Urban forestry and urban greening for sustainable urban development-A case of Dhaka north city corporation area (Zone-1)

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Abstract

Urban forestry and urban greening is one of the most substantial factors for sustainable urban development, which can contribute towards good quality of life and sound environment. Dhaka, the capital of Bangladesh once renowned for its green resources but in recent times the city is losing its greeneries very rapidly. This study was intended to explore the status of urban greening as well as to investigate the prospects and challenges for enhancing urban forestry and urban greening in Dhaka North city corporation area (Zone-1). This study focused on the qualitative approach where interview with key informants, questionnaire survey and observation techniques were followed to obtain required information. The study identified some factors that are responsible for losing of green resources in Dhaka city including transformation of existing green areas or open spaces to other land use purposes, unplanned urbanization & improper planning, rapid increase of urban population and lack of conservation activities for protecting the existing greeneries. The study also revealed that still there are ample opportunities to enhance the greeneries in Dhaka city by conserving the existing green areas (e.g. parks, gardens, playgrounds etc.), increasing roadside plantation, promoting homestead and rooftop gardening and by initiating afforestation and nursery activities.

Keywords: Dhaka city, Urban greening, Urban sustainability, Green space

Introduction

A city with substantial green spaces represents good planning and management, a healthy environment for its dwellers, vegetation and wildlife populations (Adams and Leedy, 1987; Johnston, 1990; Godefroid, 2001). Although the Dhaka city was well known for its green resources (e.g. parks, open spaces, tree covers, forested areas etc.) but due to rapid rural-urban migration, unplanned urbanization, commercial development and industrialization the city is losing its greeneries at an alarming rate. Urban green spaces or greeneries are predominantly crucial for proper functioning of the ecosystem in any urban environment (Byomkesh *et al.,* 2012). Urban green spaces can play critical role in conserving biodiversity, protecting water resources, improving microclimate, sequestering carbon, and even supplying a portion of the fresh food consumed by urban dwellers (Lovell and Taylor, 2013). Ansari (2008) asserted that the green resources in Dhaka are overwhelmed by a number of limitation inherent to the exceptional mode of urban development, rapid increase of urban population, transformation of green and other open spaces into other types of land use, lack of proper planning and implementation and management restrictions as well.

Urban sustainability progressively requires the abatement of pollution, plus the addition of positive features, notably trees, to ameliorate the new scarcity of healthy environments (Finco and Nijkamp, 2003). Urban forestry and urban greening is strongly associated with sustainable urban development. This is because urban forestry or greening can improve the quality of life and environment of the urban dwellers through its numerous functions such as by reducing urban air pollution load and provide purified air, act as heat absorber during the hot summer particularly in the cities of tropical regions, and increases the aesthetic or recreational value and so forth. For instance, the development of multifunctional urban green structures can be an important contributor to sustainable urban development in terms of improving the quality of life and environment for current urban populations (Konijnendijk *et al.*, 2004; Wolch *et al.*, 2014).Compare to all other mega cities around the world where concept of urban forestry and urban greening is highly considered as a way of sustainable urban development, in Dhaka city it is a less focused issue and a little initiative is observed in this regard. This study is aimed at discussing the status of urban greening in Dhaka city as well as to investigate the prospects and challenges for enhancing the urban forestry and urban greening in Dhaka City whereas *Uttara* (Zone-1 of Dhaka North City Corporation) has been selected as the role model. The specific objectives of the study were:(i) to provide an overview of urbanization trend and urban greening in Dhaka City (ii) to discuss the importance of urban forestry and urban greening for sustainable urban development and (iii) to explore the prospects and challenges for enhancing the urban forestry and urban greening in Dhaka.

Materials and Methods

Study area

This study is conducted in the Dhaka North City Corporation (DNCC) area (Zone-1: *Uttara*). Geographically, Dhaka North City Corporation is located between 23°44' and 23°54' North latitudes and 90°20' and 90°28' East longitudes (Fig.1). The Zone-1 (*Uttara*) of DNCC is consists of two wards and the total area is about 11.570 sq.km. (DNCC, 2014).

Fig. 1. Location of study area-Dhaka North City Corporation, Zone-1 (Source: CUS, 2014)

Data Collection

The study is based on both primary and secondary data sources. To attained primary data different techniques such as interview with key informants, questionnaire survey and observation were followed. To gather the required data and information from the respondents both open and close ended questions were used where open ended questions were used to gain in-depth information regarding the existing scenario of urban forestry and urban greening as well as to explore the opportunities and challenges for enhancing the urban forestry and urban greening in Dhaka city by giving them freedom of answering the questions or sharing their knowledge and thoughts, which is supported by Oppenheim, "the chief advantage of the open question is the freedom it gives to the respondents" (Oppenheim, 2000).However, apart from primary data, the collection of secondary data was also very essential to conduct the study which were collected from relevant scientific articles, journals, thesis papers, books, and relevant report, studies conducted by governmental organizations and from the internet.

