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Urban Ecology of Lucknow City: Synergies and Conflicts with Urbanisation, Industrial Expansion and Ecological Degradation

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ABSTRACT:
Urban ecology is the study of the distribution of living organism and their relationship with the surrounding urban environment. Urban ecology talks about the environmental, social and economic dimensions of sustainable development as well as ecological relationship between them. Lucknow city is one of the fastest growing cities in India. At present Lucknow metropolis has sprawled towards its peripheral areas. Factors like urbanization, rural to urban migration, economic opportunities, employment, education and city is emerging as a major hub of commerce these all are playing important role in city's population explosion during this time. Uncontrolled urbanisation in Lucknow has led to several issues like declining water quality, poor sanitation, traffic congestion, air and water pollution, growth of urban slums and changes in land use pattern.
The purpose of this paper is to evaluate the trends of urban growth over the years and the role of industrial expansion in economic development and ecological degradation, while air and water quality related data quantifies the degree of degradation over the years in Lucknow city. Various activities associated with urbanisation which are migration, industrial expansion, and transport processes has led to deterioration of the environment.
This paper examines the positive changes which take place due to industrial growth and urban expansion and to analyse the negative impacts of these processes on the environment of Lucknow metropolis. Negative impacts of urbanisation can be mitigate by proactive measures and innovative practices such as education and awareness regarding sustainable practices among the citizens. The finding of this research provides critical insights on balancing urban development with environmental conservation and offering policy recommendations for a more sustainable urban growth.

Key words: Urban ecology, Urbanization, Industrial expansion, ecological degradation, atmospheric pollution and urban agglomeration.

INTRODUCTION

Urban ecology includes the social, environmental and economic dimension of sustainable development as well as the ecological relationship between them (Verma et al. 2020). Urbanisation is the process through which people migrate from agriculture based settlement to larger industrial based town where main activities are related to trade and manufacturing (Thompson, 1935). Urban growth refers to an increase in percentage people living in cities, suburban, settlement and towns. Industrialisation is the

process of social and economic changes that transform the agricultural society into industrial one. Ecological degradation refers to degrading of natural environment by human activities or by natural processes. Ecological degradation mainly seen in the metropolitan cities like Kolkata, Delhi, Mumbai etc. is also emerging as a challenging issue for Lucknow.

Rapid urban growth and industrial process are the two main factors responsible for the deterioration of urban ecology and environmental degradation. Lucknow city is one of the fastest and emerging city of India recently Lucknow city have grown both area wise and demographically. The growth of city in terms of area and population has put tremendous pressure on it's natural and manmade resources. With an increase in population there is also an increase in the number of vehicles and upsurge in transport system which has result into degradation of air quality in the city. Water quality and noise pollution is also one of the emerging issues in the Lucknow city.

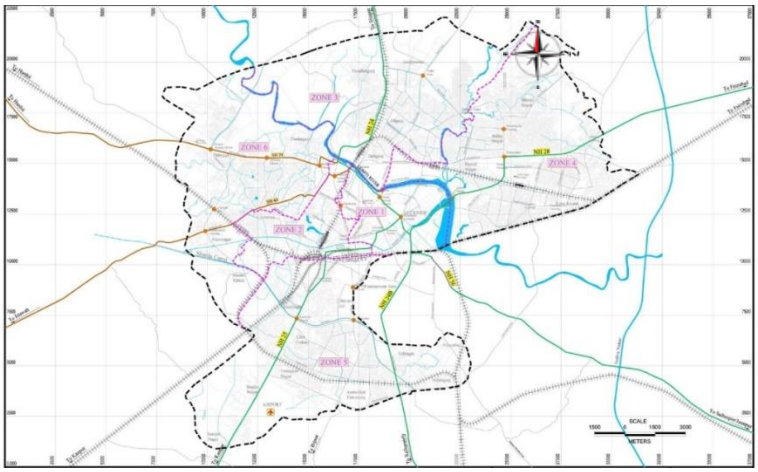
Lucknow being the administrative city and the facilities like better education, employment, healthcare, basic facilities, better transport connectivity, better standard of living are the reason people are attracting towards Lucknow city from surrounding rural and urban areas. With this migration stream there is rapid increase in population and these migrant peoples give birth to development of slums.

STUDY AREA

Lucknow is the capital city of Uttar Pradesh and geographically located between 26' 30' N and 27' 10' latitude and 80' 30' E and 81' 31'E longitude. Lucknow city is known for it's rich historical and cultural heritage. Lucknow is second largest city in Northern India and eleventh largest metropolitan cities in India It is covers an area of 310 sq. km. The city lies at an average altitude of 110 meters above the mean sea level. As per census 2011, the population of Lucknow urban is 2817105. The Lucknow Municipal Corporation is divided into 6 Zones and 110 wards. The city has grown around both the bank of Gomti river over an area of 350 sq.km. It stand at an elevation of approximately 123 meters (404ft) above sea level. Lucknow city experiences Tropical Climate with very cold and dry winter from December to mid February and dry hot summer from April to mid June and average annual rainfall of 1000mm.

The city is surrounded on the northern side by Barabanki and western side by Unnao district. Lucknow is well linked through national highways with various areas within and outside Uttar Pradesh. The city is well connected with railways also.

