INTRODUCTION

Urbanization spells out distinctly in economy, as a social milieu and as quality of life differing from that of a rural setting. Urban areas are characterized by the predominance of non-agricultural pursuits. Other characteristics are: high density of population, fast pace of life, availability of improved civic amenities and affluences. The economic development tends to strengthen commercial and industrial activities and thereby an increased number of urban centres and expanding of existing areas. Agriculture and allied sectors is the mainstay of rural masses, engage more people in employment sectors. Expansion of rural population tends to aggravate the economic life of rural areas and is hardly matched with advancement of agricultural technology. Inability to absorb in the economic environment of the rural areas and the lure of better economic prospects in urban areas, a sizable population is always on move from rural to urban areas. New urban centres continue to come up. Consequently, with the passage of time population living in urban areas tends to increase.

In the forth coming decades, rapid urbanization will be one of the greatest challenges in the world to ensure human welfare and a viable global environment. According to the current estimates, cities occupy 4 per cent of the world’s terrestrial surface, yet they are home for almost half the global population, consume three-quarters of natural resources, and generate three-quarters of pollution and wastes. Moreover, United Nations has estimated that, virtually global population and economic growth over the next 30 years will be seen in cities, leading to doubling the current population. This growth will require unprecedented investment in new infrastructure and create undreamed of challenges for political and social institutions. The transformation of surrounding land due to urban expansion and urban dwellers’ ever-increasing demand for energy, food, goods, and other resources is behind the degradation of local and regional environments, threatening basic ecosystem services and global biodiversity (Charles, et. al., 2004). This phenomenon is most common in countries of Asia and it has been estimated the fastest rate of urban growth over the
next 25 years will be in medium-sized cities with 1 to 5 million populations and that most people will live in smaller cities having less than 1 million people.

Urban growth passes through four basic processes:

1. **Rural to urban migration** has been a key factor of urban growth. Towns and cities with the beginning are confronted with the problems and factors such as perceived economic opportunity in the countryside, politically motivated settlement, insecurity in the countryside, and perceived “excitement” of city life drives rural-to-urban migration of the people. Migration rate varies over time and space, and in economically advanced countries of the world, may be balanced by a reverse migration.

2. **Natural increase** in population due to the combination of increased fertility and decreased mortality is probably the greatest numeric contributor to urban growth. Increase in global life expectancy from 46 to 66 years over past 50 years reflects major reduction in infant mortality and extension of normal life span. The recent decrease in female fertility rate, especially in cities where more women are educated and enter the workforce, somewhat balances this figure.

3. **Cross-border immigration** has also an impact on urban growth in developed and developing countries of the world. Economic opportunities and perceived lifestyle improvements are major attractions for these migrants, as are push factors in local unemployment or underemployment, environmental degradation, civil strife, and political instability.

4. **Reclassification of land** from rural to urban categories is both a real process of urbanization and a record-keeping shift that may or may not reflect current reality. Many cities in developing countries are rapidly growing at their fringes, engulfing former villages and farmlands, transforming them into dense, industrial areas, shantytowns, or less-dense suburban developments. The other process, which can
take the form of annexing rural lands to ensure control when they will be urbanized in future or redefining what constitutes urban communities by national census takers, does not reflect the same demographic reality, complicating the comparative databases we all use (Charles, et. al., 2004).

In 2010, the world’s population reached 6.9 billion persons and is expected to attain 9.3 billion in 2050. Since 1950, the population of the more developed regions increased by 0.4 billion and attained 1.2 billion persons, while the population of the less developed regions grew by 3.9 billion to attain 5.7 billion persons in 2010. The proportion of the population living in urban areas grew from 29 per cent in 1950 to 50 per cent in 2010. By the mid of this century or 2050, 69 per cent of the global population is expected to live in urban areas particularly in medium sized cities. Currently, the average annual rate of growth of the urban population in the less developed regions (2.4 per cent) is more than three times that of the more developed regions (0.7 per cent).

As a result of surging growth in the world’s population, there is need of proper access to improved drinking water sources, sanitation facilities, health, education, security, better natural environment and other amenities in urban areas. Requirement of energy resource will increase as a result of the growth in number of automobiles, and consequently, the concentration of CO₂, particulate matter and other greenhouse gases will increase in the air even at faster rates. Because of imbalances in human concentrations, socio-economic parity is another complication which would face by the world community. Therefore, the dilation of urban services and attraction of surrounding as well as far-off populations many cities will have to expand in their peripheries causing human concentrations in the form of suburbs, and inserting pressure over existing resources.

