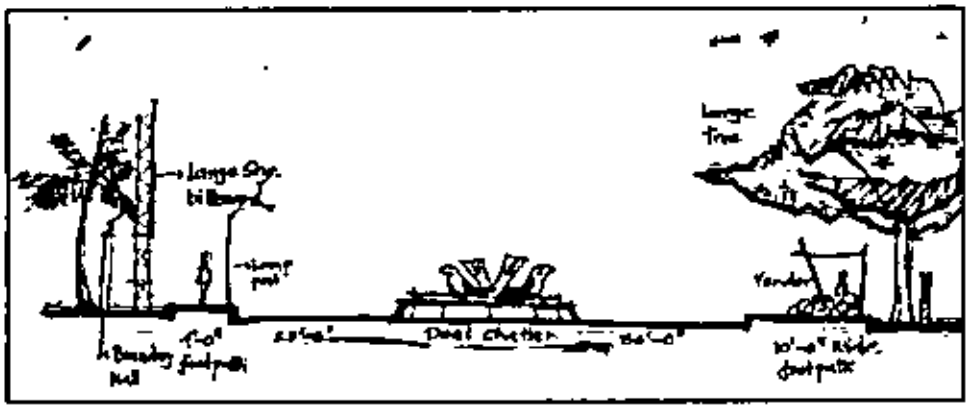


Fig: 5.35: Sectional Elevation near Doel Chattar (Doel Roundabout).

A yellow coloured gateway structure near the science library and Tin Netar majar was actually built by Charles Daws following the Mughal typology Architecture (Dani). The **Tin Netar Majar** (Three Leader Mosoleum) is a huge monumental reinforced concrete structure for the three great national leaders of Bangladesh who were buried there after their death. The flower like structure was designed by the Department of Architecture, GOB. The site of Bangla Academy campus is just opposite the Tin Netar Majar crowned with a colonial building named Barddhoman House. The Bardhoman House, now known as Bangla Academy was renovated and used by the academy authority. The people come here to enjoy the different festival and cultural program designed by the authority, particularly during the month long book fair in February.

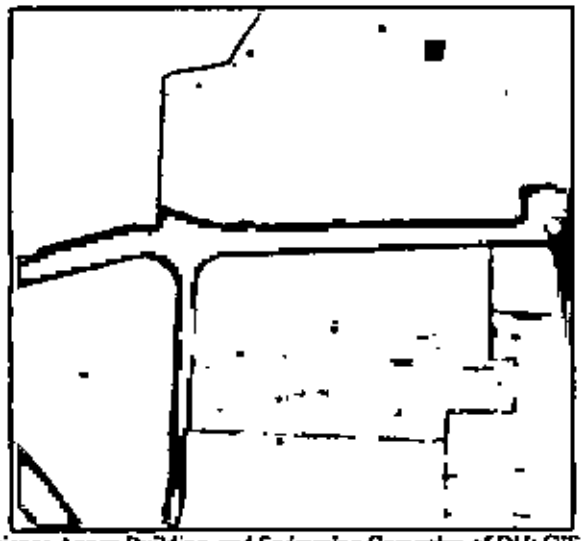


Fig: 5.36: Doel Chattar Area, Science Annex Building, and Swimming Complex of DU: GIS Area map (Source: Chief Urban Planner, DCC).

Fig: 5.37: Sectional Elevation near Doel Chattar (Doel Roundabout).

<u>Collected Data (Site; *Doel Chattar Area, Science Annex Building, Swimming Complex of DU, Bangla Academy*) are as follows(Urban Lab 01):</u>

14. Space type : Public,
    - Doel Chattar: A node Point of Dhaka City.
    - Cuzon Hall: A colonial structure of early 20th century.
    - Mir Jumla Gate: Historical structure used as entrance gate of Ramna.
    - Tin Netar Mazar: Monumental structure and the graveyard of three national leaders.
15. Built structure type: R.C.C. structures and brick and lime stone structures are found which are historically significant.
16. Entry Type: Presence of paved footpath for pedestrian movement and vehicular movement is also accelerated.
17. Ground coverage: 55% areas are covered with built forms and streets and pedestrian ways.
18. Green / Vegetation: 45% areas are filled up with large and small trees.

19. Pedestrian Use: 30% (calculated pressure of passerby aligned with the paved area) more or less uses along the day. Pedestrian movement on the both side of the street near Curzon Hall and the width of the paved surface is abnormally large compared to other pavements of the city. It is not a boulevard.
20. Vehicular Movement: 45% (calculated pressure of transports aligned with the road surface area) traffic movements at pick (8a.m.-3p.m.) hour of the day mostly are cars and rickshaws.
21. Boundary Wall: Steel Grill Present around the monument (Tomb of Three Leaders).
22. Visibility / Permeability: areas with average visibility and an axis developed towards TSC area.
23. Type of Use: Total area is mainly used by students and general people.
24. Activity: Positive, presence of students gathering, occasionally: during Baishakhi Mela (celebration of the 1st day Bengali Year) and Book Fair create in the month of February a big gathering and a huge number of people come to this place and enjoy the festival. Shishu Academy is extensively used by the children regularly or occasionally.
25. Influence: It's a corridor in between old and new Dhaka.
26. Sectional View: Highly segregated levels are present, sectional variation of levels are differing from 0'-0" to 12'-0" maximum.
27. Vendor: About 20-23 (number varies in different days) pottery sellers (beside/ blocking the footpath) present near the Shishu Academy.

(Data are collected from the field survey. These are justified and analyzed through the satellite view and GIS map of that locality and also from the different book review.)

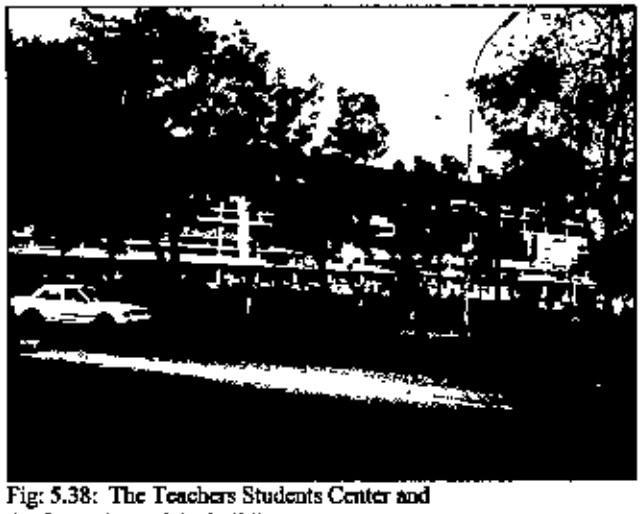


Fig: 5.38: The Teachers Students Center and the front plaza of the building.

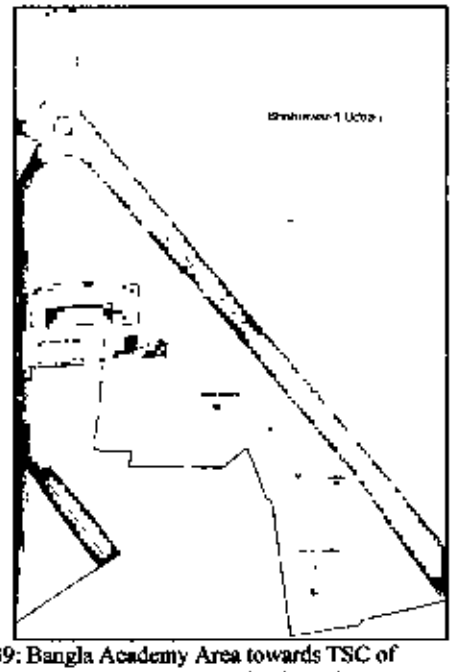


Fig: 5.39: Bangla Academy Area towards TSC of DU: Gis Area map (Source: Chief Urban Planner, DCC).

Fig: 5.40: Sculpture in front of TSC, DU acts as a node point.

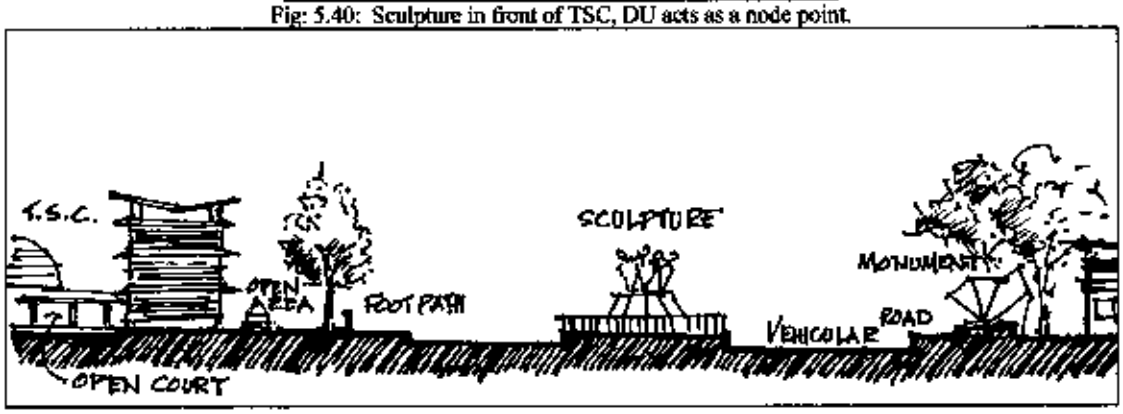


Fig: 5.41: Sectional Elevation of TSC Area, Dhaka University.

Fig: 5.42: Street art in the front boundary wall of Art Institute enriched the space.

Fig: 5.43: Open space made the set back of the National Museum Building.

In between the **Teachers Students Centre** and **Central Library of DU** there is a roundabout which creates a plaza situation for the students and outsiders. There is an entry gate of Suhrawardiuddan near TSC. A sculpture expressing the revolution motion of people in the middle of this plaza, creates another node of the area. The **Institute of Fine Arts of DU, Public Library** and **National Museum** were set parallel to Suhrawardiuddan and these buildings are in the prime position of the city where people come to visit and enjoy for all day long. The TSC, Art Institute, Public Library and Dhaka Museum are the main educational and cultural activity zone of the Dhaka city. **Shahbagh** area is one of city's bus

stoppages where passengers wait for buses to go to their destination. The Casualty and serious patients arrive to the **BIRDEM Hospital** everyday and the Bangabandhu Sheikh Mujib Medical University (BSMMU) to get treatment. These are two renowned hospitals of Dhaka.

Fig: 5.44: Huge Space in between BSMMU Hospital & BIRDEM Hospital used as the main arterial road of Dhaka.

Fig: 5.45: Road in between the Museum & the Hospital divided by too many Islands.

<u>Collected Data (Site; *Central Library of DU to Shahbag Area*) are as follows(Urban Lab 01):</u>

28. Space type : Public

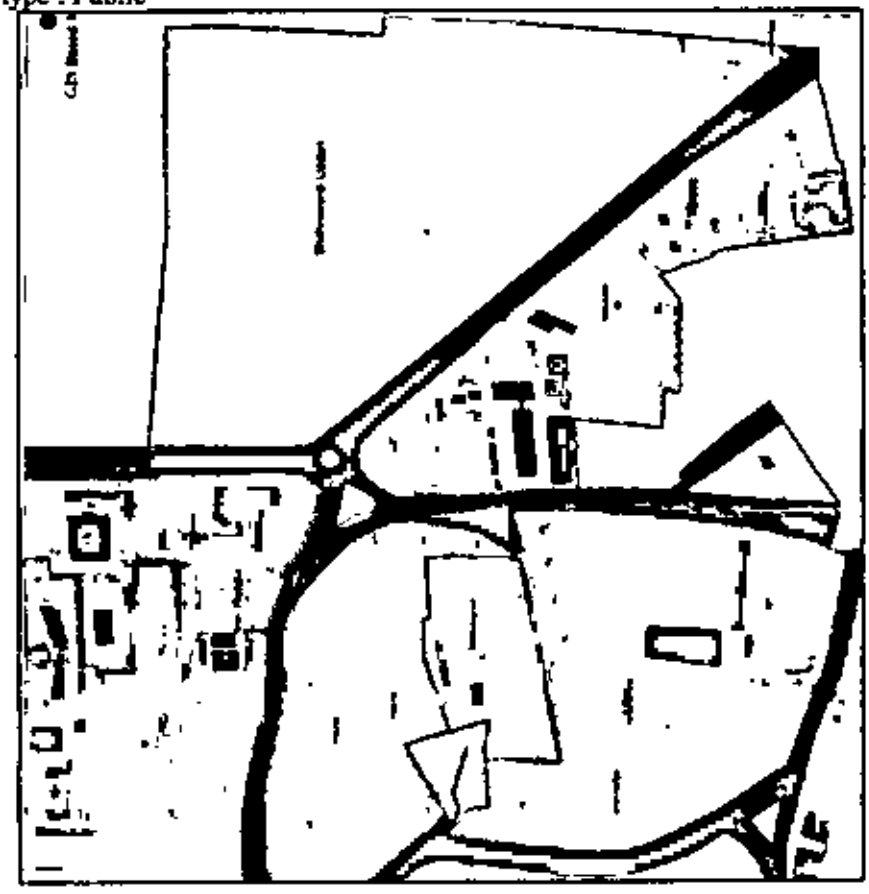


Fig: 5.46: Map of TSC AREA. DU: GIS Area map (Source: Chief Urban Planner, DCC).

- TSC: Teachers Students Centre of Dhaka University
- Central Library of Dhaka University
- Institute of fine Arts: a institute under Dhaka University
- Public Library: The head library of the country.
- National Musem
- BIRDEM Hospital: Specialized hospital for diabetic patients.
- Bangabandhu Sheikh Mujib Medical University (BSMMU): University for post graduate degrees in medical science with high rise hospital.
- Dhaka Club: Used by the elite group of the city.
- Shahbag bus stand: One of city's biggest bus stands with huge traffic load.

TSC, Central Library, Intitute of Fine Arts, Public Library Dhaka Museum are the main educational and cultural activity zone of the Dhaka city and the Ramna park is just opposite to these settlements.

29. Built structure type: R.C.C. structures and load bearing (old buildings) structures (Basically all are Institutional buildings) are found.
30. Ground Coverage: 65% areas are covered with built structure.
31. Entry Type: Mainly vehicular access.
32. Green / Vegetation: Covered 35% areas with different varieties of trees.
33. Pedestrian Use: 20% (calculated pressure of passerby aligned with the paved area) people are using the pedestrian ways.
34. Vehicular Movement: 85% (calculated pressure of transports aligned with the road surface) traffic movements at pick hour (8:00a.m.-6:00p.m) of the day mostly are cars and buses.
35. Boundary Wall: High boundary walls are present around each institution.
36. Visibility / Permeability: 40% areas are present with wider views.
37. Activity: Positive/ very high, occasionally this area used as the main meeting place. Serious patients and casualties create pressure on the road out side the hospitals.
38. Commercial Activity: Flower shops, Medicine shops, Leather shops, Restaurants are available here.
39. Influence: Easily mixing of different classes of people.
40. Sectional View: Vertically low segregated levels are present,
41. Vendor: Present in large numbers.