Sampling

The methodology of the study focused on qualitative investigations and thus convenience sampling has been followed for the survey part of the study. The inherent reason for choosing convenience sampling was that convenience sampling is the outstanding way of attaining preliminary information regarding some research questions quickly and reasonably (Berg, 2009). A total of 120 respondents were taken by using convenience sampling from the Dhaka North City Corporation (DNCC) area (Zone-1: *Uttara*), which represents the total sample size (n=120).

Data Analysis

For the analysis and interpretation of collected data the Statistical Package for Social Science (SPSS) was used. The obtained data were coded for the statistical analysis. Kothari (2004) has stated that in the stage of data analysis coding operation is usually done that helps to transform the categories of data into symbols, which may be tabulated and counted. The obtained data were coded for the statistical analysis. By using the descriptive statistics the results are presented in the forms of tables and charts.

Results and Discussion

Status of urbanization and urban greeneries

Dhaka city is now belonging to the family of world mega cities. Currently, the mega city has a population of about 12.5 million which is increasing at a rate of around 5% annually compared with the national average of 2.1% (BBS, 2011; Haq, 2006). As a consequence the city is characterized by the high level of poverty and social vulnerability, shortage of housing, infrastructure and social services, poor quality of physical and social environment and inefficient urban management (Hossain, 2006).

Trend of urbanization and urban environmental quality is closely related to each other and the quality of life and abundance of resources in any urban environment are strongly influenced by the pattern of urbanization. For instance, it is evident that unplanned and increasing urbanization throughout the world lead to the loss of urban greeneries or green spaces as well as degrade urban environmental quality (Mabuhay *et al.*, 2005; Nakagoshi *et al.*, 2006; Kong and Nakagoshi, 2006; Phan and Nakagoshi, 2007). As urbanization increases and thus more infrastructures for housing, education, transportation, commercial and industrial purposes are required to meet the growing demands of the urban dwellers, which consequently create pressure on the existing resources such as open or green spaces, cultivable lands, trees etc. (Kong and Nakagoshi, 2006; Swanwick *et al.*, 2003). Compare to developed countries this trend is more prevalent and serious in developing countries (Byomkesh *et al.,* 2012) and Dhaka City Corporation area is not an exception in this regard.

Table 1. Loss of green areas in Dhaka (1975-2005)

Year	Loss of green area (hectares)	Rate of green loss (%)
1975	18,626	--
1988	14,818	20.4%
1999	12,966	12.5%
2005	10,009	22.8%

Source: Byomkesh *et al.,* 2012

Compare to all other mega cities in the world the concept of urban forestry and urban greening is new for Dhaka city. Generally, the existinggreen spaces in Dhaka city and its periphery are observed in the form of open spaces, roadside trees, paved paths in some commercial and residential areas, parks, vegetated areas, nursery, public and private gardens and some rooftop gardening. However, presently the existing parks and gardens reflect the urban greening in Dhaka city. Ansari (2008) stated that the most popular parks such as *Ramna Udyan, Suhrawardy Udyan* and Dhaka University campus, *Osmani Udyan*, *Gulistan* Park are the most important green spaces in Dhaka and still reflecting the green glory of Dhaka but these are not sufficient enough compare to the gigantic volume of urban population. Byomkesh *et al.* (2012) noted that there are about 50 parks and open spaces in Dhaka, among which 46 are still under the

control of DCC and others are already occupied by homeless people and hawkers, some have been converted to temporary markets, bus stops, slums, etc. The result revealed that the present status of urban forestry and urban greening is unsatisfactory to the majority of the respondents (71%) it is highly unsatisfactory to 29% of the respondents (Table 2). The study identified a considerable number of trees and paved paths in some of the newly developed residential and commercial areas but in most of the commercial or industrial areas scenario is highly unsatisfactory.