Fig. 1 Political Map Showing States and Union Territories of India, and Neighbouring Countries.
Scenario of Indian Urban Systems and their Development

In India towns are known to have existed since ages. They sprang up as citadels of power, military colonies, trading centres and places of religious importance. Some of them after rising to pinnacles of glory starting decaying with the fall of ruling dynasties, changing economies and social values and lay buried in the debris of time, while few others survived from the vagaries of time and continue to exist even now. A highly developed urban civilization that flourished in the Indus
valley came into focus by the archaeological excavations at Mohenjodaro and Harappa. Ancient Indian literature is replete with references of towns that existed in ancient times. Hastinapur, Indraprastha, Kampilya, Ahichatra, Shravasti, Ayodhya, Kashi, Vaishali, Patliputra, Kapilvastu, Ujjain, Takshila etc. are the important towns that find mention in the ancient Indian literature. The Shahjahanpur or Dilli (Delhi), Agra, Lucknow, Hyderabad, Aurangabad, Mysore, Ajmer, Bijapur, Meerut, Ghaziabad, Moradabad etc are some of the cities, due to then political and historical settings, rose to eminence during the medieval period of Indian history. The maritime cities of Calcutta, Bombay, Madras and Cochin rose to enviable positions during the period British rule. Besides a number of cantonment areas and hill resort cities came into existence such as Shimla, Nainital, Mussourie, Darjeeling, Ootty etc. There are also some cities which has no historical background. Bangalore, Pune, Chandigarh, Noida, Gurgaon etc. are some cities which developed recently and attained high eminence. Haridwar, Mathura, Ayodhya, Ajmer, Amritsar, Shirdi etc. were the cities that developed as renowned places of religious importance (Fig. 1). In the course of time some towns retained their premier positions, while some others languished into oblivion or relegated to minor positions (Census, 1991).

In India out of total population of 1210 million, 31.2 per cent is living in urban centres and 68.8 per cent living in rural areas (Provisional Census, 2011). Since independence, the absolute increase in population has been reported as more population lives in urban areas rather than the rural areas. Also the level of urbanization has increased from 27.81per cent (Census, 2001) to 31.16 per cent (Census, 2011). The proportion of rural population has declined from 72.19 per cent to 68.84 per cent. During a decadal of 2001-2011, urban population has increased by 31.8 per cent and rural population 12.1 per cent (Table 1). It is expected that, the share of urban population will increase to the extent of 40 per cent of total population by the year 2021.
There has been a sharp contrast in absolute change in total and urban population in India. At the time of independence (in 1947), there were 60 million people (15 per cent) lived in urban areas and in next 50 years the total population grown two and half times, while the urban population by nearly five times.

<table>
<thead>
<tr>
<th></th>
<th>2001</th>
<th>2011</th>
<th>Difference</th>
<th>Increase (per cent)</th>
</tr>
</thead>
<tbody>
<tr>
<td>India</td>
<td>1029 (100.0)</td>
<td>1210 (100.0)</td>
<td>181</td>
<td>17.58</td>
</tr>
<tr>
<td>Rural</td>
<td>743 (72.2)</td>
<td>833 (68.8)</td>
<td>90</td>
<td>12.11</td>
</tr>
<tr>
<td>Urban</td>
<td>286 (27.8)</td>
<td>377 (31.2)</td>
<td>91</td>
<td>31.81</td>
</tr>
</tbody>
</table>

*Source: Census of India*

Land use is an indicator reflecting how and to what extent society is responding to meet its changing needs and goals or to adapt to changing environmental conditions. Ideally, it is recommended that our geographical land area should have 33 per cent forest cover. However due to increase in demographic pressure, the area under forests and agriculture is reducing continuously; consequently, area under dwellings and industry is increasing. Over the years, such interference of anthropogenic activities has been considered as the major cause of land degradation. About 85 million hectares of agricultural land in India are reported suffering from various degrees of soil degradation processes such as erosion (63 per cent area), salinization (4 per cent), alkalinization (11 per cent), water logging (10 per cent), desertification (9 per cent), loss of organic matter, loss of nutrients, soil compactness, entry of toxic pollutants etc.