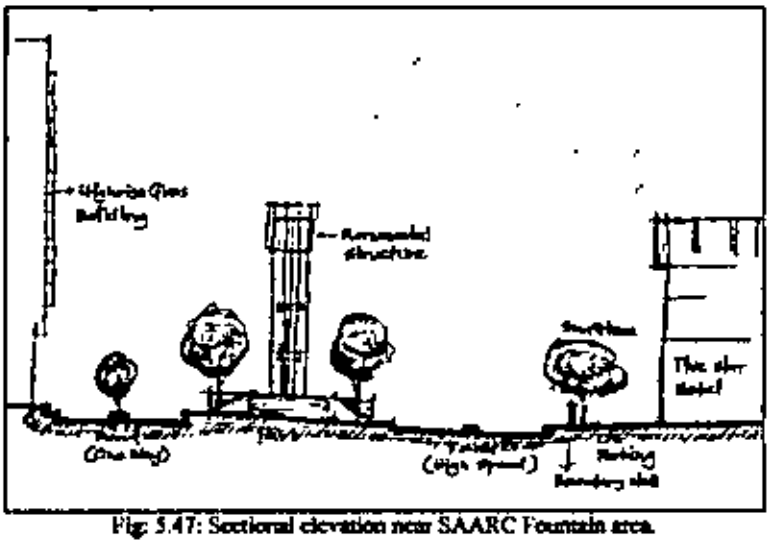


Fig: 5.47: Sectional elevation near SAARC Fountain area.

The Sheraton Hotel to Bangla Motor in the Kazi Nazrul Islam Avenue is one of the highest commercial activity zone of Dhaka city. This area comprises with high rise apartment building, wholesale bazzar, work shops, gas station / petrol pump, shopping mall, offices and government and private housing. The Kazi Nazrul Islam Avenue is the main arterial road of Dhaka. Many high-speed motor vehicles are passing through this road everyday, the huge traffic jam is the regular incident, and people have to wait for long time to get their destination.

Collected Data (Kazi Nzrul Islam Avenue) are as follows(Urban Lab 02):

42. Space type: Both Public & Private and also restricted areas are found here. It is one of the most commercial activity zones of the Dhaka city.
43. Built structure type: R.C.C. structures with heavy foundation, basement presents, high rise apartment buildings, whole sale bazaar, squatters and slums, public park, shopping mall and five star hotels and SAARC Fountain (node point of Dhaka).
44. Ground Coverage: Covered 88% areas with heavy construction.
45. Green / Vegetation: Only 12% areas are with various trees mostly medium and small.
46. Pedestrian Use: 40% (calculated pressure of passerby aligned with the paved area) uses and this range getting higher at peak hours.
47. Vehicular Movement: 100% (calculated pressure of transports aligned with the road surface) traffic movements at peak hour (8:00a.m.-6:00p.m.) of the day create huge traffic congestion. Different mode of high speed vehicles are present mostly buses. A high speed vehicular road is passing through this space known as VIP road is the main arterial road of the city.
48. Boundary Wall: Heavily protected (Height over 6'-0") each land.
49. Visibility / Permeability: Exposure 20% (Narrower view), stands with poor views of urban space.

50. Public Park: It was made for the tourists near Sonar Gaon Pan Pacific Hotel and now it is used by the lower income groups for their accommodation.
51. Begun Bari Khal: One of the city's oldest canal and most part of it filled up by built structure.
52. Activity: Positive, creates congestion, people's participations are very high during office hour.
53. Influence: Five star hotels entertain the foreigners and spaces are found moderately clean than the other part of the Dhaka.
54. Sectional View: Trouble-free segregated levels are present,
55. Vendor: number is very low but street children are selling flowers, news paper, books, food items etc

Ramna park is visible from the east side of the Mintu Road near Sheraton Hotel. The Mintu Road was planed for the high official's residential zone during 1905 to 1911 by colonial administration which was taken extended by the Master Plan of 1959. We call it the green living zone of Ramna. The total Mintu Road is covered with shaded trees like Koroi, Asholh, Bath (local name of this trees) etc.

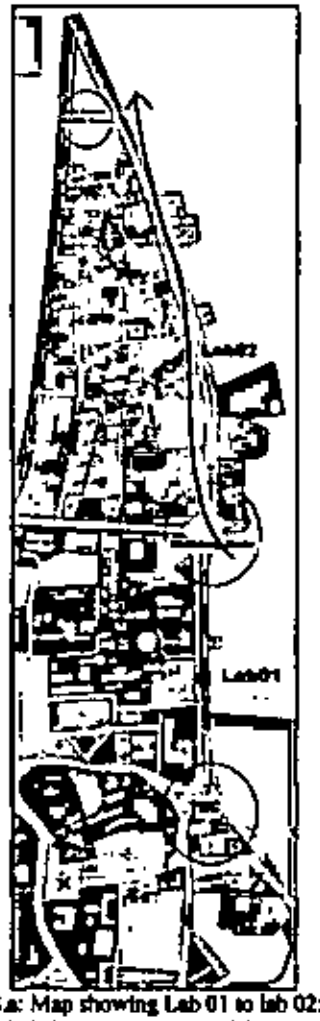
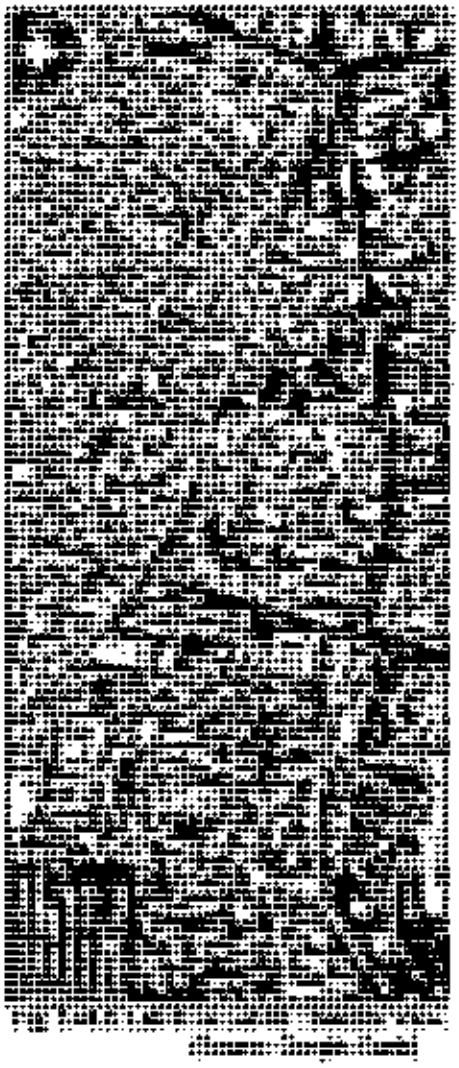


Fig: 5.48.a: Map showing Lab 01 to lab 02: GIS Area map
(Source: Chief Urban Planner, DCC)



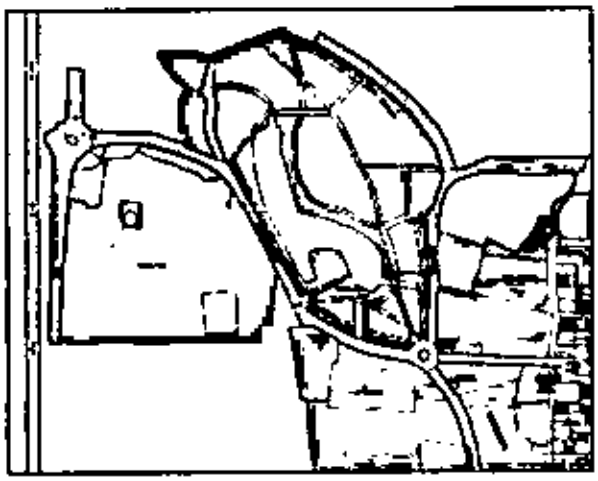


Fig: 5.49: Map showing Ramna Park and its surrounding area; GIS Area map (Source: Chief Urban Planner, DCC).

Fig: 5.50: Shows the encroachment at Ramna Park (illegal Tin shades of Kakrail mosque).

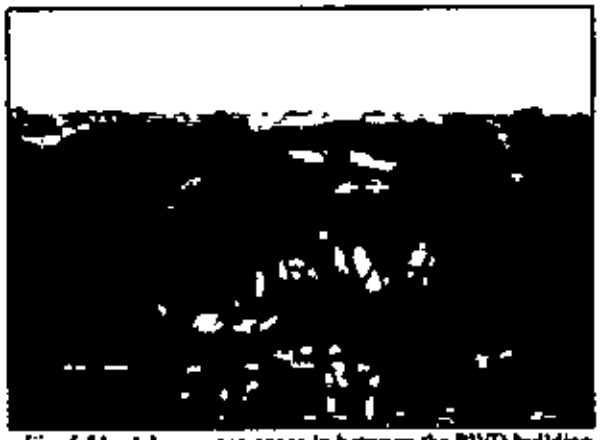


Fig: 5.51: A large open space in between the PWD building & the Supreme Court is covered with large shading trees.

The **Kakrail mosque** is the religious place for the Tablegh Jamat (worker for Islam). A good number of musulli (devoted Muslim people) always visit and stay in the mosque for a period. They built tin shades for their accommodation on the south side of the mosque, which are actually illegal settlements. We found a large open space in between the Supreme Court Building and Public Works Department building. The surface area in front of PWD building and Architecture Building is fully paved and the surface area near the Supreme Court is landscaped by paved blocks very recently.

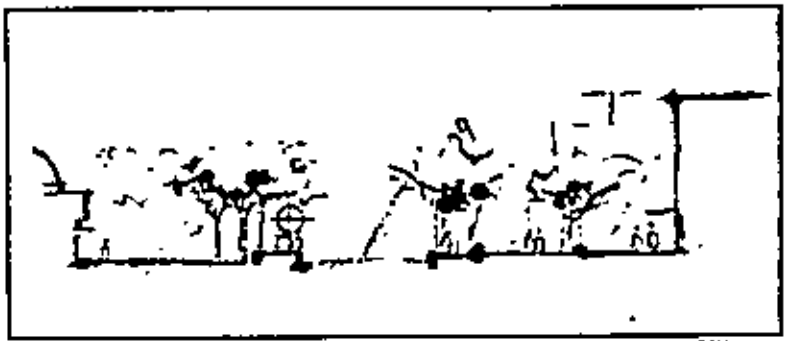


Fig: 5.52: Sectional elevation between the PWD building and Supreme Court (source of illustrations: Ahmed, 1995).

The material of landscape items are concrete and specialized bricks. Here we find a colonial Architecture type building which is now used as the High Court. Once upon a time old High Court Building was the Governor's House and later turned into the building of Dhaka college (Mamun, 2003). Now this building is being well kept by PWD.

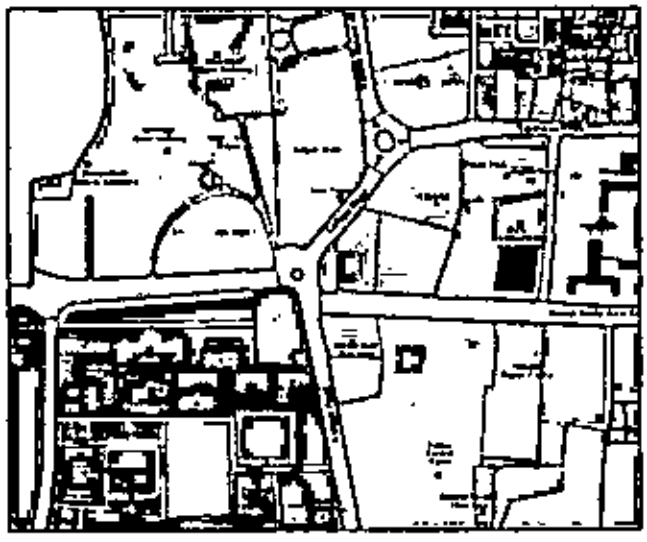


Fig: 5.33: Map showing Abdul Gani Road and Press Club area: GIS Area map (Source: Chief Urban Planner, DCC).

Collected Data (Site: *Mintu Road, Captian Monsur Ali Road and Press Club Area*) are as follows(Urban Lab 03):

56. Space type: Both Public, administrative and green living zone especially for the ministers.
57. Built structure type: Load bearing and R.C.C. structures with heavy foundation are present.

- Kakrail Mosque: Congregational place for Tableague Jamat.
- Shilpokala Academy: An Academy for Arts and Artists. Exhibitions, dramas, musical shows are very frequently observed here.
- Motshow Bhaban: Building for department of fisheries and now become a node point.
- PWD: Public Works Department is used by the engineers and architects.
- Bar Council Building: Buildings for Layers.
- Supreme Court Building: Highest Court for judgment, the general public building used by the lawyers and victims and found very restricted use.
- Press Club: Building for Journalist; it is their meeting place. Political and social processions are very frequently observed here.
- Shikhkha Bhaban: Building for Department of Education.

- Eid Gah: Muslim people of Dhaka usually used it only two times of a year for saying prayer during Eidul Fetar and Edul Ajha and other times it has no use. Eid gah is heavily fortified with steel fences. Floating people are sleeping and taking rest all the day long on its ground.

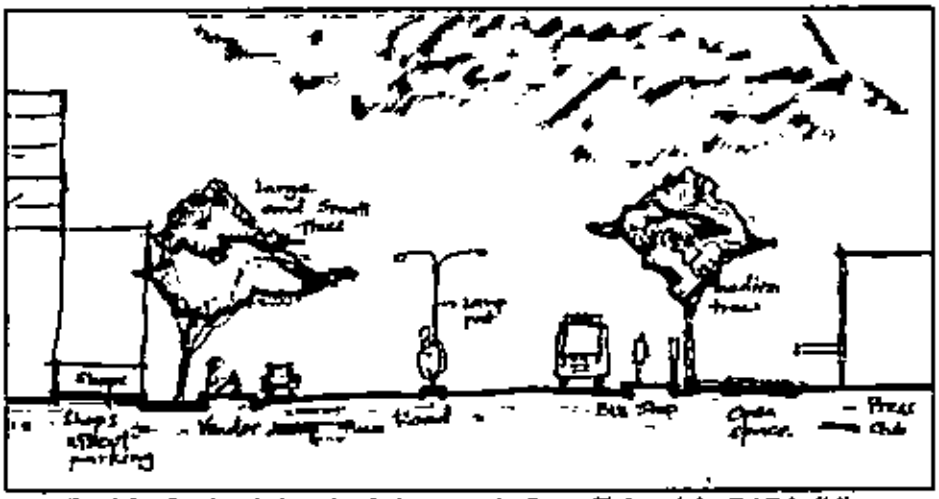


Fig: 5.54: Sectional elevation in between the Press Club and the DAB building.