Table 2. Respondent's responses regarding the status of urban greening

Variable	Frequency	Percent (%)
Satisfactory	00	00.0
Unsatisfactory	85	71.0
Highly unsatisfactory	35	29.0
Total	120	100.0

Urban green spaces are those lands that are covered with natural or man-made vegetation but are present in built-up areas (Kong and Nakagoshi 2006; Phan and Nakagoshi 2007).Urban green spaces are considered as an important part of complex urban ecosystems which provide numerous ecosystem services and benefits urban communities environmentally, aesthetically, recreationally and economically (Li *et al.,* 2005).It is apparent from different studies that among the world's major cities, undoubtedly Dhaka has the lowest number of playgrounds, parks and open spaces per capita (Hossain, 2006). However, the existing green resources and green spaces in Dhaka city now are in threatened condition. It revealed from the field observation and survey that the city is losing its existing greeneries day by day. The study also identified some factors that are involved behind the loosing of green resources including transformation of existing green areas or open spaces to other land use purposes (57%), followed by unplanned urbanization & improper planning (28%), lack of conservation activities for protecting the existing greeneries (20%) and rapid increase of urban population (15%) and (Fig. 3). For instance, most of the parks that are still showing the green glory of Dhaka now are in threatened condition due to improper management and monitoring activities. The study conducted by Ansari (2008) has stated that due to lack of proper maintenance most of the parks are under threat of different activities, such as, felling of trees, digging, and illegal/forcible occupation of open space by mini-buses and trucks and vendors. However, Table 1 shows the rate of loss of green areas in Dhaka city during the period 1975-2005 as analyzed by Byomkesh *et al.,* 2012.

Role of urban forestry and urban greening for sustainable urban development

Urban forestry and urban greening is one of the most important factors for sustainable urban development which can provide good quality of life and sound environment to the urban dwellers. Byomkesh *et al.* (2012) stated that the ecological system of a city is the result of the combination of three systems (social, economic and natural) where green spaces can act as the focal point. Urban green spaces can play a critical role in air purification, regulating local climate, reducing noise pollution, beautification etc. (Davis *et al.,* 2008). Moreover, urban greeneries also support the construction of high-quality human settlements, since green spaces are considered as the lung of any city (Jim and Chen, 2006; Khan, 2014).

Sustainable urban development requires providing a healthy and sustainable living environment with basic services for all whereas the urban greeneries are of the important one that needs to be provided to the urban inhabitants (Konijnendijk *et al.,* 2004). Generally, it is important to safeguard the environment of cities for maintaining a healthy and sound environment where urban forestry and urban greening can play significant role through its multifunctional services such as reducing air pollution, controlling flood waters, providing habitat for birds, moderating climate both at macro and micro levels, poverty alleviation and so forth. According to IADB (1997), urban greening offers improvements in air, water, and land resources by absorbing air pollutants, increasing water catchments and floodplain surfaces, and stabilizing soils. Moreover, green resources (e.g. trees and vegetation) have significant effect on moderating high temperatures especially in the cities of tropical countries like Dhaka, Bangladesh where average summer temperatures remains more than 30°C.

The study showed that the majority of the respondents (62%) in the study area have stated that urban forestry and urban greening can help the city inhabitants by reducing air pollution, followed by enhancement of good quality of life and environment (43%) and through economic benefits & poverty alleviation (15%) (Fig. 4). Besides numerous environmental benefits, urban forestry and urban greening can provide numerous social and economic benefits to its residents to sustain their livelihood (Fig. 2). For instance, urban greening can have a positive impact on physical and mental health because it can provide opportunities for physical exercise, act as the absorber of air pollutants and provide fresh air and reducing stress. Wolch *et al.* (2014) asserted that green space can promotes physical activity, psychological well-being, and the general public health of urban residents. Moreover, it can provide recreational areas for the city inhabitants particularly for the urban poor and those people who prefer to visit the outdoor recreational places close to their home (Konijnendijk *et al.,* 2004).

SOCIAL BENEFITS
- Provid asthetic beauty
- Enhance good quality of life to its dwellers
- Improve public health
- Assists to the psychological development of urban children
- Poverty alleviation
- Social & recreational values

URBAN FORESTRY AND URBAN GREENING

ECONOMIC BENEFITS
- Provide employment opportunity to the urban poor
- Source of food and medicines
- Increase property value
- Attracts the tourists and enhance tourism
- Source of fuel and energy