Rapid urbanization causes disorganized and unplanned growth of towns and cities. The pressure of an ever growing population becomes a burden on the limited civic amenities which are virtually collapsing. Asymmetrical growth of urban centres consumes agricultural land adjacent to these, resulting in a low agricultural
productivity. Besides taxing the groundwater resources available for an urban centre, an increase in the paved area severely reduces the groundwater recharge potential, leading to situations which may truly be potential catastrophes.

An understanding of the growth dynamics of urban agglomerations is essential for ecologically feasible developmental planning. With almost a third of India’s population already having become urban, it is necessary to acquire information on growth patterns of cities and how they impact the living environment. The current trend of spatial urban growth in almost all Indian cities has a haphazard pattern, particularly along the urban-rural fringe. The negativities associated with rapid urbanization, particularly the environmental consequences in cities and peri-urban areas, are among the most documented issues in urban environmental research (World Bank, 1997).

**STUDY AREA: Aligarh City and its Urban Fringe**

In Aligarh, which is the study area of the research work presented in the thesis, urbanization took place in the urban fringe areas around the city by converting prime farmlands for the purpose of urban activities. As a result of hasty steps of urban encroachment, there is a striking loss of good agricultural land in peripheral areas of the city. Moreover, this phenomenon immeasurably has socio-economic and environmental impacts in core as well as in surrounding areas of Aligarh city. The research work in the present thesis constitutes a comprehensive effort of data collection, analysis and discussion on diverse components or aspects of urban development and its impact on surrounding rural landscapes (Fig. 3).
Fig. 3 Map Showing Aligarh City and Development Blocks, Jawan, Lodha and Dhanipur in Koil Tehsil of Aligarh District.
Development of Aligarh city has been done in a very helter-skelter way that, the basic urban services did not increase with the increase in population and area of the city. During last four decades, the population of Aligarh has increased four times and spread out over much larger area. In the course of research, first of all, interaction between man and the environment was observed and considered the man’s role as a modifier of environmental variables and as a passive recipient of the effects of urban encroachment. Secondly, parameters of urban encroachment were considered to understand the dynamics of urban encroachment. As a result of encroachment innumerable complications pertaining to physical, social and economic, gushes in with the urban and rural environs were examined and discussed under various headings. It has also raised different land use related problems: urban vs rural; commercial vs residential; industrial vs institutional etc. as have emerged on the outskirts of the city. The work presented in the thesis encompasses to cover various issues of urban-rural fringe areas and formulate solutions through a diagnostic approach. In the last thesis has been appended with conclusion and some pertinent suggestions.

OBJECTIVES OF THE STUDY

The foremost aim of present research work is to highlight the problems of urban fringe of Aligarh city and suggests some measures for its development in a reasonable and suitable manner. The study was carried out based on the following main objectives.

1. To present a detailed account of geographical setting of Aligarh city and to explain a relationship between socio-cultural settings of the city and with its physical environment, and also present a historical panorama of evolution of urban settlement.
2. Acquainting a general agreement of relationship of urbanization with urban encroachment, and to explain a number of issues associated with environment and development.

3. Explaining the concept and meaning of urban-rural fringe and rural-urban continuum in the light of certain empirical models, and perception of places in the rural landscapes.

4. To present a review of approaches methods and models taking into consideration for delimitation of urban fringe areas.

5. To enumerate the processes and parameters of urban growth in Aligarh city, and to examine the loss and abandonment of agricultural lands as a result of urban encroachment.

6. To give an illustrative account of environmental impacts and ecological changes as a consequence of urban encroachment in Aligarh city.

7. To present an analysis of the impacts of urban encroachment on socio-economic frame and land use characteristics in selected villages and blocks of urban fringe.

8. To suggest a diagnostic approach for the rational planning and governance, and framing of sectorwise zonation of the city and its urban fringe areas.

9. To illustrate the discussions with the help of satellite imageries, smart art graphics, GIS maps, and pictures taken during the field surveys.
Lastly, supporting the study with suggestions for a feasible sustainable resource management, preservation of local agriculture, and providing sustainable livelihood and growth of city on urban parameters.

**HYPOTHESES**

1. The present study has been based upon the following hypotheses.

2. Encroachment of agricultural lands in the urban fringe is a consequential phenomenon of urban growth and expansion of Aligarh city.