Fig: 5.55: Bar Council built beside Ramna is an example of encroachment in the green space.

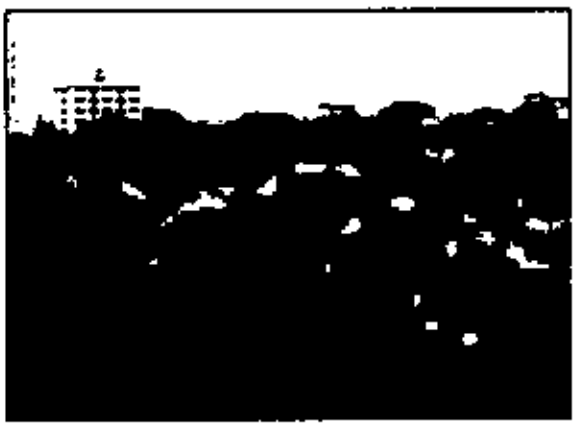


Fig: 5. 56: High rise building stands up over the large Trees of Ramna Area at the South-East End of the green space.

58. Ground Coverage: 70% areas are covered with heavy construction.
59. Green / Vegetation: 30% areas are vegetated with various trees mostly are medium and large.
60. Pedestrian Use: 30% (calculated pressure of passerby aligned with the paved area) uses and getting higher at peak hours.
61. Entry Type: Vehicular access.
62. Vehicular Movement: 100% (calculated pressure of transports aligned with the road surface) traffic movements at peak hour (8:00a.m.-6:00p.m.) of the day create traffic congestion. Different mode of high speed vehicles are present mostly buses.
63. Boundary Wall: Heavily protected with grilled wall (Height over 6'-0") in each land.

64. Visibility / Permeability: Exposure varieties are present when passing trough the street; some views create richness of the urban space (in front of Supreme Court).
65. Activity: Positive, creates little congestion, people participations are high during office hour.
66. Influence: This area becomes dead at night (after 7:00a.m.).
67. Sectional View: Trouble-free segregated levels are present.
68. Vendor: number is very low but street children are selling flowers, news paper, books, food items etc.

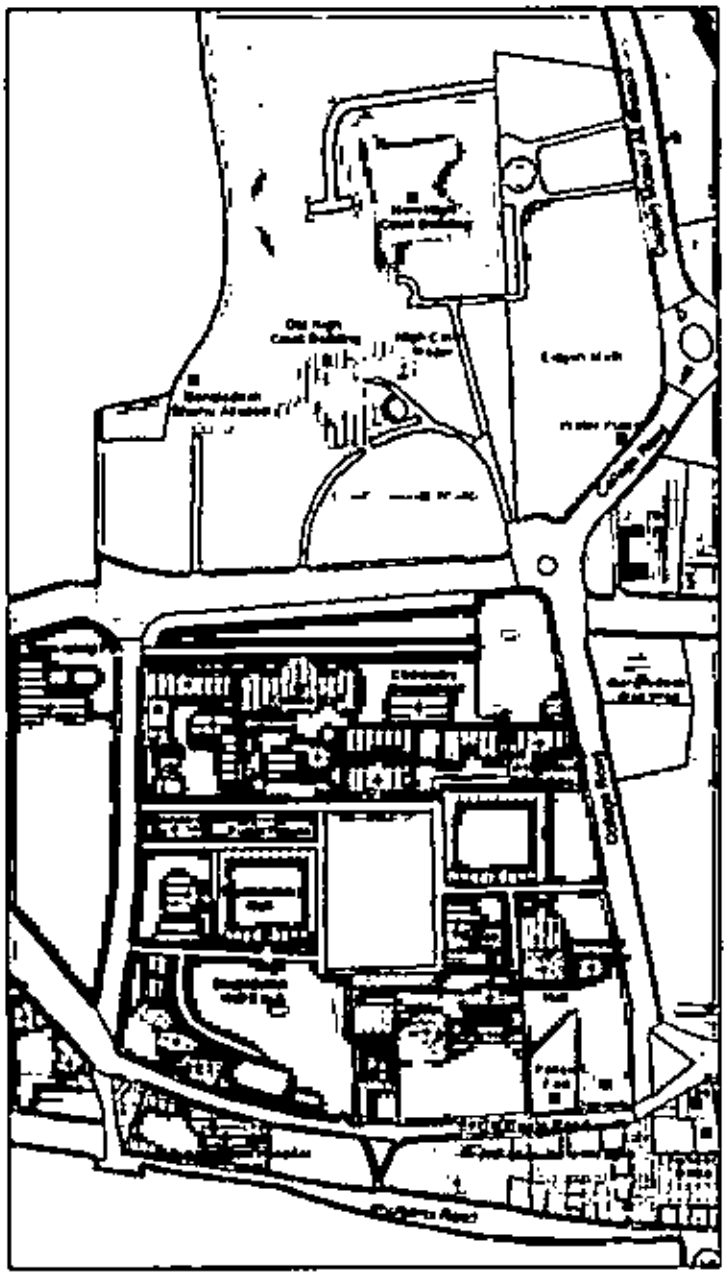


Fig: 5.57: Map showing some old structure's location: GIS Area map (Source: Chief Urban Planner, DCC).

5.4.1 Urban Functions--findings from Lab 01, 02 & 03:

Table 15: Urban Functions: Establishing existing conditions and analyzing impacts of projected conditions:

Social Function	Economic Function	Natural & Site Function
Lab 01 • Lab 01 is extensively used by the younger groups of the city who are basically students and come from different locations and besides this people of all ages come here to enjoy the cultural activities. • Housing areas of Dhaka University and BUET are also located here. • So people need the segregation in between the living and different functions.	**Lab 01** • Government can collect Tax from the visitors. • Increased vendors activities can increase visitors in number. • National Museum and Public Library gets some revenues from visitors.	**Lab 01** • Lab is in the flat land. • Beside and inside this lab a few numbers of water bodies are found. • Large and medium Trees, shrubs, ground covers are found here. • Air pollution level is much lower. • Climatic condition: Warm humid tropical climate. • Natural Resources are not estimated.
Lab 02 • Patients from different region of the country gathered here to take treatments. • Dhaka Club is the place for interaction of the elite groups of the city. • Bus stand should be well defined. • Proper parking space needed.	**Lab 02** • All classes of people come here to get their commercial services. • Foreigners from abroad find their destination here for business purposes. • Multi storied car parking is going on construction for BIRDEM Hospital. • A large scale trading can be developed.	**Lab 02** • Lab is in the flat land. • Medium and small Trees, shrubs, are found here. • Air pollution level is higher than lab 01. • Climatic condition: Warm humid tropical climate. • Natural Resources are not estimated.
Lab 03 • People come to Ramna park for fresh air and doing physical exercise. • Young couples take some refreshment here. • Press Club is the place for public interaction and manifestation. • Pedestrian accessibility required.	**Lab 03** • General people get administrative services from different government offices located here.	**Lab 03** • Lab is in the flat land. • Large, medium and small Trees, shrubs, are found here. • Differentiate changes of Air pollution level with the movement from Mintu road to Press Club area. • Climatic condition: Warm humid tropical climate.

Table 16: Urban quality components evaluation of Urban Lab 01 / 02 / 03

a. Use and User Characteristics

	User group	User and Pedestrian activity	Commercial Activity
Status Quo	Street People 3% Students 65% Office Workers 25% Elderly Person 3% Vendors 2% Others 2%	Cultural Program 23% Vending 10% Meeting with friends 15% People Watching 40% Entertainment 12%	Handicrafts 12% Banking 40% Food Cart 10% Books 8% Medicine 25% Cinema 5%
Projected	More tourists	Number of vendors should be restricted	Increased the number of exhibition
Remarks			

b. Values and Constrains

	Legal Restrictions	Social Values
Status Quo	Restriction about Vendors According to the rules of city Corporations but not implemented	Vending is tolerated, enjoyed by many people.
Projected	Apply the law to avoid Congestion	no change
Remarks	Dhaka originally invite vendors Pressure from crowds	

c. Physical Amenities and Characteristics

	Scale, width, height	Micro Environment	Materials	street furniture	planting
Status Quo	Low rise , big blocks buildings	fresh air quality, not so noisy	Bricks25% , RCC 70% Wooden window	bench	large and medium trees Foliage type More trees
Projected	no change	acceptable noise quality no change		more furniture	more trees
Remarks	one of the most accommodating space in the area				

d. Circulation and Service

	People Density	Vehicle Density	Service trucks	Accident rate and Conflict	Public Toilets
Status Quo	Heavy during occasion, low crowded	Moderate, Rickshaw cab and bus stand	no major conflict	high but not heavy casualties	none
Projected	Disciplined gathering	minimum increase	no change	Drive carefully Ensure signaling	must be provided
Remarks	Increased congestion due to confluence				

IMPACT: COMPONANT INTERACTION EVALUATION

5.4.2 Consequence of Feedback from Different Age Group:

Result sheet of the questionnaire survey:

Age Group: [8-18]:[18-25]:[25-35] : [35-45]:[45-55]:[55-65]:[65+]

Populace Size: 100 persons in each age group and the total number of population are 700.

1. Purpose to come at Ramna:
   - physical exercise: 36%
   - recreation and breathing: 27%
   - Work: 19%
   - Walk through to destination: 11%
   - Others: 7%
2. Time of highest User per day: Morning and Evening.
3. How they (User) come here:
   - Alone: 67%
   - Group: 33%
4. Wanting at Ramna look alike:
   - Green Trees: 78%
   - Openness: 15%
   - Other Options: 4%
5. Choosing of space: liking most:
   - Shahabag: 15%
   - T.S.C.: 32%
   - Bangla Academy: 10%
   - Park inside: 43%
6. Invitation of more people in Ramna make disturbance:
   - Yes: 66%
   - No: 34%
7. Build more structure at Ramna:
   - Yes: 18%
   - No: 82%
8. Billboard for Advertisement along the road side:
   - Yes: 16%
   - No: 84%
9. Ramna used as a place for Pahela Baishakh (first date of Bengali year):
   - Yes: 89%
   - No: 11%
10. Vegetation at Ramna:
    - Cut down: 29%
    - Need more Plantation: 71%
11. Keeping natural environment at Ramna:
    - Yes: 62%
    - No: 38%
12. Keeping Ramna Lake as it is:
    - Yes: 87%
    - No: 13%
13. Finding Birds at trees:
    - Yes: 69%
    - No: 31%
14. Reason of discomfort at Ramna:
    - Built Structure: 37%
    - Vendors: 28%
    - Others issues: 35%
15. Keeping boundary wall surrounding the open space:
    - Yes: 46%
    - No: 54%

5.5 Ecological Footprint of Ramna:

The Ecological Footprint is a resource management tool that measures how much land and water area a human population requires to produce tha resources it consumes and to absorb its wastes, taking into account prevailing technology. The sustainability challenge is for us to find ways to experience rewarding lives, within the limits of one planet. The ecological footprint (or eco-footprint for short) is a tool to measure our ecological performance. By measuring the Ecological Footprint of a population (an individual, a city, a nation, or all of humanity) we can assess our overdraft, which helps us manage our ecological assets more carefully. The ecological footprint is a means of measuring and communicating human induced environmental impact upon the planet. The footprint analysis presented in this report seeks to indicate:

- the area of land, or footprint that examined area would require to sustainably maintain the current life styles of its inhabitants;
- the relative contribution of various activity components to this footprint.

Table-11 below presents the results of the EF study of Ramna Area, Dhaka. The consumption items listed in the table have been influenced primarily by data availability. To accounts for these omissions some assumptions have been made.

A. Distributions of Impacts by Category:

Table 17: The component footprint analysis of Ramna:

	Consumptions Items	**Consumption**	**Footprint**
Utilities	Electricity (GWh)-domestics	1360	198329
	Gas (GWh)-domestics	4240	165430
	Electricity-others (GWh)	640	9230
	Gas-others (GWh)	780	8756
	Water-household (m^3)	140820280	15480
		Sub. Utilities	397225
	Consumptions Items	**Consumption**	**Footprint**
Travel	Travel by car (passenger km/yr)	5076390	19321
&	Travel by bus (passenger km/yr)	319082130	12690
Others	Travel by train (passenger km/yr)	x	x
	Travel by motor cycle (passenger km/yr)	85670	690
	Travel by rickshaw (passenger km/yr)	7063216	9890
		Sub. Travel and others	42591
	Consumptions Items	**Consumption**	**Footprint**
Food	Food (t)	417240	601360
Land &	Wood Products m^3	34350	390560
Wood	Built Land	7500	7500
		Sub. Food, Land & Wood	999420

	Consumptions Items	Consumption	Footprint
Materials	Recycled Waste (t)-glass	4649	2230
&	Recycled Waste (t)-paper and card	6238	8378
Waste	Recycled Waste (t)-metal	3526	649
	Recycled Waste (t)-domestic	2890	439
	Waste-household (t)	189540	538926
	Waste-commercial (t)	150320	401233
	Waste inert-brick, concrete etc. (t)	32500	28930
		Sub. Materials & Waste	980785

Population of Ramna and Surrounding area: 3, 27, 200 *(aprox. Number from local level survey)*
Ecological Footprint of Ramna and surrounding area (hr per yr): 11014.32
(ha per capita/yr): 0.0336
(Data Source: BSS, BEC, DCC, RAJUK, RHD, LGED, BRTA, DTCB, DMP, STP, BANGLADESH COUNTRY REPORT, WASA, DESA, HABITAT COMMITTEE, MINISTRY OF HOUSING AND PUBLIC WORKS, ECONOMIC REPORT OF BANGLADESH, WORLD BANK REPORT 2003)

Key Findings

- This study estimates that the area of land required to sustainability support the population of Ramna at current consumption rates to be 11014.32 hectares of productive land.
- The average Ramna footprint is 0.0336 ha.
- Each Ramna resident uses more than 0.033 hectares.

B. Distribution of Impacts by Category:

An analysis by category of impacts shows the highest impact category to be 'materials and waste' followed by 'food, land and wood', 'transport and others' and then 'utilities'-see figure below.

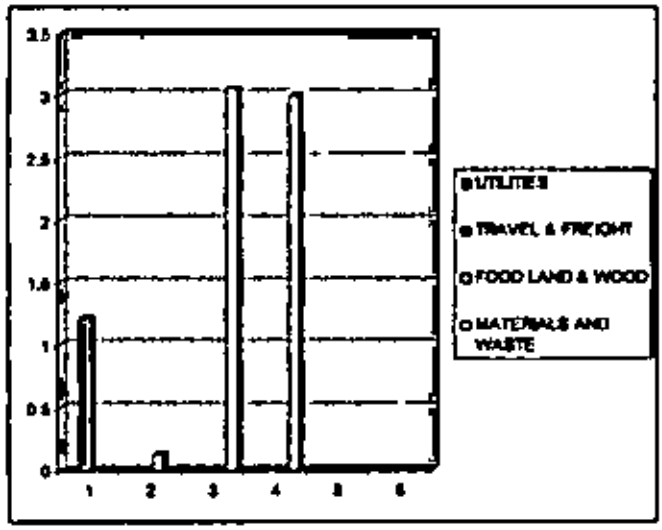


Fig: 5.58: Footprints by category

Distribution of Impacts by components:

Figure below shows the distribution of impacts by component-ordered in terms of the size of impact. It can be seen that the largest 3 impacts are waste (commercial and household) and road. Note that for comparative purposes, no double counting adjustments have been made in the figure bar chart.