ENVIRONMENTAL BENEFITS
- Reduce urban air pollution
- Reduce urban heat island effects
- Air purification
- Enhancement of biodiversity
- Enhancement of soil fertility and compactness
- Prevention of soil erosion
- Reduce noise
- Provide barrier against natural disasters
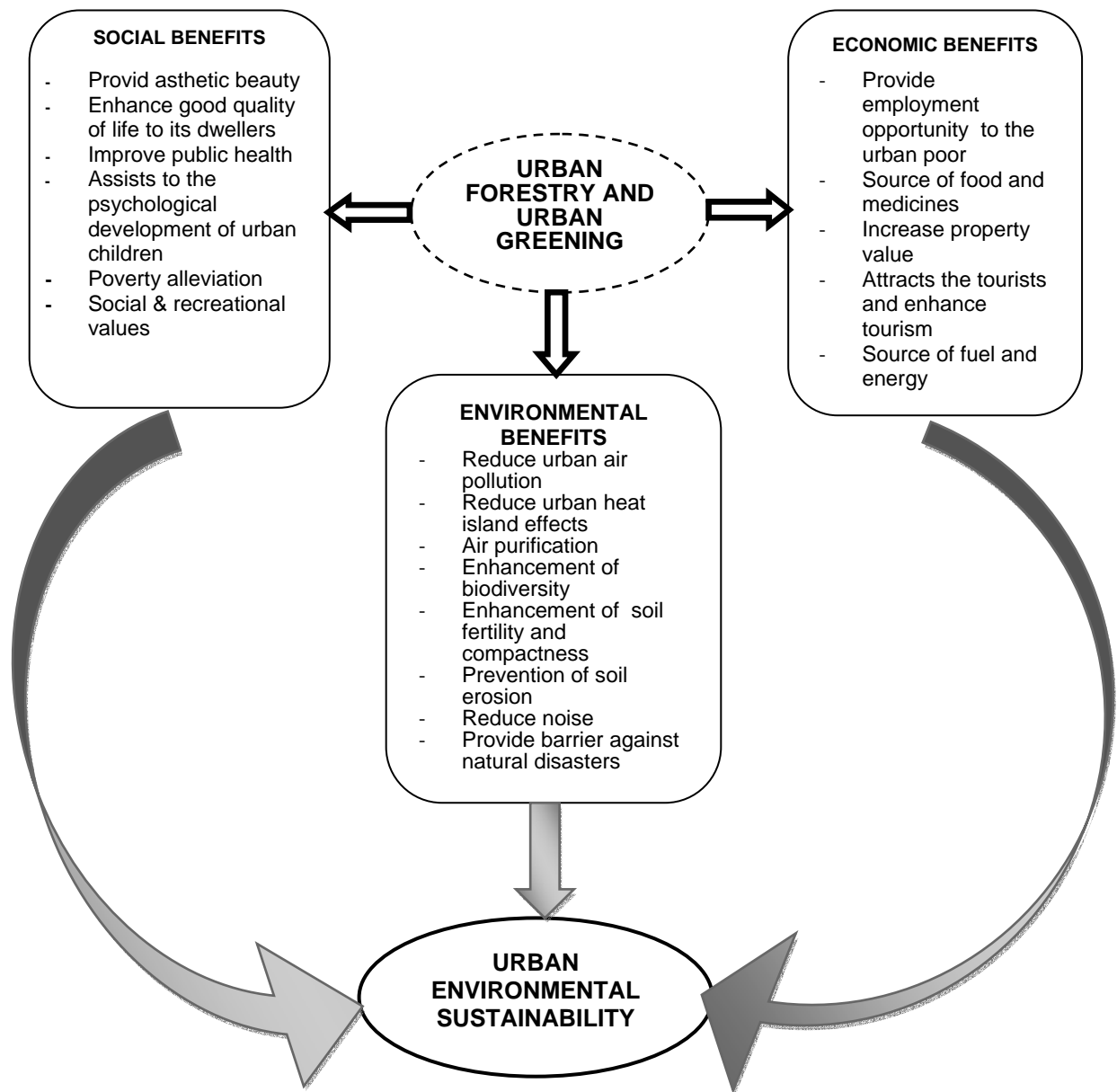
URBAN ENVIRONMENTAL SUSTAINABILITY