3. Demographic, economic and spatial indicators together have an impact of urban development on the villages in the fringe of Aligarh city.

4. Urban expansion in the fringe areas has an impact on the physical environment, wetland ecosystems and climate.

5. Urban encroachment has clear impacts on the agricultural system and cropping pattern of the fringe areas.

6. Planning for development of agro-processing sector could be a fruitful approach for providing livelihood to the rural population in the fringe areas.

7. Sectorwise zonal planning in Aligarh and its surrounding fringe areas could be a better way of sustainable development.
DATABASE AND METHODOLOGY

Research Proposal

The research work presented in the thesis is an outcome of qualitative analysis that involved the application of statistical methods and interpretations of data. Statistical information used in this study was obtained from records of various government departments, organizations, national and international research agencies. One of the best methods has been an interview-based interaction with farmers and non-farmers who reside in villages of urban fringe areas of Aligarh city. The study has also been nourished by the primary surveys on actual sites in selected villages to know the problems of the farmers by preparing village profiles, which directly helped in collecting the required data and estimates. On the basis of data collected and primary information obtained, the actual plan of research was framed and presented in the form of thesis.

A detailed analysis of policy reviews of various public documents viz. master plan reports, statistical diaries, economic abstracts, district census handbooks, and village and town directories etc. were consulted in order to prepare a complete plan for the present and future scenario of the city development. In addition, a panoramic presentation has been possible with the use of satellite images available with the courtesy of Google Earth software programme. This has helped me in interpreting a number of aerial photographs at different locations in urban fringe of Aligarh city.

Data Collection and Analysis

Urban area has been defined as an area marked with high population density and a dominance of non-agricultural land. Between the well recognized urban land use and the area devoted to agriculture, there exists a ‘zone of transition’ in landuse, social and demographic characteristics, lying in between the:

- a) continuously built-up areas and suburban areas of central city, and
- b) rural hinterland, characterized by almost a complete absence of non-farm dwellings, occupations and land use (Pryor, 1968).
Urban development in Aligarh city has been examined on the basis of eight parameters that have led encroachment of agricultural lands for urban uses. These parameters are:

1. Spatial structure and character: city morphology
2. Rural-urban migration
3. Development of residential houses
4. Increase in transportation facilities
5. Industrial establishments
6. Commercial and market development
7. Government offices
8. Community services:
   (i) Educational
   (ii) Health and sanitation
   (iii) Other services

Ability to assess, measure, and monitor urban sprawl depends upon the availability of relevant, accurate and reliable data. Following publications/records of various government departments were cogitated and consulted to collect data, and information needed for this research work.

5. District National Informatics Centre (NIC), Aligarh
8. Pollution Control Board, Aligarh Centre

**Indicators of Urban Encroachment**

Urban encroachment has been described as an area within the standard metropolitan area which is outside the urbanized area (Queen and Carpenter, 1958). Kurtz and Eicher (1958) in their study have described urban fringe based on five criterions:

1. Location
2. Demographic characteristics - population, growth, density, sex ratio and literacy.
3. Landuse characteristics - agricultural, non-agricultural landuses.
4. Occupational structure - agricultural, non-agricultural workers.
5. Governmental structure

For carrying out the present research work indicators or variables belonging to three different categories were taken into consideration to describe the developmental process in urban fringe areas.

**A. Demographic Indicators**

b. Density of population - number of persons per sq. km.

\[
\text{Density} = \frac{\text{Total population}}{\text{Total area in sq.km.}}
\]
c. Sex ratio - calculated as number of females per thousand males.

\[
\text{Sex ratio} = \frac{\text{Total female population}}{\text{Total male population}} \times 1000
\]
d. Literacy - calculated as percentage of literates and non-literates.
B. Economic Indicators

Ratio of agricultural and non-agricultural workers- considered as percentage of population engaged in farming and non-farming activities.

C. Spatial Indicators

a. Net sown area
b. Cultivable waste lands
c. Fallow lands
d. Barren lands
e. Area under forests
f. Pasture lands
g. Orchards
h. Ratio of agricultural and non-agricultural areas

Analysis of demographic and spatial indicators has an important role in understanding the sustainability and governance issues in urban fringe areas. In three development blocks, namely, Jawan, Lodha and Dhanipur forming the urban fringe of Aligarh city, these are the chief indicators considered in enumerating the urban impact on rural landscape.