Table 18: Distribution of Impacts by Category:

Utilities	1.Electricity (GWh)-domestics	0 606
	2.Gas (GWh)-domestics	0.505
	3.Electricity-others (GWh)	0.028
	4.Gas-others (GWh)	0.026
	5.Water-household (m3)	0.047
Travel	6.Travel by car (passenger km/yr)	0.059
&	7.Travel by bus (passenger km/yr)	0 0387
Others	8.Travel by train (passenger km/yr)	0
	9.Travel by motor cycle (passenger km/yr)	0.0021
	10.Travel by rickshaw (passenger km/yr)	0 0302
Food	11.Food (t)	1.84
Land &	12.Wood Products m3	1.19
Wood	13.Built Land	0.022
Materials	14.Recycled Waste (t)-glass	0.0068
&	15.Recycled Waste (t)-paper and card	0.025
Waste	16.Recycled Waste (t)-metal	0.0019
	17.Recycled Waste (t)-domestic	0.0013
	18.Waste-household (t)	1.647
	Waste-commercial (t)	1.22
	19.Waste inert-brick, concrete etc. (t)	0.088

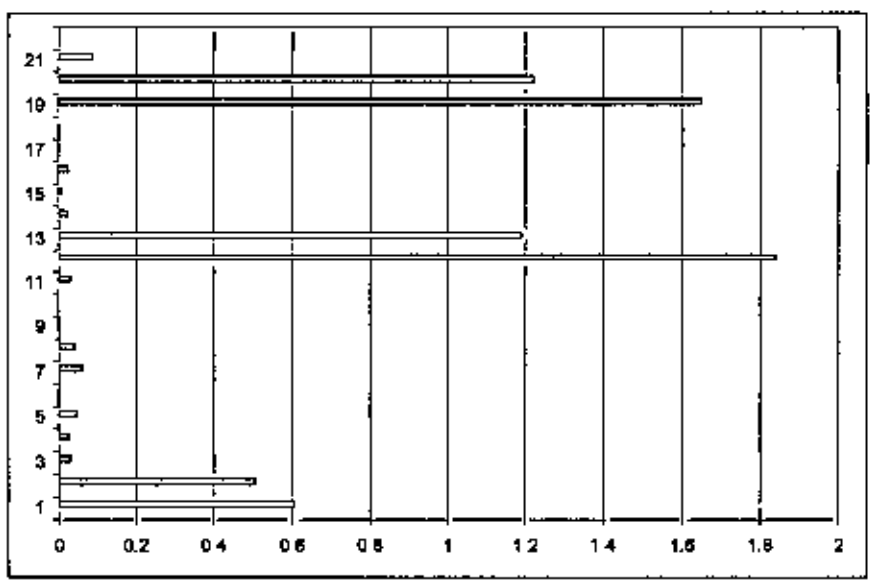


Fig: 5.59: Hn/ Capita

EF is a means of simply measuring, monitoring and communicating the environmental dimension of sustainable development. It indicates the relative size of Ramna's impact on the environment and how far the city needs to go to achieve ecological sustainability. Footprint analysis similar to that presented here has been used to formulate sustainability targets, inform decision-making, for education and public awareness purposes. The EF analysis can also provide a frame work for future data gathering exercises. While the purpose of this report is not to produce specific recommendations for further action, we find the following generic action points helpful.

Table 19: comparison of Ramna Area with its surrounding built areas:

Check list for sustainability	Densely built area	Area in between	Ramna area
Maximum Temperature (day time)	43 deg C Location: Motijheel (CBD)	36 deg C	28 deg C
Day Light Illumination (inside room)	Very low (almost dark)	Low light and dark environment.	No use of supplementary lighting.
Natural Air and Ventilation	Air velocity rate in between interior and exterior is very low, increasing RH value.	Air velocity rate in between interior and exterior is very low, hot air creates vortex, increasing RH value.	Most of the area covered with large shading trees. Large trees are barrier for wind flow, creates gentle breeze.
Top Soil and Vegetation	Wind and rain carry exposed soil dust and creating blockage to sewerage drain. Most of the areas are paved with concrete.	Wind and rain carry exposed soil dust and creating blockage to sewerage drain.	Top soil covered with grass.
Building Material	Steel , Cement, Sand, Brick, Aluminium and Glass (needs high energy to produce)	Steel , Cement, Sand, Brick, and Glass (needs high energy to produce)	Mainly low rise horizontal load bearing structures are found in location.
Conservation of Water Resources	Depends on under ground water source. No use of rain water harvesting or recharging the ground water.	Depends on under ground water source. No use of rain water harvesting or recharging the ground water.	Different chemical compounds degrade water quality of R amna lake, depends on under ground and surface water source. No use of rain water harvesting or recharging the ground water.
Natural Energy	Natural lighting and ventilation are missing.	Natural lighting and ventilation are missing.	Evatranspiration of plants and evaporative cooling of water bodies are very high.
Material's Durability	Calculated time for building structure is 50 years and more	Calculated time for building structure is 50 years and more.	Semi pucca houses found in Ramna.
Reuse and Renovation	Most of the buildings designed in a way that is very critical to renovate.	Few buildings can be renovated and reuse in case of increasing demands.	Most of the buildings located in green area, any extension of structure needs through analysis..

The overall goal was to design with a low negative impact on the natural environment. Wood was considered the most environmentally sound material for construction as long as it comes from sustainable sources and require little energy for processing. No wood comes from the forest. The roof tiles are produced locally. Constructions are made of traditional carpenters. Designs facilitate the demolition of building when it is time to dismantle it. Some materials are reused, i.e. fittings and sliding doors. Electrification is partly based on solar energy. Instead of large mechanical devices natural ventilation is

achieved through windows, which also provide ample daylight. Another ecological principle is to achieve effective utilisation of space by minimizing rooms and provide for flexibility in uses. Provisions are also made for extensions and remodeling required in future.

5.6. Summary:

Open spaces are given little attention and are not at all considered as one of the infrastructure or functional need of a city. Ramna is now in much squeezed form of open space. Before and after the independence Ramna is the place of cultural activities of the city dwellers. At present the land of Ramna is under-utilized (not proper use as city's open space) by the city dwellers, the condition of present use being substandard, while maintenance is poor.

The field work on Ramna open space has been divided into main three categories is: Educational, Cultural and Public Zone, Commercial Activity Zone, Administrative and Green living Zone. The field study relentlessly analyzed three surrounding zones (named as LAB) of this open space through its layout pattern, growth of development, land use and user's quality, sectional variations and over all its ecological pattern language. The studies reveal that in spite of the deteriorating conditions, it being an open space and providing the citizens with their much needed breathing space the area is thriving and vibrating with urban activities. The activities in the Ramna open space range from daily, seasonal and annual, with much diversity of pattern and participation. The vegetation pattern in the area decisively plays a responsive role in attracting diversity of people and activity into the area.

The Ramna area is the largest open and green space area of Dhaka city. The ecosystem approach towards qualitative assessment of urban open space at Ramna shows that there is a correlation between converging activities into the area, diversity of vegetation and comfort conditions. The area is becoming shorter and shorter by the unplanned encroachments and fragmented developments; it needs to be conserved for the posterity.

Chapter VI

Discussions and Recommendations

Discussions and Recommendations

6.1 Discussion

01. Open space are an important element of built environment which provide vibrancy and sustainability to a city. The unplanned encroachments and promulgation of built forms contribute to deforestation, water logging, flooding, overheating, pollution of water, soil and air etc. The prime problem in our urban context is over heating, pollution and water logging while governing ingredients in the natural environment are open spaces, woods and water bodies and the environmental variables are temperature, relative humidity, air velocity, precipitation, soil-moisture and biomes. Looking at the global economy today, one has to be increasingly aware of energy as a scarce resource; the need for architects to design for a sustainable future becomes a self-evident imperative. The available open spaces are, therefore, required to be organized judiciously to maximize its response. Biodiversity of place and contextual response in open space design and management has a bearing on the comfort feeling of the users. Ecological footprint and the theory of partition matrix as discussed therefore used in this study as the yardstick for analysis to achieve these goals.

02. Dhaka City has experienced a long transformation with respect to land uses, functions and importance in the regional context. The city has taken somewhat multi-nuclei form with haphazard land use patterns. The variation in shape, size, layout, treatment, and development of urban open spaces is an offshoot of physical, socio-cultural, political and economic factors. Ramna as an open space in this city starts during Mughal rule. Dhaka requires at least 20% of its area as open space, whereas, at present the percentage of open space of DCC is 9 to 10%. Local planning experts suggest at least 1 acre of parks and open spaces per 1000 population for cities of Bangladesh. It suggests that natural vegetation is the primary and sometimes last representative of nature in the city and that vegetation contributes to the sense of place. Open space must be considered as a public good when attempts to measure its value are made. Open green Spaces in the city act like its lungs besides being used as active recreational and leisure areas for its citizens.

03. Dhaka is now a mega city of over 10 million people. The average growth rate has decreased from 7% to 2% but the urbanization rate has exceeded 6%. In the past the city was clean, the air was fresh to breathe, fewer traffic and the river was the main way to transport and lifeline for attraction and now Ramna is the only major public open space in this city. The geomorphology of the Ramna region is intense. The geomorphological character of the region is defined by the lakes, ponds, green open spaces, and by the dense built form situated at a short distance around the open spaces. People are moving all the day long in Ramna and producing wastes and pollutions. Here in Ramna we find large and small trees and plants and huge lake considered as the habitat of many different spices of organisms. The important characteristic of this area is that it is extensively covered by vegetative surfaces and has a distribution of a large number of mature trees. The climate of the Ramna area is characterised as mild Tropical with hot humid features. Wind velocities are high during wet season. Studies have shown that urban parks and green areas in cities can create a cool island, the intensity of which depends on the type and quality of the vegetation. Urban Parks with high and wide canopy trees have the maximum cooling effect during the hottest hours of the day and have a positive effect on human climatic comfort.

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6.2 Summary of findings

Dhaka city was once blessed with lush green open spaces with age-old trees and many natural water bodies, some of which still exist and the limited space of Ramna is the best example. Now Ramna still stand with the several species of plants/trees only which are 124 in members. Biomass is under threat in

this locality because the current rate of extinction of different species due to the spreading growth of built surfaces and genetic resources are 100 times faster than what it would have been through the natural process. Therefore, there is a big need for conservation. Here we have identified during our study that the causes of deteriorating urban environment is the lack of public awareness towards the natural elements of the environment and the presence of voracious mentality of the society. Vegetation plays a substantial role in sustainability of Ramna and is of great value in greening cities and contributing to regional design. Ramna needs the ecological landscaping, which has created wild landscape of indigenous species. This paper attempted to define guideline for an ecosystem approach of analysis of open spaces to make our city green.

Vegetation plays a significant part in microclimate design but is also of great value in greening cities. Ecological landscaping has created wild landscapes of indigenous species. Local environmental design has been the start of community business initiatives that have helped towards regeneration. We have fond potential of vegetation in reducing the quantities of harmful gases in the air along with dirt and dust, in the Ramna study.

According to the sustainability paradigm it is, however, essential to respect traditions. One reason is that exiting building stock needs to be preserved and reused in order not to waste resources. Another reason is that local climatic conditions must be taken into consideration to save energy and give buildings an ecological footing. To achieve sustainability it is important to implement agreements on the reduction of non-renewable resources such as steel, aluminium and other metals. To save energy it is also necessary to reduce the use of cement and burnt brick. It is likely that earth will be a most appropriate construction material if sustainability becomes the leading paradigm in architecture. Architecture is designed for the inhabitant who must live in and use the building. Building with ventilation, sanitation and other installations are to be in harmony with nature.

City is the centre of ecological destruction; it can also be the centre of ecological reconstruction. Using an urban 'ecology checklist' one can begin to identify those impacts of the conventional built environment which separate it from the natural environment, or wilderness. With this measuring stick one may proceed to assess the ecological impact of urbanism. With the eco-footprint analysis, eco-healthiness of the place can be analyzed as has been done in Ramna. Ramna is found to be within healthy limits of eco-sustainability and therefore socially attractive, but awareness and vigilance must go on to keep it intact.

6.3 Recommendation:

The ecological approach to our business and design is ultimately about environmental integration. Dhaka has no unifying notion underlying the city's layout but its various parts tell their individual tale of many generations of the local inhabitants and their continuous effort to adapt their environment to their

changing needs, with the aid of improving technique and under the pressure of economic necessity and shifting cultural values. In this paper we have traced the decision making process in the growth and formation of Ramna. Openness has become an important issue in the world today. A change of land use in areas not optimally used is positive when enough space is left. Nevertheless, when a certain degree of density exceeds, as is the case in Ramna in early 1970s problems begin to arise. The growing number of low and high-rise buildings contributes further to a feeling of being shifted to narrow canyons. There are also social problems that increase and are detrimental to public safety.

Present research on Ramna area suggest that the existing lake needs major restoration to revive its aquatic life and natural surrounding. Ramna Lake was originally kept in its natural state for recreational purpose. Studies demand that the lake be restored in its natural state to develop an acceptable ecosystem but again some of the social realities can not be ignored, which suggest need for the development of the lake to cater for national level events. Considering various options like -

- Restoration and Preservation of the Natural Ecosystem and neighborhood character,
- Total redesigning of the built environment and preparing the site to cater for the national level activities attracting the large number of people;
- Conservative surgery to accommodate only the most essential national level activities and leave rest of the lake untouched after restoration.

There was no control over encroachment in Ramna area. In Bangladesh, there are no bylaws and rules to handle open spaces like Ramna, as a result gradually the situation is deteriorating and create crisis in the built environment. However, following options may be considered for improvement of the area:

- Reshape the disfigured earth.
- Restore the topsoil section.
- Reclaim extraction pits, fills, and spoil pipes
- Maintain the quality of the land.
- Prevent landscape defacement with local varieties.
- Take steps to preclude erosion.
- Protect water resources.
- Preserve the fish and wildlife habitat and encourage local flora and fauna for appropriate biodiversity.

People of this city of Dhaka have to remain ever busy at fulfilling their daily needs of life. The matter of recreation is hence an ignored aspect both at individual and organizational level. Yet recreation has been recognized as a fundamental human right nationally as well as internationally. Barrier free open spaces especially when nearer to roads, bus stops, shopping and other facilities and within affordable walking distance they function effectively. To create such open spaces now mean many structures are to be torn down in different localities. This proposition is neither practical nor feasible. Thus it can be argued, the design of those green and open spaces- for the most part, urban parks – should receive attention equal to that of the cities' buildings.