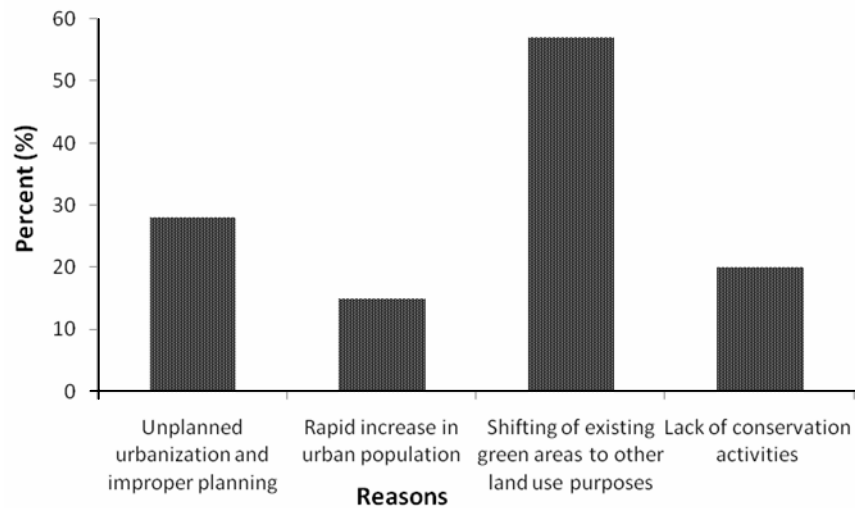Fig. 2. Role of urban forestry and urban greening for urban environmental sustainability

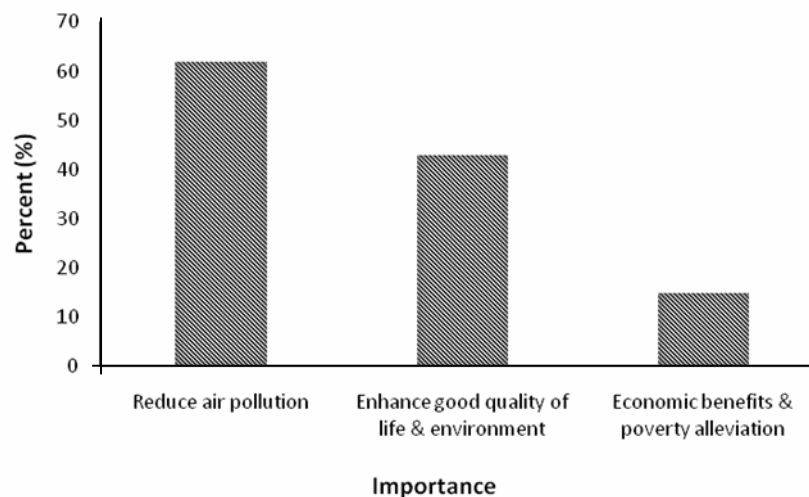Fig. 3. Reasons behind losing of green resources

Fig. 4. Importance of urban forestry and urban greening

In Dhaka a large number of people are living below the poverty line. To get the job or to generate income is a priority for the urban poor that are also related to better urban policy for achieving sustainable urban development and therefore, it is agreed to the theory of "urban policy for ordinary cities". For example, from the ordinary cities perspective it can be affirmed that generating income opportunities are the top most priorities of the poor people in the urban city and to support the economic growth and its expansion is associated with the policy agenda (Robinson, 2006) whereas the concept of enhancing urban greening can play the crucial role for urban poor. For instance, urban greening can play an important role by providing some start-up jobs to the poor people and some skilled and unskilled laborers and can also create many permanent job opportunities (IADB, 1997). Moreover, recently a significant number of nurseries (for selling flowers, non-timber forest products, trees species for rooftop gardening etc.) are found in Dhaka city, which helps the urban poor by providing employment opportunities.

Urban forestry and urban greening can act as the one of the major drivers to bring urban environmental sustainability through its diversified services into the three spheres of sustainable development (Fig. 3) and thus to achieve urban environmental sustainability in Dhaka it is obvious to conserve the existing

green spaces or greeneries from rapid degradation. This is because the loss of urban green spaces or greeneries is resulting in the loss of biodiversity and their habitats (BCAS, 2006; Khan *et al.,* 2004), contributing to the emergence of infectious diseases in the city and increasing atmospheric pollution (Khalequzzaman *et al.,* 2007; Azad and Kitada, 1998; Hasan and Mulamoottil, 1994), all of these factors have detrimental effects on the urban ecology of the city and human life. These environmental disturbances not only worsen the functions of ecosystem of that area, but also have devastating effects on the local climate.

Possibilities for enhancing the urban forestry and urban greening

Urban population in the major cities of most of the developing countries is increasing rapidly, which consequently creating huge pressure on the existing green resources or green spaces and Dhaka city is not an exception in this regard. Moreover, improper and poor urban planning is worsening the situation day by day. Although this study identified that Dhaka is losing its existing greeneries or green spaces enormously however, still there are ample possibilities to the City Corporation authority, RAJUK (Capital development Authority), urban planners and local inhabitants to enhance the urban greening in the city that can sustain the existing life of the urban population. It also revealed from the study that38% of the respondents mentioned that it is possible to enhance the urban forestry and urban greening in Dhaka city by conserving the existing green areas or green spaces (e.g. parks, gardens, playgrounds etc.) followed by increasing roadside plantation (31%), by promoting homestead and rooftop gardening (21%) and by initiating afforestation and nursery activities (10%) (Table 3).