Case Study Approach

This research work has involved a robust and in-depth study for which case study approach was applied for analyzing the urban encroachment. The case study incorporates that, how many people are involved in farming and non-farming activities; number of literates and illiterates; number of peripheral villages and number of far-lying villages; industrial and institutional areas; commercial and residential areas etc. A case study approach based on the information obtained through primary sampling provides opportunity of in-depth discussion with citizens living on margins and those on frontline of the problems.

Therefore in addition to secondary statistical data, a socioeconomic survey was conducted for collection of primary information during 2009-10. This was done
through questionnaire based interview of farmers in 40 villages located around Aligarh city. Relevant information was also acquired through personal observations on actual sites of the problem.

The urban fringe of Aligarh city lies amidst three development blocks, namely, Jawan, Lodha and Dhanipur consisting a total of 347 villages covering an area of 682.4 sq. km. On the basis of distance decay consideration, the urban fringe area around Aligarh city has been divided into three subsequent zonal rings (Table 2).

Table 2  Zonal divisions of Urban Fringe, their Distances and Selected Villages.

<table>
<thead>
<tr>
<th>Name of zonal ring</th>
<th>Subsequent distance (in km.)</th>
<th>Number of selected villages</th>
</tr>
</thead>
<tbody>
<tr>
<td>Inner fringe</td>
<td>Between 6 - 8</td>
<td>20</td>
</tr>
<tr>
<td>Middle Fringe</td>
<td>Between 8 - 10</td>
<td>12</td>
</tr>
<tr>
<td>Outer fringe</td>
<td>Between 10 - 12</td>
<td>8</td>
</tr>
</tbody>
</table>

The prime objective of the present study is to assess the impact of factors of urban encroachment on agricultural lands and their environmental implications with the selected research paradigm, which can only be possible with discussion-based interviews and observations within the villages.

A survey of urban wetlands and other water bodies in the fringe villages was also conducted during 2009-10. Various issues with regard to loss of wetlands were investigated with the help of observations and discussions with local residents. During the survey at least 42 wetlands were discovered and a number of factors were investigated with a view of different intensities, which are responsible for the loss of biodiversity and aquatic ecosystem. Probable causes for the loss of wetlands can be considered on following three sets of factors:

1. **Socio-economic causes of wetland’s loss:** Population growth, in-migration, poverty/ marginalization, cultural changes and overall human pressure.
2. **Proximate causes of wetland’s loss**: Water pollution, eutrophication, ecosystem changes, biodiversity loss and overall environmental changes.

3. **Political and local Causes**: Policy failures, land conversions, lack of control over resources, weak legislation and unsustainable development.

**Cartographic Presentation**

For cartographic presentations in the thesis, the required maps were obtained from different sources and processed accordingly. Base maps pertaining to geographical setting of Aligarh were accessed from the National Informatics Centre, Aligarh. The village boundaries, development block maps and urban land use maps were obtained from District Census Handbook and Uttar Pradesh Statistical Atlas Vol-I. Municipal maps were used for determining the city boundary, wards and urban morphology of Aligarh city. Master plan map of Aligarh Development Authority was used to lay out the metropolitan area of city, highways, by-pass ring road and sectorwise zone map.

Use of remote sensing and GIS techniques were made possible by the affability of Google Earth software programme through which satellite images of different locations were obtained. These images were helpful to prepare maps by overlaying techniques that provide city sprawl map which was drawn on Arc view 3.1 software facilitated from GIS Lab. of the Department of Geography. Also the municipal maps of 1951, 1976, 2001 and current satellite images were overlaid to prepare map of time series changes in the municipal area of Aligarh city.

Simple percentages and average values from data sets were obtained to display with the help of various cartographic techniques and statistical diagrams. These include pie-charts, wheel graphs, bar diagram, percentage bar graphs and line graphs. Moreover, the presentation of research work has been comprehended with the help of smart art graphical illustrations of Microsoft programmes facilitated from the
Computer Cartographic Lab. of the Department of Geography. The presentation of work has also been illustrated with panoramic pictures taken during the surveys of the study area.

References


Sixth Sense, 2005. Definitions from Oldham Sixth Forum College.
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