Thick vegetation along major roads may reduce the habitat fragmentation effect which may be grown especially with the pollution resistant or hardy species to reduce atmospheric and noise pollution. Trees are good air filters other local varieties of fruit bearing trees may also be planted in the peripheral locations and along the residential plots but away from the water body. There are numerous local species of plants that may be used to achieve different design effects. Following local varieties of trees that are suitable for different roads (GUC or GUP) of an urban area may be planted for positive ecological impact.

Green roofs (VgR) also offer many ecological, economic, aesthetic and psychological benefits, especially in high density urban areas where ground level recreation and green space is scarce. Extensive green roofs are built when the primary desire is for an ecological roof with limited human access. Intensive green roofs look like traditional roof gardens because a much wider variety of plant material is encouraged in this approach. Architectural accents such as waterfalls, ponds - even golf course - offer recreational spaces as well. VgR can help reduce global warming, lower the urban heat island effect, improve air quality, reduce ambient air temperatures, filter air, bind dust particles, and reduce glare. Besides green patches, water bodies are another major component of open spaces (GUP) contributing towards environmental sustainability. Restoration of natural drainage system and creation of adequate water bodies is needed for a sustainable ecosystem in Dhaka.

Here the most important priority is to preserve large ecological reserves capable of supporting a high level of biodiversity. However, municipalities have limited financial resources and preserving large natural areas within a growing metropolis may not be feasible. A more realistic approach is to create an ecological network from four basic components: ecological nodes, restoration areas, buffers, and ecological corridors.

The backbone of an ecological network is a series of ecological nodes or pockets that protect biodiversity "hot spots." The selection of ecological nodes should: represent all ecosystems, maintain viable populations of all native species, maintain ecological and evolutionary processes, and be responsive to change. The size of ecological nodes would vary depending on the financial resources available, the amount of land available and the species targeted for protection.

Preserving the remaining green areas will often not be enough to ensure the health of the ecosystem. This is why ecological nodes need to be supplemented with restoration areas that have a high ecological potential (but not necessarily a high ecological value at the present moment). The role of restoration areas will be to supplement and strengthen the ecological nodes already in place. Many years will be required, however, before restoration areas come back to their natural state.

Ecological nodes as well as restoration areas should be surrounded by buffers. Alien species can thrive in and around ecological nodes, but also disturb the Ecological flows of the ecosystem. Buffers can

protect rich ecological areas by protecting them from direct contact with intensive land uses. In addition, buffers can serve as marginal habitats for vulnerable species.

Ecological corridors, placed strategically, would link ecological nodes together and maintain the ecological flows within the system without necessarily preserving the entire ecosystem - an unrealistic option, especially in peri-urban localities experiencing development pressure. These ecological corridors could, like buffer zones, serve as moderate to high quality habitat for some species. More importantly, they can promote species dispersal between patches to prevent the genetic isolation of small breeding populations or offer travel corridors for migratory species. The appropriate width of ecological corridors depends on the goals and resources of individual municipalities. Taken together, these different elements can realistically ensure biodiversity preservation without merely preserving land and permitting economic growth.

6.4 Conclusion:

In a nutshell, the eco-design is designing the built environment as a system within the natural environment. The outlook on urban quality is changing nowadays, as a part of general shift in cultural values. The need for change is primarily a result of the continuous process of intensification of land use. Openness has become an important issue in Dhaka today. The purpose of this paper is to present techniques that enable the designer to understand the settlement pattern of the built environment at Ramna area. Here we have identified during our study that the causes of deteriorating urban environment is the lack of public awareness towards their life style and pattern of living. In fact outdoor spaces so to say open spaces of any type; spacious-non spacious, spectacular-non spectacular, formal-informal that surround us in our every day situation shape the major part of our lives. Still every day the urban open spaces are shrinking and are becoming less accessible at an upsetting rate. This is a frightening situation in cities especially of rapidly urbanizing countries. As cities are growing at a very faster rate, so the huge open spaces become ever more important for the well being of the urban dwellers. It is believed that Bangladesh being in the tropical area is better placed to strike the resources in their built environment design. This is, as we experience today, more true of Dhaka, the capital of Bangladesh, hundreds of public open spaces of different sizes were either partly or fully lost to building structures. Like any other sustainable city, Dhaka needs a huge stock of open spaces for urban services or utilities and circulation besides space needed for different public function and recreational activities. It is known that for a healthy city we need a right balance and proportion of open built up open spaces. The design of those open spaces for the most part, urban parks-should receive concentration equal to that of the buildings.

Sustainable development means changes in economic structures, organization and activity of an economic ecological system that are directed towards maximum welfare and which can be sustained by available resources. There are many other definitions of sustainable development and there was a time when it was

difficult to convince how mis-guided economic policy could degrade environment. But things have changed. However, it seems that the concept of sustainable development is much easier to promote at individual than collective level. Achieving the goals of sustainable development involves changes in attitude towards life and patterns of consumption, identifying environmental problems from people's perspective, and regeneration of traditional or folk wisdom to protect environment. A move towards a sustainable future, therefore, needs a major cultural transportation. Failure to protect and mange the environment as well as to sustain development are likely to hit survival of many developing countries in the coming years. Formulation of a comprehensive environmental policy by the government of Bangladesh in collaboration with scientists, NGOs, relevant departments and interested individuals connected with environment can save Dhaka and its open green spaces and water bodies. Media also can play an important role in turning these issues.

Our myriad of construction, manufacturing and other activities are, in effect, making the biosphere more and more inorganic, artificial and increasingly biologically simplified. To continue without the balancing the biotic content means simply adding to the biosphere's artificiality, thereby making it increasingly more and more inorganic. Exacerbating this are other environmentally destructive acts such as deforestation and pollution. This results in the biological simplification of the biosphere and reduction of its complexity and diversity. We must first reverse this trend and start by balancing our built environment with greater levels of biomass, ameliorating biodiversity and ecological connectivity in the built forms and complementing their inorganic content with appropriate biomass. We should improve the ecological linkages between our designs and our business processes with the surrounding landscape, both horizontally and vertically. Achieving these linkages ensures a wider level of species connectivity, interaction, mobility and sharing of resources across boundaries. Such real improvements in connectivity enhance biodiversity and further increase habitat resilience and species survival.

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Annexure: 01:

The Past trend of Growth and Metamorphosis of Urban Dhaka:

The urban matrix of Dhaka city, capital of Bangladesh, is not a result of any broad based planning, its structure has evolved through stages, certain areas were planned while other unplanned and rather organic. Dhaka is the jewel in the crown of an urban conglomeration with a continuous history of more than thousand years. Chosen as their capital by a Mughal 'subehdar' for its strategic location enhanced by riverine communication and vast stretch of hinterland, Dhaka has been an eastern romantic city for centuries.

The growth of Dhaka originated from the convenient location of river transport linkages. Dhaka has a glorious commercial tradition since the beginning of the Christian era (Rizvi, 1975) and in different periods of the history, the city was expanded due to significant developments of trade and commerce (Islam, 1972).

From the very beginning of its development, the city got centrality and the highest commercial importance in the eastern part of India. Globally Dhaka has been reputed as the 'Queen' of the eastern cities (Dani, 1962). Planned development over different periods of time, as witnessed in other living cities has not been a characteristic of Dhaka city. What has physically happened in Dhaka throughout its more than five hundred years of known history is not clearly apparent from its existing structure. The growth of Dhaka has brought with its demand for expanded infrastructures to serve the needs of urban residents and visitors.

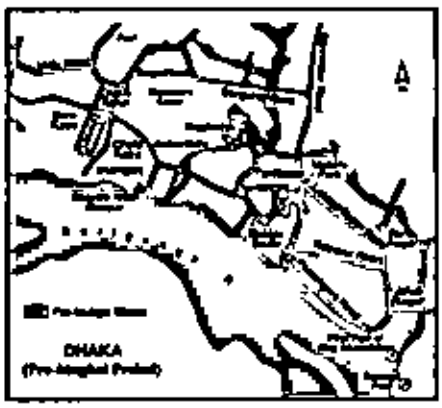


Fig: Map of Pre-Mughal Dhaka (source: Banglapedia)

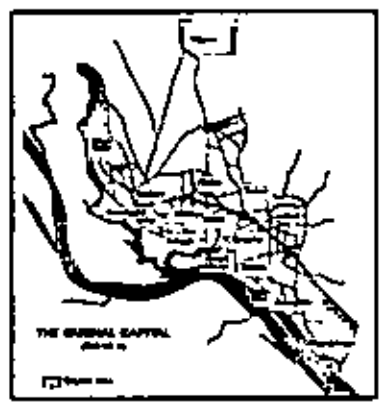


Fig: Map of the Mughal Capital (source: Banglapedia)

Historic core of pre-Mughal settlements of Dhaka stretched over approximately half a square mile lying between the Dhulai Khal (a canal) and the Buriganga river. The total area along the north bank of the river was bounded and also well connected by the river and canal system, serving as the main means of transportation. A linear pattern of neighbourhood consisting of linear street and bazaar (market place) and surrounding mahallas (cluster of houses or localities) was evident from the city's growth.

Dhaka City has experienced a long transformation with respect to land uses, functions and importance in the regional context. The Afghan Fort (presently Central Jail) was the administrative headquarter of the Mughals. The business areas were located at the two distinct centres - at Chawk Bazar and Bangla Bazar. Adjacent to these areas, Sankhari Bazar, Kumartuli, Patuatuli, Sutrapur, Tanti Bazar, Bania Nagar, Churi Hatta and Sanchi Bandar were used as the low class residential areas for artisans and labourers. The Fort

formed the nucleus around which the upper class people of the city used to live. Bakshi Bazar was used as the residences of the ministers and secretaries of the Mughals. The Fort itself accommodated a palace. Other upper class residential areas were Becharam Dewri, Aga Sadeq Dewri, Ali Naqui Dewri and Amanath Khan Dewri etc (Mowla, 2003).

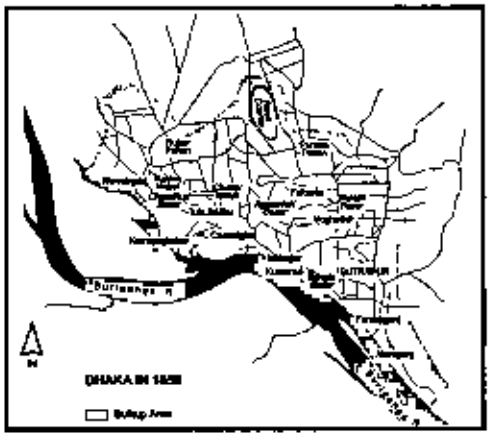


Fig: Map of Dhaka, 1859 (source: Banglapedia)

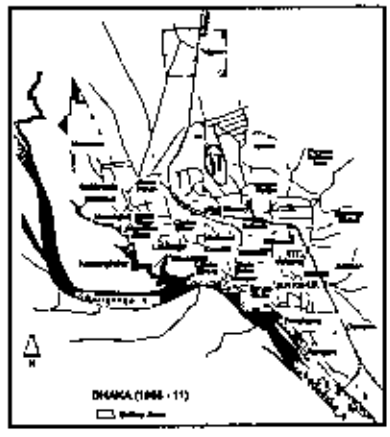


Fig: 3Map of Dhaka: Capital of East Bengal and Asam Province, 1905-11 (source: Banglapedia)

Physical development of Dhaka was concentrated mainly on the river front of Buriganga extending towards the north up to another rivet Turag. Total layout was rational arising out of convenient infrastructural linkages. Dholai Khal played an important role in transporting goods and traffics throughout the city.

New areas of the city were founded during colonial period, in contrast to the traditional city, with detached buildings and wide roads in regular layouts. The traditional system of mixed use areas was replaced by single-use zones. Layout design of the buildings and building by-laws together influenced the building form and design. In the colonial period, main development of the city took place in the Ramna area, north of the railway line. In 1905, when Dhaka became the capital of East Bengal, the building of a new town was started beyond the rail road in Ramna (Ahsan, 1991). However, the administrative centre was in older part although had shifted from old fort to Victoria Park (Ahmed, 1986). Chawk remained as the main trade centre, although the business areas extended upto Ramna along Nawabpur Road. In Map of 1906, the global integration core was pushed towards the north near Ramna where the newly planned, relatively orthogonal grid was introduced (Mowla, 1999a).

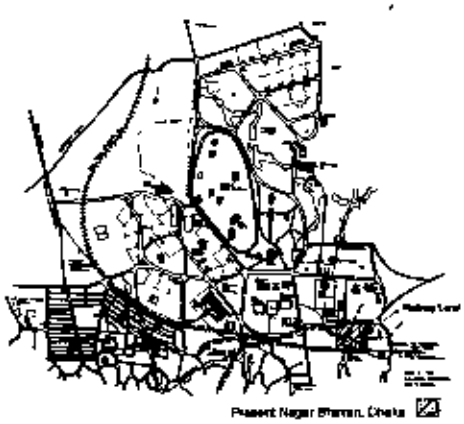


Fig: 3.5: Civil Station in 1906 (source: Mowla Q.A. & Reza, A.T.M., 2000)

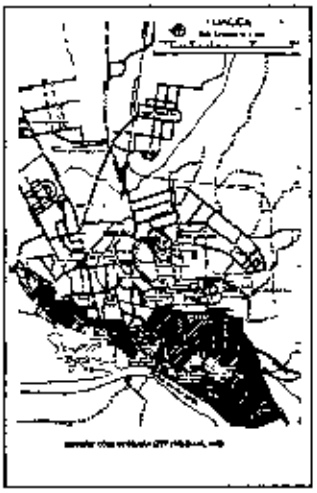


Fig: Historic Core of Dhaka City 1962 (Dani, 1962)

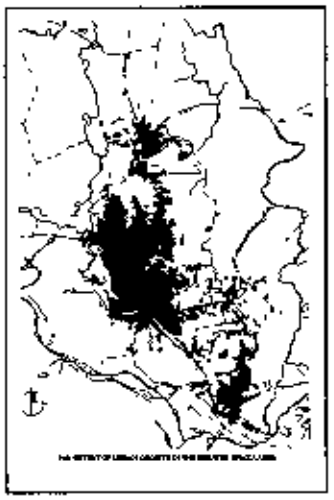


Fig: Extent of Urban Growth in the Greater Dhaka Area. Source: Tareq, M. (1997)

During the Pakistan period no significant planning efforts were made to improve the overall transport condition of the city. Only a few residential areas were created and some improvements were done on others (Mamoon, 1987). The 'Dacca Master Plan' was formulated in 1959, considering the city as a provincial capital of the then Pakistan. 'Dacca Improvement Trust' (DIT) was established to materialise the plan. Independence of Bangladesh eventually triggered massive demographic transfer towards the new national capital as well as random development. Poor urban governance, delay and negligence in implementing the proposals, failure to respond to the rapid and dynamic changes of the city and shortage of city planning experts further jeopardised the overall structure of the city (Mowla, 2001a).

