

Urban Agriculture in DMDP Area: A Case Study of Gazipur, Kaliganj, Rupganj and Narayanganj Upazilas

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Abstract

Urban and peri-urban agriculture (UPA) has become a key component of the survival strategies of poorer sections of the population while also providing a significant contribution to the urban fresh food supply chain. The positive impacts of this industry include improved nutrition and health, an improved environment for living, increased entrepreneurship and poverty alleviation. Urban agriculture is one of the most effectual concepts of sustainable development. It improves the quality of urban environment through greening and reduction in pollution. In many developed and also in some developing countries, local authorities start to recognize the role of urban agriculture for local economic development, enhancing urban food security and offering recreational services to urban citizens. In a developing country like Bangladesh, where a huge number of people face food insecurity, practice of urban and peri-urban agriculture can play a vital role in supplying fresh foods. Urban planners in developing countries should pay more attention to peri-urban agricultural practices which could assist in improving urban environment, generating employment and reducing future food insecurity. The aim of the study is to determine the suitability of the study area for urban and peri-urban agriculture in DMDP area. As it is not possible to conduct the study for the whole DMDP area within a limited time, the study has narrowed down to Gazipur, Kaliganj, Rupganj and Narayanganj Upazilas.

Introduction

Urban agriculture, the growing of food within the confines of the city, has recently gained prominence as a solution attempting to reverse the ills of urbanization. The adoption of urban agriculture puts food production and consumption in closer proximity and thus allows cities to attain a higher degree of food self-sufficiency.

Urban poverty tends to be fuelled by people migrating towards the cities in an attempt to escape the deprivations associated with rural livelihoods. Dhaka, the capital city of Bangladesh has experienced a higher rate of urban growth in recent decades and emerged as the world's fastest growing mega city. Due to unrestrained urban growth, it will be the fourth largest urban agglomeration of the world with a population of 21.1 million by 2015 (UN, 1999). The city is facing incredible problems associated with unplanned development, high level of poverty, social vulnerability, inadequate infrastructure, lack of social services, poor quality of physical and social environment, and inefficient urban management. High price of food and inability of most families/ households to buy or provide adequate amount of nutritious food make them vulnerable to hunger

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and disease. Urban agriculture promotion and its sustainability seem to be a remedy to such situations, whole augmenting income and employment opportunities in the cities. For the residents of Dhaka, there is limited access to fresh, healthy, culturally appropriate and affordable food. While nearly almost half of the people of Dhaka are food insecure. Overall, a much higher percentage are unable to obtain fresh and nutritious produce (Food Security in Bangladesh, 2005). Moreover, urban agriculture can help residents, especially the poor urban poor to survive in terms of crisis, such as famine. In this context, this study aims to explore the suitability of urban agriculture in the DMDP area for the betterment of the area.

Working Definition of Urban Agriculture

Urban agriculture defined in simple terms is the growing, processing, and distribution of food and other products through intensive plant cultivation and animal husbandry in and around cities (Bailkey et al., 2000). A definition which takes into account the use of resources is defined by the United Nations Development Program as “an industry that produces, processes and markets food and fuel, largely in response to the daily demand of consumers within a town, city, or metropolis, on land and water dispersed throughout the urban and peri-urban area, applying intensive production methods, using and reusing natural resources and urban wastes to yield a diversity of crops and livestock” (Smith et al., 1996).

Objective of the Study

The objective of this research is to explore the suitability of agriculture in the study area by using GIS.

Methodology of the Study

The whole study has been conducted following a methodology which consists of some sequential steps. The subsequent steps are described here in details which are followed to achieve the objectives of the study. The case study areas are selected by considering the following criteria:

- Existence of large amount of unutilized and underutilized agricultural land.
- Availability of water bodies.
- Existence of flood flow zones.
- Located within DMDP area.

In the Detailed Area Plan of DMDP, Group A contains the highest amount of agricultural land (Detail Area Plan, 2010) and also fulfills the other selection criteria. Therefore, four upazilas of Group A have been selected as the study areas which are Gazipur Upazila, Rupganj Upazila, Kaliganj Upazila and Narayanganj Upazila.

Suitability Analysis of Urban Agriculture

After reviewing relevant literatures, a methodology has been developed to fulfill the aim of the study which has been described here in details. The Suitability analysis is completely a Geographic Information System (GIS) based approach. To explore the suitability of urban and peri-urban agriculture, the major four factors affecting urban and peri-urban agriculture have been considered. The factors are: soil, land use, road accessibility, and water resource accessibility (Thapa and Murayama, 2007). These are decision making parameters for suitability analysis of urban agriculture. GIS map have been used for making the suitability maps of these four parameters. These maps are firstly classified to identify the level of suitability according to some conditions which influence the suitability of urban and peri-urban agriculture. These classification criteria have been acquired from different secondary sources. After the classification, suitability maps have been prepared for the parameters. The classification of these four factors according to the level of suitability for urban agriculture and the corresponding ranks are given in Table 1.