Table 3. Techniques of enhancing urban forestry and urban greening

Variable	Frequency	Percent (%)
By conserving existing green areas/spaces	46	38.0
By increasing roadside plantation	37	31.0
By promoting homestead and rooftop gardening	25	21.0
By initiating afforestation and nursery activities	12	10.0
Total	120	100.0

Another important opportunity for enhancing urban greening is to create new parks, botanical gardens, play grounds and roadside plantations to the expanding or newly developed residential and commercial areas. Ansari (2008) specified that Dhaka City Corporation (DCC) and RAJUK (Capital development Authority) prepared an "Urban Area Plan 1995-2015 for Dhaka city" where they include surrounding municipalities (e.g. *Savar, Karaniganj* and some part of *Narayanganj* municipalities) under the DCC areas. To enhance the urban forestry and greening these areas can be considered for developing new small parks, play grounds, botanical garden by the city planners. Moreover, recently most of the housing companies surrounding the Dhaka city are doing their land development projects by establishing green areas like parks, garden, playgrounds etc. to attract the customers which is a positive sign for enhancing urban greening.

As a city of more than 12 million people it is hardly difficult to find available free spaces for establishing new green areas. However, currently the practice of rooftop gardening is increased significantly to the city dwellers. This is because Dhaka city is characterized by huge number of high-rise buildings both in the residential and commercial areas, which can be considered as potential places for initiating rooftop gardening and therefore, it can play a vital role for enhancing urban greening. For instance, Ansari (2008) noted that rooftop gardens are a smart way to use the available city space. City dwellers can take a simple and easy initiative to make all roof tops green by planting different trees (fruit trees, vegetables, etc.) or practice gardening. Hien *et al.,* (2007) showed that roof top gardening can provides a wide range of environmental benefits to the urban inhabitants by reducing surface temperature down to 31°C and ambient temperature by 1.5°C within 1m distance. Besides the above mentioned options for enhancing urban greening there are some other potential strategies that urban planners could follow such as green areas could be integrated into the water treatment projects, business parks, highway construction, flood-plain protection, and urban farms (IADB, 1997).

Challenges to enhance the urban forestry and urban greening

Although the enhancement of urban greening is a prime requirement for sustainable urban development in the major cities of developing countries but there also exist different obstacles and challenges behind its implementation. This study recognized several constraints in the way of enhancing urban greening in Dhaka. For instance, the majority of the respondents (65%) recognized high population density and lack of availability of free spaces as the major obstacle for enhancing urban greening, followed by low implementation of environmental laws for conserving the existing greeneries (20%), irresponsible management and improper planning by the urban planners (20%) and lack of public awareness in this regard (15%) (Fig. 5).
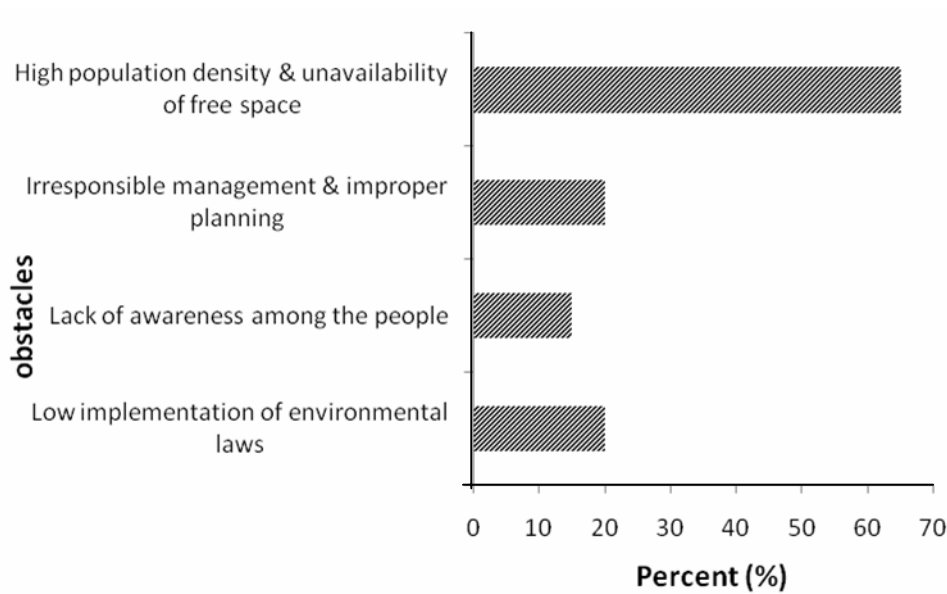