In 1971, Bangladesh emerged as an independent and sovereign state and Dhaka was declared as its capital city. The city grew at an incredible pace, in keeping with its status as the capital. Dhaka now stretches from Shadarghat in the old historic town to Mirpur and Tongi to the north. Dhaka is growing at a fast rate (5.3% per annum during the last inter-census period) and emerging as a Mega city of the next century (BBS, 1995).

Fig: Zoning: Built Areas and Open Spaces of Dhaka City: Satellite view of the Dhaka city, 1996, Source: SPARSO.

The CBD shows a northward pull and has become diffused from Motijheel (Ahsan, 1991). A second CBD emerged around New Market. Besides, Kawran Bazzar and Shere-E-Bangla Nagar are also demarcated with new pockets of government and commercial institutions. The urban grid is consolidated more in the periphery than in the centre, which actually enhanced the existence of the hollow core at the centre (Nilufar, 1999).

Dhaka's past growth and present urban configuration have been shaped by the city's relative susceptibility to flooding. The consideration of settlements and use of land have predominantly been influenced by the availability of high grounds, not the trend of major road approaches. The changes of the population dynamics have also called upon internal structure changes within the city, such as changes in the characteristics of different zones, intensification of use of land, change in use, alteration of location for optimum uses and the invasion and succession. As a result, the city has taken somewhat multi-nuclei form with haphazard land use patterns.

Area and Population of Dhaka (1600-2001): Table:

Year	Periods	Population	Area (sq.mile)	Source
1600	Pre-Mughal	Un Known	1	Islam, 1974
1608	Pre-Mughal	30,00	2	Asaduzzam & Rob, 1997
1700	Mughal Capital	9,00,000	50	Taylor, 1840
1800	British Town	2,00,000	8	Taylor, 1840
1867	British Town	51,635	8	Census, 1901
1872	British Town	69,212	20	Asaduzzam & Rob, 1997
1881	British Town	80,358	20	Asaduzzam & Rob, 1997
1891	British Town	83,358	20	Asaduzzam & Rob, 1997
1901	British Town	1,04,385	20	Asaduzzam & Rob, 1997
1911	British Town	1,25,733	20	Census, 1911
1921	British Town	1,68,510	20	-
1931	British Town	1,96,111	20	-
1941	British Town	2,95,735	25	-
1947	Capital of E. Pakistan	2,50,000	25	Census, 1951
1951	Pakistan Period	3,35,928	28	Census, 1951
1961	Pakistan Period	5,50,143	28	Census, 1961
1971	Bangladesh Period	16,79,572	40	Asaduzzam & Rob,1997, BBS
1974	Bangladesh Period	17,72,434	40	Census, 1974
1981	Bangladesh Period	24,75,710	62	Census, 1981
1986	Bangladesh Period	44,64,262	62	Census,
1989	Bangladesh Period	55,00,000	155	BBS
1991	Bangladesh Period	61,05,160	360 sq.km.	Islam-1991, BBS- 1991
2001	Bangladesh Period	84,00,000	360 sq.km.	BBS, 2001

(Source: Taylor, 1840 and rest from the census of Bengal, East Pakistan & BBS, Islam, Nazrul, From City to Megacity, 1996, Ahmed, Sharif Uddin, DHAKA: Past Present Future, 1991, Asaduzzaman and Abdur Rob, Urbanization of Dhaka City, 1997)

Annexure-2
Questionnaire

A feedback form was distributed to the **visitors** those who are visited this area, **students** of University of Dhaka, and also to the **government employee** of PWD and Motsho Adhidaptar. Survey basically conducted here to find out the Ramna's qualitative assessment as an open space of Dhaka city and also find out public awareness about ecosystem and the will to protect and conserve its natural environment.

A questionnaire survey as follows:

(It's a qualitative assessment survey honoring the ecosystem for M. Arch thesis)

Ecosystem Approach towards Qualitative Assessment of Urban Open Space in Ramna

Serial no. :.....(fill up by the surveyor)

Name:.....Gender: [Male/ Female]

Age: [8-18]:[18-25]:[25-35] : [35-45]:[45-55]:[55-65]:[65+]

Occupation:.....

Location of Interview:.....

(Please give a Tick mark where necessary according to your choice.)

1. What is the purpose to come here? (tick any):
    a. physical exercise b. breathing c. recreation d. leisure e. walk through to destination f. for better environment g. to feeling open space h. work
2. What time do you usually prefer to come?

a. Morning b. Noon c. Evening d. Night

3. How many you came here in a day/ month?
4. 1/2/3/4 times in a day or 1/2/3/4 times in a day
5. Come alone or group : alone / group
6. Come here with: car / bus / rickshaw / walk / jogging
7. how much time you spent here: 01 / 02 / 03 / 04 hours
8. Which thing of this space attracts you most?
9. a. Openness b. Green Trees c. Lake d. Benches and Sitting Shades
10. Which place attracts your interest most?

11. a. Around the Shahbag b. Shishu Park c. TSC d. Park Inside d. Bangla Academy

12. Do you think the celebration of Pahela Baishak should take place here?

13. [Yes / No]

14. If functions are to be held to invite more people to this place, could it disturb the environment of the Ramna? [Yes / No]

15. Do you think more structures need to be building here? [Yes / No]

16. Do you think Billboards are necessary here? [Yes/ No]

17. Vegetation of this area need to: [Cut Down / More Plantation].

18. What type of Plant you like most?

a. Fruit type b. Flower type c. Wooden type d. Foliage type

19. Do you feel cool here than the other part of the city? [Yes / No]

20. Do you think that the lake must be filled up for increasing the flat lands?

    a. [Yes / No]

21. Do you want to keep the natural environment of Ramna? [Yes / No]

22. Do you want to find monkey/ snake on the tree? [Yes/ No]

23. Do you want to find birds on the tree? [Yes/ No]

24. What is the Air quality here?

a. Heavy to inhale b. Refreshing c. Bad smelling d. Sizzling

18. What you think is the main reason for making discomfort here?

    a. Huge Plantation b. Built Structures c. Vendors d. Insects

19. The park needs boundary walls : Yes / No

20. The level of maintenance is : well / ill .

21. Mention any problem you see or experience in this area?

.....
.....
.....

20. What do think can be done for the conservation of Ramna Area?

.....
.....
.....
.....
.....
.....

Thanks for your co-operation.

Annexure: 3

Public Concern and Action

The basis of all life upon our planet is the process by which solar energy is converted into organic compound by means of photosynthesis in green plants. This function is in turn dependent upon an infinity complex and delicately balanced life support system involving the whole of our universe. Each of us, as a living organism, draws vitality from this system - an eternal circle of life death and reuse. This is what we call ecological footprint of an area - any disturbance in it has an impact on our environment.

In a crucial sense, then, pollution may be considered as any act which defiles the earth matrix, the air, the soils or the water supply and thus disrupts the fragile balance of life. The examples and lessons are to be found everywhere around us. Unless we act decisively to correct the tragic error of our ways, and out law forever the crime of defilement, the damage will soon pass the point of no return. For as significant as the extent of pollution is the alarming rate of increase within the past decade. We are joined in a race with time. Our culminating rush towards the Ramna should accelerate the rates of pollution and resource consumption continues without abatement, this area would become unfit for any kind of habitation within the next few decades. It is clear that the cost of environmental protection - even healthful survival - will be more than many will wish to bear. We must attack, as an act of ultimate survival, every threat to the life support system.

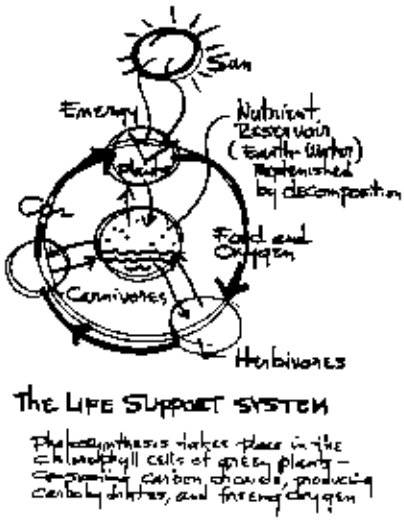


Fig: The life support system

In the final analysis, or well being in all aspects of life - physical, inspirational, social, and economic - depends upon the balance of nature. A central purpose of our lives, therefore, and one affecting all individual and group action, must be the safeguarding of our terrestrial habitat, the earth, the water, and the air at Ramna.

Pollution:

Pollution occurs when an activity or process yields deleterious by products which disrupt a natural or man made system of order (Simonds, 1978). Pollution is usually associated with the production of energy, the

production of goods, or the disposal of waste by products. It equates with inefficiency. It indicates a lack of ingenuity and long range planning. It disregards the public welfare. The common denominator of pollution is the long range loss for the many to provide short time gain for the few. Pollution is a degrader, a despoiler, and a threat to the very survival of all living things, including the greatest polluter - man himself.

The Soil:

Land, then, is not merely soil; it is a foundation of energy flowing through a circuit of soils, plants, and animals. Food chains are the living channels which conduct energy upward; death and decay return to the soil. The circuit is not closed; some energy is dissipated in decay, some is added by absorption from the air, some is stored in soils, peats, and long lived forest; like a slowly augmented revolving fund of life (Simonds, 1978).

Fig: Soil Stabilizers

It is within this zone that earth, air, and water intermix in the presence of sunlight. Here miracle of chemistry, osmosis, transpiration, decay, transmutation, and regeneration take place. It can be said that the health and comfort, as well as food and water supply, of the human race are utterly dependent upon the workings within this fragile matrix. This is in turn are largely dependent upon the presence of topsoil and humus.

Where the absorptive surface cover of the watersheds (a line of high land where streams on one side flow into one river, and streams on the other side flow into a different river) has been destroyed, as by the clear cutting and burning of our forests, or by uncontrolled development, new land use regulations must be firmed by which surface erosion and runoff must be checked. Most soils in their natural state are protected by vegetation from the blowing winds or from being washed away by the runoff of falling rain. Such vegetation cover may range in type from the loose knit dune grasses and sedges along the coast of to dense wetland alder thickets and fir that compose the upland forests. As a soil protector their function much the same in all cases, for their roots, shoots, and tendrils, together with decaying leaves, twigs, and branches, from a tightly interlaced mat that absorbs and holds the water, allowing its percolation into the earth. Where the protective ground covers have been removed or destroyed, the unchecked surface runoff is concentrated into rivulets and streams which soon cuts roots into the soil and eventually further erode them into deep and ever deepening gullies. The down stream covers are in turn torn loose and great areas of land may thus be rendered useless. A further serious consequence is that the eroded soil deposits often do great damage farmlands and to the rivers and lakes which they discolor and fill with silt.

Air:

Air is the breath of life. Air is the swirling mixture of gases and vapor that surrounds planet Earth. Without air there could be no form of life. Humans, like most plants and animals could live for sometime without

food or water, but without air they would die within a few minutes. It is the oxygen of the air that makes life possible. It combines with other substances in the process called oxidation. This releases heat and energy, the basis of growth and movement. Air is a substance having weight. Every square inch of the Earth at sea level sustains a pressure of about14.7 pounds. Air, like the sea, is continuously in motion and links all habitations, no matter how remote, into a world community.

Fig: Black Smoke from chimney.

We have always believed the supply of this essential element to be inexhaustible. We are now learning, however, that almost within our life time clean, uncontaminated air has become scarce. Even in remote reaches of the Arctic Circle and South Sea Islands the amounts of airborne poisons have reached concentrations lethal to birds and fish and indirectly to humans. When one considers the vastness of the universe, the relatively microscopic earth speck with its unique atmospheric conditions is such a rarity that one can only wonder how it came to be. Yet it exists, because it exits, so do we. For only planet earth, of all the heavenly bodies known to us, is enveloped with just the right combination of vapors to support human life.

It is at the lower level where the air is naturally denser, that the pollution is concentrated. Each particle of matter acts to seed condensation in the form of clouds, fog, rain, ice, or snow, even the weather and climate are affected. The stratified layers of particles, especially the veil of carbon

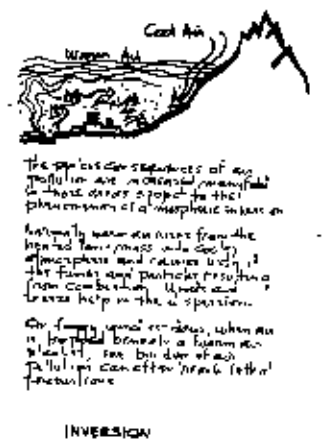


Fig: Inversion

dioxide between the sun and our planet, from a filter which allows solar rays to penetrate but which tends to preclude the Earth's built up heat from escaping. Apparently this 'greenhouse effect' has now been

detrimental. Who are the offenders? There are many sources of air pollution. Such as ***Carbon Monoxide, Hydrocarbons, Particulates, Sulfur Oxide, Nitroge Oxide, Other Pollutants***. Equally disruptive and injurious, these include radioactive particles, metal in suspensions, and photochemical smog.

In sum air pollution in its many forms is a killer and devastators. We will discharge more waste into the air today than yesterday, more tomorrow than today. And the end is not in sight, for despite our most optimistic predictions, we cannot presently foresee a reversal of the trend. Why? There are several reasons:

- National birth rates declines but the human life span increases.
- Every year migratory people are increases in the metropolitan areas.
- The demand by each individual for goods and energy has increased year by year.

Water:

Man, whenever he lives, whatever his culture, waits for the rain. Often he waits in hope, sometimes in fear, sometimes in vain, for the waters of the world do not always suit man's needs or desires as they move through their predestined circle to and from the sea. Yet if he is wise, man has with in power ability to exercise a measure of control over the movement of waters, and in so doing, he may to a significant degree, control his own destiny. While the laws that control our water cycle cannot be changed, they can be understood and made to work in man's behalf. The blending of natural law and human endeavor is the essence of resource management (Preudhomme, 1970). Water, like air, is essential to all living things. Water is one of the most abundant yet precious substances on earth. In those places where it is not to be had, no life can be sustained. Average rate water consumption in Dhaka city is about 230 gallons (source: Dhaka WASA) per capita per day. Flashing a toilet requires about 6 gallons, taking a shower 10 or 20 gallons, a bath as much as 30-40 gallons varying gender to gender.

Fig: Life in water.

More water is being drawn from many of the earth's surface and underground reservoirs than is flowing into them. We are running out of potable water. This is a fact of life that won't go away, and it is one that has to be faced. There's another fact, too, and it is that the quality of water we drink and wash with and swim in today is far from what is use to be, and we have to face up to this, also.

The oceans, which cover almost three quarters of the globe's surface, hold 97 percent of all the earth's water. Of the 3% balance, being the world's total fresh water supply, approximately 75% is locked up in the polar ice caps and over 24% exists in the form of ground water and less than 1% is in the atmosphere and all the terrestrial streams, rivers, lakes and wet-land combined.