Each of these four parameters has different intensities of influence. To consider the level of influence, individual weights are assigned for each parameter. Thapa and Murayama have developed these weights for developing country through using Analytical Hierarchical Process which are given in Table 1.

Table 1: Classification of the parameter of UPA according to suitability

Parameters	Weights	Types	Suitable	Rank
Soil	37	Chy	Highly	3
		Chy Loam	Medium	2
		Loam	Low	1
Land Use	31	Agriculture, Flood flow zone, Water body	Highly	3
		Residential Area	Medium	2
		Others(Industrial, Commercial, Overlay zone, Road, Mixed)	Low	1
Road Accessibility	16	Within 0.5 mile	Highly	3
		Within 1 mile	Medium	2
		More than 1 mile distant	Low	1
Water resource accessibility	10	Within 0.3 km	Highly	3
		Within 0.6 km	Medium	2
		More than 0.6 km distant	Low	1

Linear combination method (Eq.1) was used to overlay the GIS data and integrate the AHP results to show the level of suitability of UPA. In this study, four GIS map results (i.e., soil, land use, road accessibility and water resources accessibility) were multiplied by their corresponding AHP weights individually and then all GIS data layers were arithmetically overlaid to derive a final suitability map. The map was further scaled into qualitative information (using equal interval method) as high suitable, medium suitable, low suitable and unsuitable land for peri-urban agriculture. The equation of integrating GIS data and AHP results is given below:

$$LC = \frac{1}{n} \sum_{i=1}^n D_i * W_i \dots \dots \dots \text{Eq. 1}$$

LC = Linear combination

Di = Decision parameters

Wi= AHP Weight

n = Number of parameters

Data Sources

To collect data which are required to achieve the objective of this research work, both primary and secondary data sources have been used. After the fixation of conceptual framework data collection was started.

Primary Data collection: For primary data collection, reconnaissance survey and questionnaire survey have been held. At the earliest stage of survey, reconnaissance survey has been held to have an idea about the site. General information about the site characteristics have also been

collected along with studying the base map. The special characteristics of the sites have been examined by on-site observations.

A questionnaire survey has been conducted to collect the data relevant to the urban agriculture. To prepare a questionnaire to collect the necessary data of households of the study area, some strategies have been followed. The population of the study area was 13, 14,701 in 2010 (Detailed Area Plan (DAP), 2010). From this population, a sample size of 384 has been determined at 95% confidence level and 5% confidence interval (Creative Research System, 2010).

Secondary Data Collection: Collection of secondary data has been started to collect after the formulation of conceptual framework. Soil data of Gazipur, Kaliganj and Rupganj Upazilas have been collected from Soil Research Development Institute. Information about soil suitability for urban and peri-urban agriculture has been collected from Bangladesh Agricultural Research Institute and also by reviewing the manual of Soil Research Development Institute. The production rate of agricultural products has been collected from Bangladesh Agricultural Development Corporation and Bangladesh Bureau of Statistics. A huge amount of data has been collected from Rajdhani Unnayan Kartripakkha (RAJUK). The base map of study area, road map, water resource map, land use map and other related information about the study area have been collected from RAJUK. This information has been gathered from the project report of 'Preparation of Structure Plan (SP), Urban Area Plan (UAP) and Detailed Area Plan (DAP) - Metropolitan Development Plan Preparation and Management in Dhaka'. Other relevant information has been collected from different books, journals, thesis reports, researches, web documents.

Data Processing and Analysis

After the collection of raw data in both quantitative and qualitative form, these are processed using different techniques. There were both hard copies and soft copies of maps which have been processed by using ArcGIS. The primary data collected through questionnaire has been processed by Statistical Package for Social Science (SPSS) and Microsoft Excel. Variables have been declared in SPSS variable sheet and data input have been conducted for further analysis.

After completion of data processing, data was analyzed following different methods and models. ArcGIS, SPSS and Microsoft Excel have been used for data analysis in order to achieve the objective. An integrated technique of Analytical Hierarchical Process (AHP) and Geographic Information System (GIS) has been used to evaluate the suitability of the study area for urban and peri-urban agriculture.