Fig. 5. Obstacles for enhancing urban forestry and urban greening

Among the different obstacles rapid urbanization seems to be the major problem behind the enhancement of urban greening in Dhaka. This unprecedented growth in urbanization is creating and will continue to create massive pressure on the existing open or green spaces due to different shorts of activities such as housing, industrial and commercial construction. Jim (2004) stated that compact urban areas are characterized by the close association of buildings and roads with limited interstitial space to insert greenery. Ansari (2008) noted that increasing population creates adverse effects on the urban environment and thus the valuable green areas are converted to built-up areas. As a result, due to the lack of availability of free spaces it is becoming a challenging task for the city planners to enhance urban greening in the city. For example, Byomkesh et al. (2012) has stated that in 2002, Dhaka city corporation (DCC) has planted 29 thousands trees in the city whereas the target was 45 thousands and this was failed due to unavailability of free spaces.

However, despite of the population pressure, other vital constraints are poor environmental legislation and its implementation, lack of cooperation between the city planners and the stakeholders in the decision making process, improper maintenance and monitoring of existing green resources, lack of proper planning by the government bodies, lack of public awareness regarding the importance of urban greening for improving the quality of life and environment and financial constraints, which are strongly associated with the political processes towards the development of an ordinary city in a sustainable manner. For example, Ansari (2008) asserted that the government of Bangladesh formulated the National Environmental Management Action Plan (NEMAP) to connect all sorts of development activities with the environment to improve the quality of life of people but the poor practices and implementation of

environmental laws and regulations there observed the deteriorating condition of urban green resources. So, there needs better policy or implementation of laws to safeguard the existing greeneries of Dhaka city. This is because urban theory regarding development and globalization points toward political involvement in defining city spaces. Since the beginning of urban development, local political processes have been shaping the cities (Robinson, 2006) whereas Dhaka city is not an exception.

Conclusion

Green resources are inevitable part of a city and through its multifunctional services it can play a vital role for sustainable urban development of a city. This study revealed that a gigantic volume of urban population in Dhaka city is creating serious pressure on its existing green spaces and green resources and thus it is becoming a challenging task for the city planners alone to enhance its urban greeneries. A better cooperation and coordination among government bodies, stakeholders, city planners, private organizations and local inhabitants can enhance urban forestry and urban greening especially in newly emerging residential and commercial areas like *Uttara* (Zone-1 of DNCC). Moreover, the city corporation authority and RAJUK (capital development authority) can enact a mandatory 'urban greening policy' for the conservation and enhancement of urban greening and urban forestry in Dhaka city. This study also identified that the concept of urban forestry and greening can contribute a significant role in the three pillars of sustainable development (social, economic and environmental) and thus important for sustainable urban development.

References

Adams, L.W., Leedy, D.L. (Eds.) 1987. Integrating Man and Nature in the Metropolitan Environment. National Institute for Urban Wildlife, Columbia MD.

Ansari, A. N. 2008. Opportunities and Challenges of Urban and Peri-Urban Forestry and Greening in Bangladesh: Dhaka City as a Case. Master's Thesis. Department of Landscape Management, Design and Construction. Swedish University of Agricultural Sciences (SLU), Sweden.

Azad, A.K. and Kitada, T. 1998. Characteristics of the air pollution in the city of Dhaka, Bangladesh in winter. *Atmos. Environ*, 32(11): 1991–2005

BBS, 2011. National population census 2001: preliminary report. Bangladesh Bureau of Statistics, Ministry of Planning, Dhaka.

BCAS, 2006. Dhaka City State of Environment. Bangladesh Centre for Advanced Studies, Dhaka.

Berg, B. L. 2009. Qualitative research methods for the social sciences. Pearson International Edition.

Byomkesh, T., Nakagoshi, N. and Dewan, A.M. 2012. Urbanization and green space dynamics in Greater Dhaka,Bangladesh. *Landscape Ecol. Eng.,***8:**45–58.

CUS (Centre for Urban Studies) Dhaka, 2014. [Available online at]: http://cusdhaka.org/maps/598/attachment/dcc-north-new. Accessed on: September 17, 2015.