Man has also interfered drastically with wetlands and aquatic animals such as fishes, crocodile etc. and he has also polluted water with factory waste. Swamps and marshes, which form a habitat for many animals

has been filled with mud to from agricultural land. Wetlands are among the most valuable ecosystems on the planet, protecting fisheries, preventing floods, and even filtering pollution. Yet the perception that they are damp, dangerous and disease ridden has produced a near universal response 'Drain it'! By absorbing flood water and storm surge coastal wetlands reduce the risk of death and crop losses.

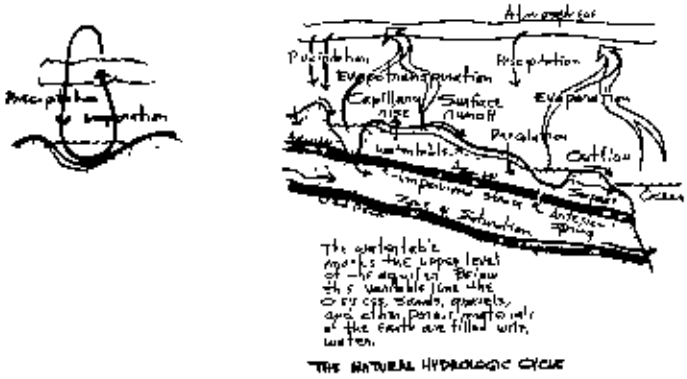


Fig: The Natural Hydrologic Cycle

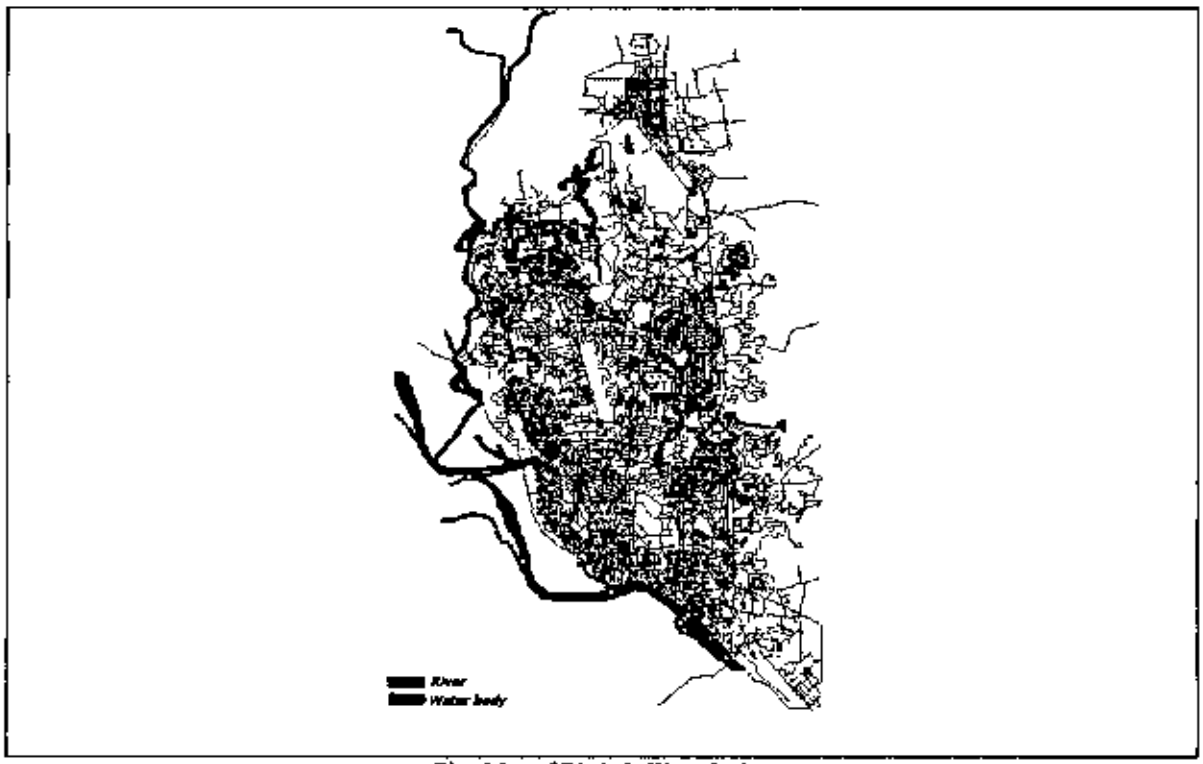


Fig: Map of Dhaka's Water body.

Eighty percent of the freshwater wetlands which existed over hundreds of years in Dhaka city have been drained. The elimination of these natural holding and recharge basins has resulted in an enormous subsequent loss to the down stream property owners. Many such wetlands still exist simply because the cost or bother of filling them in. Some are in their natural state; others polluted and trash filled to the point of disgrace.

In region blessed with natural lakes or sizable manmade reservoirs, those in authority have the responsibility for making them available for the sustainability of the settlement or for enjoyment and use of

the entire community. They also provide breeding ground for fish and wild life, and nesting place for the birds which regulate the teeming insects' population. A water body in a state of natural harmony maintains a balance where nutrients and organic materials combine with dissolved oxygen in a cleaning cycle.

Rivers have provided an important means of transportation and a source of profit and pleasure. City dwellers consume prodigious of fresh water daily, much of this drawn from rivers. Industry requires huge additional reserves for its washing and cooling processes. Sewage and industrial wastes, after treatment, are usually returned to waterways as the most convenient means of disposal. It is hard to believe, but it is true, that many communities and some large cities, still dump raw sewage directly into the source of regional water supply.

The science of water management is as old as civilization, but in recent years it has taken on new dimension and importance. In broad terms it deals with three aspects of water and its use. Its objectives are to assure the supply, protect the quality, and promote its efficient consumption. In searching for new means by which the fresh water reserves may be sustained, can find a number of possibilities. These include watershed protection and reforestation, new techniques of precipitation catchments, and the tapping of new sources.

Most problems of water supply and pollution are the result of unplanned exploitation. Today, with soaring water demands and critical shortage in some regions, we are looking to the science of water management with new respect and interest. The right to produce is not right to pollute. Industries using good quality water for their processing must return an equal amount of good quality water to rivers and lakes. In sum, under the water pollution control act, environmentalist can use the public hearing to make known their views on proposed discharge permit and compliances schedule. They have access to information needed to measure the effectiveness of the permit and compliance schedules. They can determine if laws are being enforced. And if necessary, they can take court action against violators (Zeldin, 1973)

Annexure: 04:

Ecological Footprint: An Area Based Indicators of Sustainability:

Biophysical examinations of humanity's resource throughput reveal why we witness such rapid loss of biodiversity. Human activities just occupy too much space. Footprint numbers illustrate the basic premise of sustainability and conserving biodiversity: the need to live with nature, within its regenerative and waste assimilation capacity and with other species with which we share the planet. As cities grow ever more densely developed, so the remaining green spaces grow ever more important for the well being of the cities' inhabitants.

The sustainability challenge is for us to find ways to experience rewarding lives, within the limits of one planet. The ecological footprint (or eco-footprint for short) is a tool to measure our ecological performance. It tracks how much individuals, organisations, cities, regions and nations, or humanity as a whole consumes and compares this amount to the resources nature can provide. More precisely, it shows how much biologically productive land and water area a given population occupies to produce all the resources it consumes and to absorb its waste, using prevailing technology (source: Global Footprint Network).

More elaborately we can say that **The Ecological Footprint is a resource management tool that measures how much land and water area a human population requires to produce the resources it consumes and to absorb its wastes, taking into account prevailing technology.**

In order to live, we consume what nature offers. Every action impacts the planet's ecosystems. This is of little concern as long as human use of resources does not exceed what the Earth can renew. But are we taking more? Today, humanity's Ecological Footprint is over 20% larger than what the planet can regenerate. In other words, it now takes more than one year and two months for the Earth to regenerate what we use in a single year.

By measuring the Ecological Footprint of a population (an individual, a city, a nation, or all of humanity) we can assess our overdraft, which helps us manage our ecological assets more carefully. Ecological Footprints enable people to take personal and collective actions in support of a world where humanity lives within the means of one planet

The ecological footprint is not about how bad things are. It is about how they are—and what we can do about it. The figures should not merely lead to a more informed discussion of our challenges ahead. More importantly, such assessments can help governments, businesses and NGOs shape sustainable development. At last, these organisations have at hand a clear and comprehensive measure of human impact on the Earth. The measure shows us where we are, in which direction we need to go, and which projects and programs move us there. This type of simple and accessible tool can finally put the abstract sustainability concept into concrete terms and cut through the paralysing and widespread confusion.

Ecological Footprint Method:

The ecological footprint method provides a systems approach for global, national, regional, local and personal natural capital accounting that can trace **demand** and **supply**. Such natural capital accounts could complement Gross Domestic Product (GDP) measurements as they allow to document ecological risks and social equity. ***The ecological footprint is a means of measuring and communicating human induced environmental impact upon the planet.*** The footprint analysis presented in this report seeks to indicate:

a. the area of land, or footprint that examined area would require to sustainably maintain the current life styles of its inhabitants;
b. the relative contribution of various activity components to this footprint.

The EF uses land as its 'currency'. By taking a holistic approach the footprint traces the resource supply chains and accounts for waste disposal and emission assimilation. Such biophysical assessments can summarise progress toward sustainability by tracking and comparing the ecological situation year after year, as done with economic indicators. For every scale, from the globe down to the nation, the region, the municipality, the business or the household, measures of natural capital such as the ecological footprints can point out to what extent this particular population is closer or further away from sustainability. The presented assessments become the starting point for more detailed local comparisons and time series. Historical analysis can show the path of the past and illuminate to what extent economic and demographic growth have enlarged a nation's or region's footprint. Also, they offer themselves as indicators of countries' potential vulnerability and their contribution to global ecological decline.

The WWF's Living Planet Report analyses the eco-footprint of 150 countries around the world every two years. In 2004 Australia had the fourth highest eco-footprint, 7.7 **global hectares (gha)** per capita. The average eco-footprint globally was 2.2gha with only 1.8gha available per person globally. This is equivalent to using about 1.2 planets or it would take 1.2 years to regenerate what humanity uses in one year, as indicated by the graph.

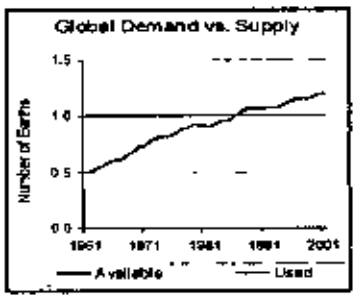


Fig1: Shows Global Demand vs. Supply

Figure 1 shows the ratio between the world's demand and the world's biocapacity in each year, and how this ratio has changed over time (source: Living Planet Report 2004). This indicates we are using nature more rapidly than it can regenerate. This is called **ecological overshoot.** The WWF's Living Planet Report 2004 also indicates that if everyone else in the world consumed resources and energy and produced wastes the way Australians currently do, we would need approximately four Earths to support us.

The average Victorian needs 8.1 gha of land to sustain their lifestyle. The Victorian Footprint is approximately 5 per cent larger than the Australian average ecological footprint of 7.7gha per person.

Compared to the average Australian, Victorians use three times more natural gas and one tenth less electricity, although the predominant fossil fuel in Victoria used for electricity is brown coal, which is more

emissions-intensive. Victorians also eat more seafood, drive further and our houses use more energy. Figure 2 shows the ecological footprint of nations for 2001, compared to Victoria, the world average and the available capacity per person.

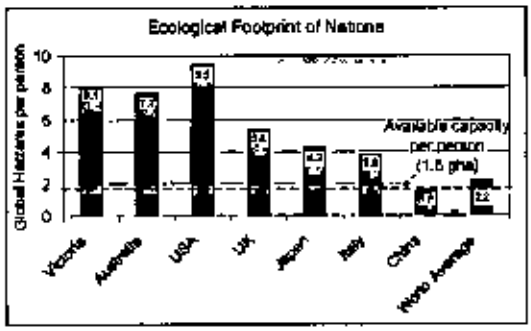


Fig 2: Shows the ecological footprint of nations for 2001, compared to Victoria, the world average and the available capacity per person.

Calculate Our Eco-footprint:

Measuring our own eco-footprint can help us to use resources more carefully, so we can secure people's wellbeing–now and in the future. Calculating the eco-footprint of our organisation, household or school helps to identify the environmental impacts of everyday activities and capture progress towards more sustainable practices. Everyone has different living circumstances, types of schools or offices and these affect your eco-footprint. The calculators are best used to help compare the impacts of your everyday decisions in living in your home or working in your school or office.

Conventional wisdom suggests that because of technology and trade, human carrying capacity is infinitely expandable and therefore virtually irrelevant to demography and development planning. By contrast, this article argues that ecological carrying capacity remains the fundamental basis for demographic accounting. A fundamental question for ecological economics is whether remaining stocks of natural capital are adequate to sustain the anticipated load of the human economy into the next century. Since mainstream (neoclassical) models are blind to ecological structure and function, they can not even properly address this question. The present article therefore assesses the capital stocks, physical flows, and corresponding ecosystems areas required to support the economy using "ecological footprint" analysis. This approach shows that most so-called "advanced" countries are running massive unaccounted ecological deficits with the rest of the planet. Since nor all countries can be net importers of carrying capacity, the material standards of the wealthy can not be extended sustainably to even the present world population using prevailing technology. In this light, sustainability may well depend on such measures as greater emphasis on equity in international relationships, significant adjustments to prevailing terms of trade, increasing regional self-reliance, and policies to stimulate a massive increase in the material and energy efficiency of economic activity.

Appropriated Carrying Capacity and Ecological Footprints:

We can now redefine human carrying capacity as the maximum rates of resource harvesting and waste generation (the maximum load) that can be sustained indefinitely without progressively impairing the productivity and functional integrity of relevant ecosystems wherever the latter may be located. The size of the corresponding population would be a function of technological sophistication and mean per capita

material standards (Rees, 1988). This definition reminds us that regardless of the state of technology, humankind depends on a variety of ecological goods and services provided by nature and that for sustainability, these must be available in increasing quantities from somewhere on the planet as population and mean per capita resource consumption increase (Overby, 1985).

Now, as noted earlier, a fundamental question for ecological economics is whether supplies of natural capital will be adequate to meet anticipated demand into the next century. Inverting the standard carrying capacity ratio suggests a powerful way to address this critical issue. Rather than asking what population a particular region can support sustainably, the carrying capacity question becomes: How large an area of productive land is needed to sustain a defined population indefinitely, wherever on Earth that land is located? (Rees, 1992; Rees & Wackernagel, 1994; Wackernagel & Rees, 1995). Since many forms of natural income (resource and service flows) are produced by terrestrial ecosystems and associated water bodies, it should be possible to estimate the area of land/water required to produce sustainably the quantity of any resource or ecological service used by a defined population at a given level of technology. The sum of such calculations for all significant categories of consumption would give us a conservative area-based estimate of the natural capital requirements for that population.