Study Area Profile

For the preparation of Detailed Area Plan (DAP), the total area of RAJUK jurisdiction has been divided into five separate groups and several locations. Group-A is a part of that distribution. The project area of Group-A is situated on the north east part of the Dhaka City with a gross area of 1,10,052 acres. This research has been carried out for four upazilas of the Group A which are Gazipur, Kaliganj, Rupganj and Narayanganj Upazilas (Detailed Area Plan (DAP), 2010).

Suitability Analysis of Urban Agriculture

This study aims to analyze the suitability of the area for urban and peri-urban agriculture. To promote urban agriculture within an area, it is very crucial to judge the suitability of that area for urban and peri-urban agriculture. As the output of the suitability analysis, a suitability map has been prepared for the study area. To prepare the suitability map for urban and peri-urban agriculture, the major affecting factors have been considered. Soil suitability, land use, road accessibility, water resource accessibility, these four parameters have been analyzed differently. The soil data for Narayanganj Upazila could not be collected because of data unavailability. For that limitation, Narayanganj Upazila could not be considered for the suitability analysis. The result of the suitability analysis has been discussed here.

Soil Suitability

There are three types of soil within the study area, which are Chy, Chy loam, Loam (Soil Research Development Institute, 2001). According to the Bangladesh Agricultural Research Institute, Chy is the most suitable soil for the production of agricultural products and Chy loam is the medium suitable soil and Loam is not so suitable soil for agricultural production. In Gazipur Upazila, about 22% soil is Chy, 52 % is Chy loam and 24 % soil is loam. In Rupganj Upazila, almost 70% soil is suitable for agricultural production. In Kaliganj Upazila, 45% soil is Chy and Chy loam. So there is also a huge scope for agriculture practice. Figure 2 displays high suitability of soil for urban and peri-urban agriculture in most of the land of study area (Gazipur, Kaliganj, Rupganj Upazilas).

Land Use Suitability

To prepare the land use suitability map, land uses proposed in DAP has been classified according to the suitability of Urban Agriculture. In DAP, about 38.56 % land has been proposed as agricultural land (Detailed Area Plan (DAP), 2010). These agricultural lands are considered as highly suitable for urban agriculture. Flood flow zones can provide added benefits by promoting agriculture in dry season. Inundation by flood water and layers of salt make these zones highly suitable for agricultural production. Water bodies are also used for aquaculture. So in case of land use suitability classification, water bodies and flood flow zones are considered as highly suitable for agricultural use. Residential areas also have a scope for urban agriculture in the form of backyard gardening, roof gardening and community gardening. Industrial area, Commercial area, Overlay zone and mixed use areas are assigned as less suitable for agriculture. In Gazipur Upazila, about 79% land is highly suitable for agriculture. The amount of highly suitable agricultural land is about 89% in Kaliganj Upazila and about 81% in Rupganj Upazila. So these three Upazilas have great possibility for urban agriculture in case of land use suitability. Figure 3 shows that most of the areas are suitable for agricultural activities within the study area (Gazipur, Kaliganj, Rupganj Upazilas).

Road Accessibility

Road accessibility also influences urban and peri-urban agriculture to a large extent. The farmers need to have access to the agriculture inputs and also to the local market for selling the products. By considering these factors, any area having access to physical road network within 0.5 mile has been assigned as highly suitable because this distance can easily be passed by foot. Within the study area, most of the places have high access to the physical road network. Figure 4 refers to road accessibility of the study area (Gazipur, Kaliganj, Rupganj Upazilas). The map shows high accessibility of roads for urban agriculture in the study area.

Water Resource Accessibility

The whole study area is crisscrossed by different types of water bodies such as River, Khal, Pond, Ditch, Swamp etc. Water Source is used for irrigation which is must for agricultural production. Urban and Peri-urban agriculture fully depends on water resources. Availability of a nearer water source decreases the cost of large and medium scale agricultural activities to a great extent. Existence of water bodies also reduces environmental problems while improving aesthetic quality.

The areas of Gazipur, Kaliganj and Rugganj upazilas have a great access to water resource which creates a huge scope for urban and peri urban agriculture. This is shown in Figure 5.