Davis, R.G., Barbosa, O., Fuller, R.A., Tratalos, J., Burke, N., Lewis, D., Warren, P.H. and Gaston, K.J. 2008. City-wide relationships between green spaces, urban land use and topography. *Urban Ecosyst,* 11**:**269–287.

DNCC (Dhaka North City Corporation), 2014. [Available online at]: http://www.dncc.gov.bd/dncc-setup/geographical-location-area-of-dncc.html. Accessed on: September 17, 2015.

Finco, A. and Nijkamp, P. 2003. Pathways to urban sustainability. *Journal of Environmental Policy and Planning*3:289–302.

Godefroid, S. 2001. Temporal analysis of the Brussels flora as indicator for changing environmental quality. *Landscape and Urban Planning* 52:203–224.

Hasan, S. and Mulamoottil, G. 1994. Environmental problems of Dhaka City. *Cities,* 11(3):195–200.

Haq, K.A. 2006. Water Management in Dhaka. *Water Resources Development,* 22(2): 291–311.

Hien, W.N., Puay Yok, T. and Yu, C. 2007. Study of thermal performance of extensive rooftop greenery systems in the tropical climate. *Building and Environment,* 42:25-54.

Hossain, S. 2006. Social characteristics of a megacity: a case of Dhaka City, Bangladesh. TASA Conference 2006, University of Western Australia and Murdoch University. Pp.1-9.

IADB, 1997. Good practices for urban greening. Environment Division of the Social Programs and Sustainable Development Department. Inter-American Development Bank. Washington, D.C. pp. 1-88.

Jim, C.Y. 2004. Green-space preservation and allocation for sustainable greening of compact cities. *J.Cities*, 21(4): 311–320.

Jim, C.Y., Chen, W.Y. 2006. Perception and attitude of residents toward urban green spaces in Guangzhou (China). *Environ Manag,* 38(3):338–349.

Johnston, J. 1990. Nature areas for city people. Ecology Handbook 14. London Ecology Unit, London.

Khan, M. 2014. Study of Open Spaces in the Context of Dhaka City for Sustainable Use: A Syntactic Approach. *IACSIT International Journal of Engineering and Technology,* 6(3): *238-243.*

Khan, N.A., Choudhury, J.K., Huda, K.S. 2004. Forestry sector review report. Bangladesh Forest Department, Ministry of Environment and Forest, Dhaka.

Khalequzzaman, M., Kamijima, M., Sakai, K., Chowdhury, N.A., Hamajima, N. and Nakajima, T. 2007. Indoor air pollution and its impact on children under five years old in Bangladesh. *Indoor Air,* 17(4):1–8.

Kong, F. and Nakagoshi, N. 2006. Spatial-temporal gradient analysis of urban green spaces in Jinan, China. *Landsc Urban Plan* 78:147–164.

Konijnendijk, C.C., Sadio, S., Randrup, T.B., and Schipperijn J. 2004. Urban and peri-urban Forestry in a Developing Context-Strategy and Implementation. *Journal of Arboriculture.* International Society of Arboriculture, 30(5):269-276.

Kothari, C. R. 2004. Research Methodology: Methods & Techniques. 2nd edition. New Age International (P) Ltd. New Delhi, India.

Lovell, S.T. and Taylor, J.R. 2013. Supplying urban ecosystem services through multifunctional green infrastructure in the United States. *Landscape Ecol.*28:1447–1463.

Li, F., Wang, R., Paulussen, J. and Liu, X. 2005. Comprehensive concept planning of urban greening based on ecological principles: a case study in Beijing, China. *Landscape and Urban Planning,* 72(2):325-336.

Mabuhay, J., Isagi, Y., Nakagoshi, N. 2005. Ecological indicators of biodiversity in tropical urban green spaces. *WSEAS Trans Environ Dev*1:85–91.

Nakagoshi, N., Watanabe, S., Kim, J.E. 2006. Recovery of green resources in Hiroshima City after World War II. *Landsc Ecol Eng*2:111–118.

Oppenheim, A.N. 2000. Questionnaire design, interviewing and attitude measurement. Continuum. London and New York.

Phan, D.U., Nakagoshi, N. 2007. Analyzing urban green space pattern and eco-network in Hanoi, Vietnam. *Landsc Ecol Eng* 3: 143–157.

Robinson, J. 2006. Ordinary cities: between modernity and development. London: Routledge.

Wolch, J.R., Byrne, J. and Newell, J.P. 2013. Urban green space, public health, and environmental justice: The challenge of making cities 'just green enough'. *Landscape and Urban Planning*125: 234–244.