A simple mental exercise serves to illustrate the ecological reality behind this approach. Imagine what would happen to any modern human settlement or urban region, as defined by its political boundaries or the area of built-up land, if it were enclosed in a glass or plastic hemisphere completely closed to material flows. Clearly the city would cease to function and its inhabitants would perish within a few days. The population and economy contained by the capsule would have been cut off from both vital resources and essential waste sinks leaving it to starve and suffocate at the same time. In other words, the ecosystems contained within our imaginary human terrarium would have insufficient carrying capacity to service the ecological load imposed by the contained population.

Cities necessarily appropriate the ecological output and life support functions of distant regions all over the world through commercial trade and the natural biogeochemical cycles of energy and material. Indeed, the annual flows of natural income required by any defined population can be called its "appropriated carrying capacity. Since for every material flow there must be a corresponding land/ecosystem source or sink, the total area of land/water required to sustain these flows on a continuous basis is the true "ecological footprint" of the referent population on the Earth. Calculating its ecological footprint provides a rough measure of the natural capital requirements of any subject population for comparison with available supply.

"Footprinting" the Human Economy:

Box.a: A Family of Area-based Sustainability Indicators

Appropriated Carrying Capacity - The biophysical resource flows and waste assimilation capacity appropriated per unit time from global totals by a defined economy or population.

Ecological Footprint - The corresponding area of productive land and aquatic ecosystems required to produce the resources used, and to assimilate the wastes produced, by a defined population at a specified

material standard of living, wherever on Earth that land may be located.

Personal planetoid - The per capita ecological footprint (EF_p/N).

Fair Earthshare - the amount of ecologically productive land "available" per capita on Earth, currently about 1.5 hectares (1995). A fair seashare (ecologically productive ocean - coastal shelves upwelling and estuaries - divided by total population) is just over .5 ha.

Ecological Deficit - The level of resource consumption and waste discharge by a defined economy or population in excess of locally/regionally sustainable natural production and assimilative capacity (also, in spatial terms, the difference between that economy/population's ecological footprint and the geographic area it actually occupies)

Sustainability Gap - A measure of the decrease in consumption (or the increase in material and economic efficiency) required to eliminate the ecological deficit. (Can be applied on a regional or global scale.)

The first step in calculating the ecological footprint of a study population is to estimate the per capita land area appropriated (aa) for the production of each major consumption item 'i'. We do this by dividing average annual consumption of that item ['c,' in kg/capita] by its average annual productivity or yield ['p,' in kg/ha] per hectare: $aa_i = c/p_i$

In practice, it is often only possible to estimate average per capita consumption by dividing aggregate consumption by the referent population size. Of course, many consumption items (e.g., clothing and furniture) embody several inputs and we have found it useful to estimate an areas appropriated by each significant input separately. Ecological footprint calculations are therefore both more complicated and more interesting than appears from the basic concept. (Wackernagel & Rees, 1995).

We then compute the total per capita ecological footprint ('ef') by summing all the ecosystem areas appropriated by individual items in the annual shopping basket of consumption goods and services:

$$ef = \sum_{i=1}^{i=n} aa_i$$

Thus, the ecological footprint (EF_p) of a study population is the *per capita* footprint multiplied by population size (N): $EF_p = N(ef)$

Also, while we define the footprint comprehensively to include the land/water areas required for waste assimilation, our calculations to date do not account for waste emissions other than carbon dioxide. Accounting fully for this ecological function would add considerably to the ecosystem area appropriated by economic activity. Together these factors suggest that our ecological footprint calculations to date are more likely to be under-estimates than over-estimates.

The challenge is to achieve eco-footprint savings -- both directly through your own behavior and indirectly through other people or organisations behavior that you can influence. You might find that you save money

(increasing the household or school budget, or business profitability) and improve your quality of life or business profitability by examining your eco-footprint and undertaking actions to minimise it.

Ramna being the largest and oldest of urban open spaces in Dhaka is considered for studying-it's ecological status and the human response to the environment. Historically Ramna area went through different phases of transformation but it never lost its basic character of an urban socio cultural and recreational centre. With this backdrop, user response has been assessed against the changing pattern of biomass in the area. Imagine a glass dome over Ramna- what area would this dome have to be to ensure that the population could maintain their current lifestyles using the productive land enclosed within the dome?

The Ecological Benchmark: How much Nature is there per Global Citizen?

Adding up the biologically productive land per capita world-wide of 0.25 hectares of arable land, 0.6 hectares of pasture, 0.6 hectares of forest and 0.03 hectares of built-up land show that there exist 1.5 hectares per global citizen; and 2 hectares once we also include the sea space. Not all that space is available to human use as this area should also give room to the 30 million fellow species with which humanity shares this planet. According to the World Commission on Environment and Development, at least 12 percent of the ecological capacity, representing all ecosystem types, should be preserved for biodiversity protection. This 12 percent may not be enough for securing biodiversity, but conserving more may not be politically feasible.

Accepting 12 percent as the magic number for biodiversity preservation, one can calculate that from the approximately 2 hectares per capita of biologically productive area that exists on our planet, only 1.7 hectares per capita are available for human use. These 1.7 hectares become the ecological benchmark figure for comparing people's ecological footprints. It is the mathematical average of the current ecological reality. Therefore, with current population numbers, the average footprint needs to be reduced to this size. Clearly, some people may need more due to their particular circumstances -- but to compensate others must therefore use less than the average amount available. Assuming no further ecological degradation, the amount of available biologically productive space will drop to 1 hectare per capita once the world population reaches its predicted 10 billion. If current growth trends persist, this will happen in only little more than 30 years. The Ecological Footprint measures the extent to which humanity is using nature's resources faster than they can regenerate. It illustrates who uses how much of which ecological resources, with populations defined either geographically or socially. And, it shows to what extent humans dominate the biosphere at the expense of wild species. The Ecological Footprint clarifies the relationship of resource use to equity by explicitly tying individuals' and groups' activities to ecological demands.

Annexure: 05:

Lost Species:

A number of Species of birds, animals, reptiles, trees and shrubs were lost forever from Ramna Area. From review of the different articles we knew their existence in this locality. They were as follows:

Black francolin
Francolinus francolinus

Indian Pied Hornbill
Anthracoceros albirostris

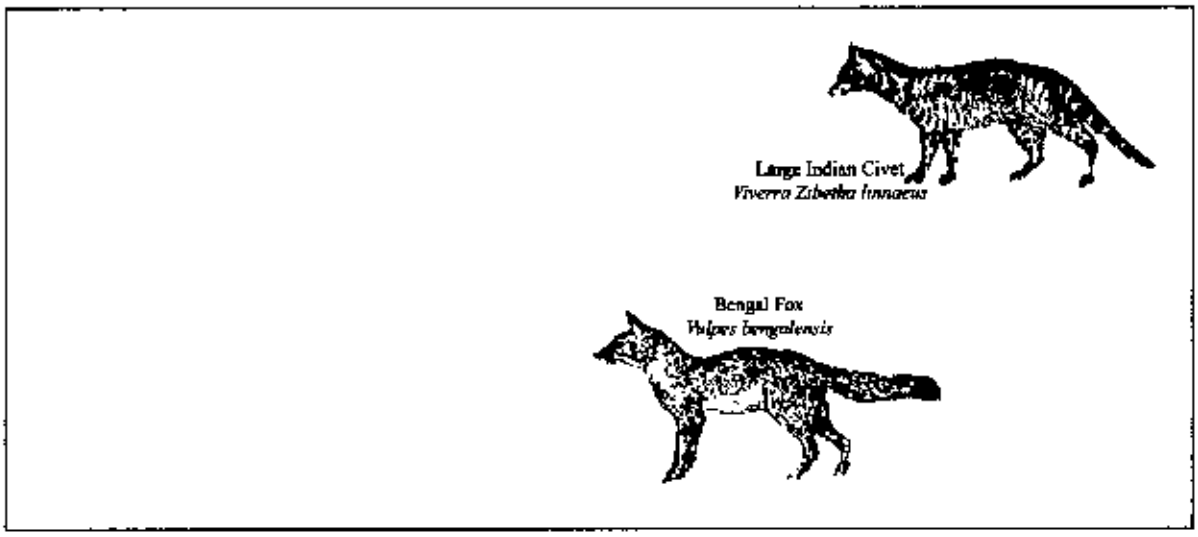
Rufous Bellied Woodpecker
Dendrocopos hyperythrus

Forest Eagle Owl
Bubo nipalensis

Large Indian Parakeet
Psittacula eupatria

Greater Adjutant
Leptoptilos dubius

King Vulture
Sarcogyps calvus



Source: Bangladesher Biponno Bonno Prani, Published by IUCN

Annexure: 06:

The Open Space Conservation Planning:

Planning is a course of action which utilizes scientific and technical information for considering and reaching consensus on a range of choices. Ecology is the study of the relationship of all living things, including people, to their biological and physical environments. Ecological planning may be defined as the use of biophysical and socio cultural information to suggest opportunities and constraints for consensual decision-making about the use of the landscape. The ecological planning method is primarily a route for studying the biophysical and socio-cultural systems of a place to reveal where a specific land use may be best practiced.

Human societies face many social, economic, political, and environmental problems and opportunities. Since an eco-design is the interface between social and environmental processes, ecological planning addresses those issues that concern the inter-relationship between people and nature. The planet presents many opportunities for people and there is no scarcity of environmental problems.

An understanding of human ecology is essential in conducting a socio-cultural inventory and analysis. Since humans are living things, human ecology may be thought of as an expansion of ecology-how humans interact with each other and their environments. Interaction then is used as both a basic concept and an explanatory device. Ecosystems vary in size. They can be as small as a puddle or as large as the Earth itself. Any group of living and nonliving things interacting with each other can be considered as an ecosystem. Within each ecosystem, there are habitats which may also vary in size. A habitat is the place where a population lives. A population is a group of living organisms of the same kind living in the same place at the same time. All of the populations interact and form a community. The community of living things interacts with the non-living world around it to form the ecosystem. The habitat must supply the needs of organisms, such as food, water, temperature, oxygen, and minerals. If the population's needs are not met, it will move to a better habitat. Two different populations can not occupy the same niche at the same time, however. So the processes of competition, predation, cooperation, and symbiosis occur. Habitats, then, are specific to a population. Each population has its own habitat. For example, a population of ants has its own habitat. Several populations may share a habitat. For example, in a small pond several aquatic populations may co-exist in the same water at the same time. An aquarium is a good example of a shared habitat. The energy cycle within biomes, habitats, and ecosystems determines which populations survive and which die. All living things need energy. Ultimately, the sun is the source of all energy in an ecosystem. Different species have different functions: producers, consumers, decomposers, and scavengers. Since energy and water are vital to the survival of an ecosystem, a system of conservation is needed. In many ecosystems, the conservation of resources is a natural, almost unnoticeable process. Life substances, for example, are recycled in the ecosystem. The exchange of carbon dioxide (given off by animals) and oxygen (given off by plants) is actually a process of conservation. The waste of one species becomes food for another. When resources become limited, the conservation process becomes more urgent and more visible with an increased need for recycling. If conservation efforts fail, species become endangered and extinction can occur. A species becomes endangered when there are not enough habitats available to

support all members of the population. When the habitat vanishes, and all members of the population die, then the species is considered extinct.

Open space has been defined as an outdoor area in the metropolitan region - including public meadows and parks, but also unfenced vacant lots and abandoned waterfronts - which is open to freely chosen and spontaneous activity, movement, or visual exploration by a significant number of city people. An open space has no necessary relation to ownership, size, type of use, or landscape character (Marcou, O'Leary, & Associates 1970). Open space and recreation are vital elements in an urban environment. Open space is an extremely valuable commodity for communities for natural systems preservation, recreation, education, cultural heritage, and aesthetics (Center for Excellence for Sustainable Development, 1999).

People benefit from the use of recreational services and activities supplied by urban open space and parks. Non-user benefits, such as the aesthetic value of a scenic view, are also afforded by open space. Other amenities include the intrinsic value of the flora and fauna preserved within open space, the role of open space as habitat in sustaining genetic diversity or stability in ecosystems, and the security of knowing that valuable natural areas will be available for appreciation by future human generations.

A city contains many buildings, but even a single building has multiple impacts on its environment. A city is more than the sum of its building however. It includes roads, services and infrastructure, all of which consume energy and land. A city is much more than this. It is first and foremost, a place of culture. Urban open spaces have served as stages for the drama of human life and stirring events.

The ecological worldview does not seem to be culture-dependant- an interesting observation given that all ecological theory stresses the primacy of place- but understandable once one realises that the principal aspects of ecology concern the basic elements of air, earth, water and fire (energy).

Cities need to become green. They must be transformed into places that are life enhancing and regenerative. The ecological city model is being developed in many location around the world, so far however, that development has been mostly conceptual. It is hard to find an example of something resembling a functioning ecocity. There are small scale experiments underway in Germany, Denmark, Australia and the USA. Not usually, these developments have a sense of purpose generated by a spiritual and or semi-spiritual ideology and this is also true in the developing world.

The Goals of the State Open Space Conservation Plan are:

- To protect water quality in State including surface and underground drinking water supplies, and lakes, streams and coastal and estuarine waters needed to sustain aquatic ecosystems and water based recreation;
- To provide high quality outdoor recreation, both land and water based, accessible people regardless of where they live, how much money they have, or their physical abilities;
- To protect and enhance those scenic, historic and cultural resources, which are readily identifiable as valued parts of the common heritage of State citizens;
- To protect habitat for the diversity of plant and animal species to ensure the protection of healthy, viable and sustainable ecosystems, biological diversity within the state;

- To protect habitat to sustain and enhance populations of endangered species, threatened species and species of special concern;
- To protect habitat, to sustain the traditional pastimes of hunting, trapping, fishing, and wildlife viewing;
- To maintain the critical natural resource based industries of farming, wood products, commercial fishing and tourism;
- To provide places for education and research on ecological, environmental and appropriate cultural resources to provide a better understanding of the systems from which they derive; and
- To preserve open space, particularly forest lands, for the protection and enhancement of air quality.

Buildings don't make cities, people make cities. The physical form of the city is shaped depending on the technology people employ.

This study attempts to identify the areas of environmental degradation in Ramna. Ramna, according to different estimates and records, faces total decline in the supporting capacities of her ecosystems. Putting together all the information collected over the Study period it seems that there are some environmentally critical zones in Ramna. Environment awareness is not some thing that is restricted to classrooms, laboratories, libraries or seminar halls. Nor is it the concern of any particular type of class of people including the students, scholars and professionals. The fundamental goal of environmental education should be to empower people to think in terms of a future, which is totally compatible with the idea of an environmentally safe and sustainable process of development. At present most people base their understanding of environment and development issues on traditional knowledge or information provided by different media and interest groups. Many remain ignorant of ways in which they could contribute to improving the environment and ensuring better use of resources.