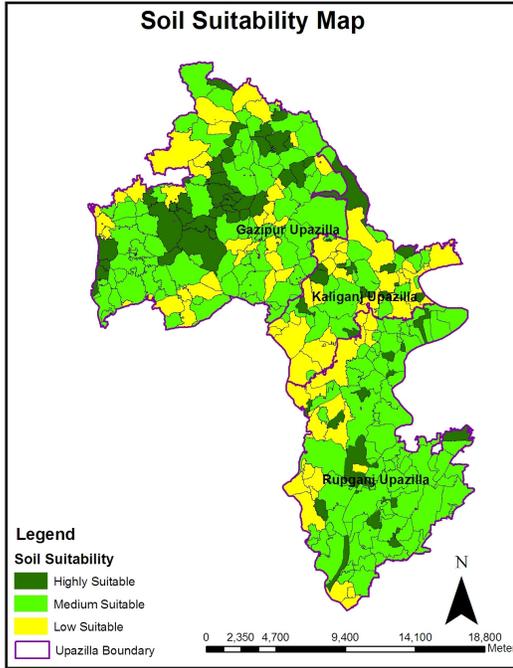


Fig. 2: Soil Suitability Map

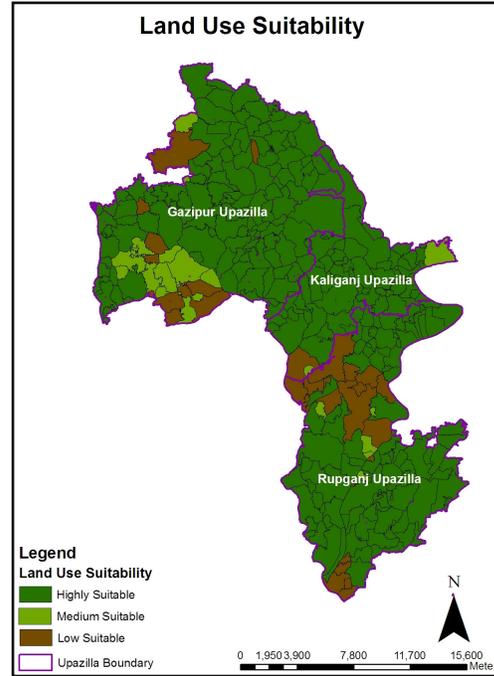


Fig. 3: Land use Suitability Map

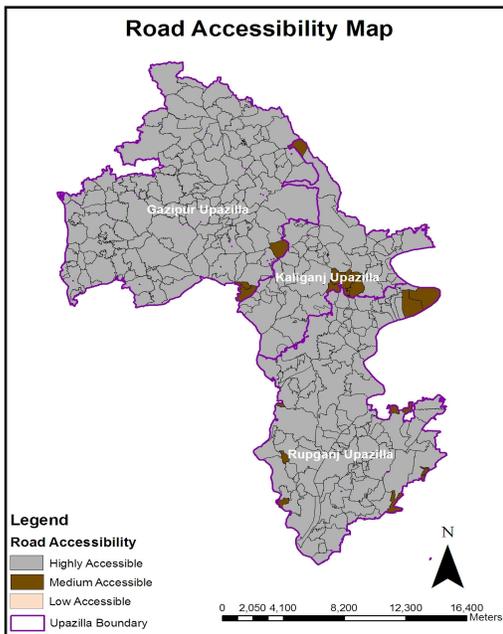


Fig. 4: Road Accessibility Map

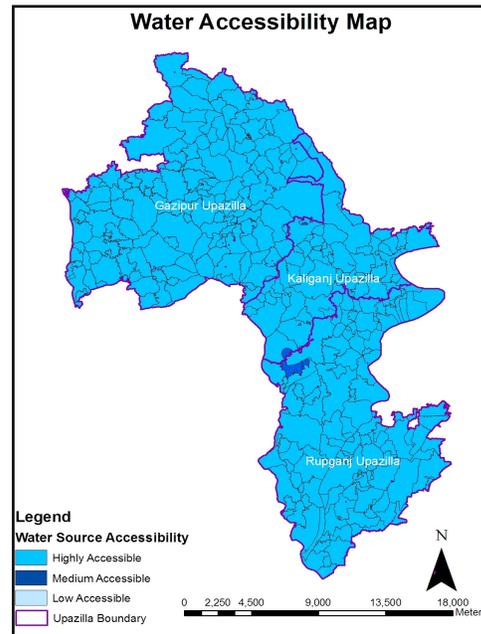


Fig. 5: Water Accessibility Map

Suitability of the Study Area for Urban and Peri-urban Agriculture

Final suitability map has been prepared by integrating the suitability ranking of parameters and corresponding AHP values. The suitability map shows the suitability of the study area for UPA. From the final ranking collected from the secondary source, final suitability map has been prepared. The final output of suitability analysis indicates that all the three Upazilas have a huge scope for urban and peri-urban agriculture. In Gazipur Upazila, about 21% area is highly suitable and 68% area is medium suitable for agriculture. About 17% area is highly suitable and 58% area is medium suitable for agriculture in Kaliganj Upazila. Within Rupganj Upazila about 12% area is highly suitable and about 72% area is medium suitable for agriculture. All this information indicates that the area has a great potential for urban and peri-urban agriculture. Figure 6 shows that most of the areas within Gazipur, Kaliganj and Rupganj are suitable for urban and peri-urban agriculture. The result of suitability analysis for all the four suitability parameters along with the final suitability result is presented in Table 2.

Table 2: Percentage of areas for different levels of suitability parameters.

Upazilas	Percentage of area according to Soil Suitability			Percentage of area according to Land use Suitability			Percentage of area according to Road Accessibility			Percentage of area according to Water accessibility		
	HS	MS	LS	HS	MS	LS	HA	MA	LA	HA	MA	LA
Gazipur	22.3 %	52.8%	24.7%	79.8%	11.75	8.4%	97.4%	2.5%	0%	100%	0%	0%
Kaliganj	18.9%	25.3%	55.6%	89.7%	6.4%	3.8%	79.4%	20.5%	0%	96.1%	3.8%	0%
Rupganj	15.8%	69.7%	14.3%	81.1%	4.3%	14.4%	89.1%	10.8%	0%	97.1%	2.8%	0%

HS= Highly Suitable, MS= Medium Suitable, LS= Low Suitable

HA= Highly Accessible, MA= Medium Accessible, LA=Low Accessible

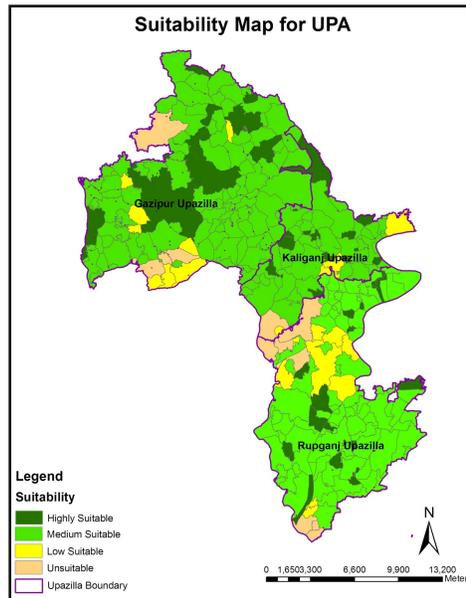


Fig. 6: Suitability Map of Urban and Peri-urban agriculture for Gazipur, Kaliganj and Rupganj Upazilas

Findings of the Study

The findings were based on the data analysis. Some recommendations were also provided focusing on the potential of urban agriculture in ensuring food security in urban areas. Some significant findings are observed from data analysis, which are summarized here.

Most of the areas are high and medium suitable for urban and peri-urban agriculture. According to the suitability analysis, the percentages of highly suitable area are 21.6%, 17 % and 12.9 % in Gazipur, Kaliganj and Rupganj Upazilas respectively. Percentages of medium suitable areas are 63.8%, 58.9 %, 72.6% in Gazipur, Kaliganj and Rupganj Upazilas respectively. So it can be stated that the area has a huge scope for urban and peri-urban agriculture.

Most of the designated agricultural zones in DAP for the study area are sufficiently suitable for agricultural production, especially vegetables production. If all these zones are utilized for vegetable production then the possible production could not only fulfill the local demand, but also could serve the people of other areas.

Recommendations

Some recommendations are made based on the research findings to expand the practice of urban agriculture. As the study area is adequately suitable for urban and peri-urban agriculture, the designated agricultural zones in DAP within the study area should be utilized accordingly. The Government and the concerned authorities should be ensuring the optimum utilization of the agricultural land by restricting other uses.

In many developed and also in some developing countries, roof top gardening and community gardening is widely practiced for local food production. In DMDP area, urbanization trend is increasing which results to a huge built up area. In this case practice of roof top gardening and community gardening can play a vital role for supplying fresh foods for urban people. Unutilized and incidental spaces within city should be brought under effective use by promoting urban and peri-urban agriculture. To promote urban and peri-urban agriculture within the community, organizations should be developed by the involvement of community people.

Conclusion

Urban and peri-urban agriculture have not received adequate policy attention in Bangladesh. Policies, such as National Agricultural Policy 1999, National Food Policy 2006, National Food Policy Plan of Action (2008-2015) have not addressed the important aspect of urban agriculture and food security. In these policies, only rice and wheat production got the priority but, for example, a very essential aspect of vegetable production has not been considered. Therefore, urban agriculture should be included into such policies.

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