Fig 1: Base Map of Lucknow



Source: Lucknow Municipal Corporation

OBJECTIVES OF THE STUDY

The main objective of the work is to study the spatial growth of the city along with the urban and industrial growth and it's impact upon the environment. The study has been done keeping in mind the following objectives:

- To explain the spatial growth of the city
- To study migration pattern in this urban landscape
- To study about industrial growth in the city
- To identify prominent type of environmental degradation caused by the process of urban growth

DATA BASE AND METHODOLOGY

For this research the population related data are based on Census of India. Other informations have been collected from Uttar Pradesh Pollution Control Board (UPPCB), Lucknow Municipal Corporation (LMC), some other information has been collected from internet websites of Lucknow; industries related data collected from District Industries Centre and population projection data is taken from Master Plan 2031 report. Graphs and charts have been used to show the visual representation of data.

DEVELOPMENT OF URBAN ECOSYSTEM

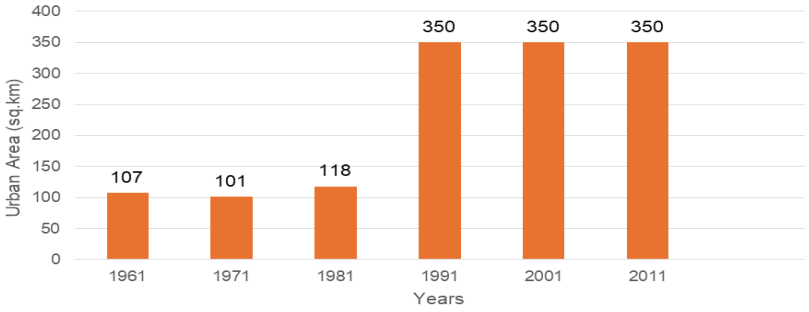
The trend of development of Lucknow city after 1961 and till date is given below:

Spatial growth

Lucknow is a metropolitan city with 28 lakh population spread over an area of 350 sq. km. In the year 1961 the total area under LMC was only 107 sq. km which increased three folds in the year 1991. Since 1987 no amendment in the boundary took place. This increased in spatial growth indicates that city is growing outward and this growth are due to population pressure, migration and increased demand for housing and infrastructure. The driving force for the growth of the city are administrative city, educational hub, capital city which has been continuously attracting people from nearby rural and adjacent urban areas. Spatial growth highlights the changes in land use where agriculture or vacant land is converted into residential areas and commercial areas. Town and Country planning Department of Uttar Pradesh added 197 village for Master Plan 2031 out of which 37 villages fall under Lucknow Development Authority with total area of 14,126 ha. After this incorporation total developed area in Lucknow comes to approx. 980 sq. km.

More residential spaces are needed because of growing population which has resulted into creations of new colonies around the city. Recently three township named IT city, wellness city on Sultanpur road and Education city will be located on Mohan road. With the budget of 4,300 crore LDA is planning to develop an IT city on 1582 acre between Sultanpur and Kishan Path road.

Fig 2: Expansion of Urban Area under Lucknow city from 1961 to 2011



Source: Lucknow Municipal Corporation

Migration of Population

Migration is one of the important factors that determines the level of urbanisation. Migration in a city tells about the level of development, employment opportunities, living standard, level of industrial growth and also the level of slum growth around the cities. It has been generally observed that migration tend to flow towards the area of greater economic opportunities and area with abundant development activities (Vaidyanath, 1967 and Gopal and Krishnan, 1975)

Migration into city accounts for 37% increase in population over the last decade i.e. from 2001 to 2011. According to data published by "Study on Counter Magnet Areas to Delhi & NCR by National Capital Region Planning Board" total in-migrants in Lucknow city for the decade 1991-2001 have been 2,36,788 in numbers and out migration was 75,486.

During Lockdown which took place due to Covid Lucknow experiences reverse migration. People who migrated to other metro cities started migrating towards there hometown due to covid restriction.

Lucknow city is the administrative heqdquarter of Lucknow district and Lucknow division. Migration of population in Lucknow city is mainly related to economic factors such as employment, better business related opportunities, better infrastructure, and urban amenities and social factors such as marriage, women security and less crime rates and better education facilities these are the factors which attract people from surrounding rural areas towards Lucknow city. The high level of skilled, semi-skilled and educated people are migrating from nearby rural areas of Hardoi, Sitapur, Barabanki and Raibareilly to Lucknow city in search of better opportunities.

Population growth

The population of Lucknow city in 1961 was 6,15,523 person and reached upto 28,1705 in 2011. The city population registered a decadal growth rate of 70.79% between 1981 and 1991 the main reason for this rapid growth was because of change in municipal boundary area before 1981 the total municipal boundary area was 118 sq.km but after 1991 it increased to 350 sq. km. The trends of population growth during the last two decades shows declining trends because of higher percentage of people have migrated towards metropolitan cities like Delhi and Mumbai for better living standards and better employment opportunites especially among youths. The population expansion in Lucknow city at present is driven by factors such as urbanisation, migration from rural areas and economic development.

This increase in population has led to various development challenges such as increase in ecological degradation of the city. The migration of people increased the demand for housing, leading to the development of real estate sectors.

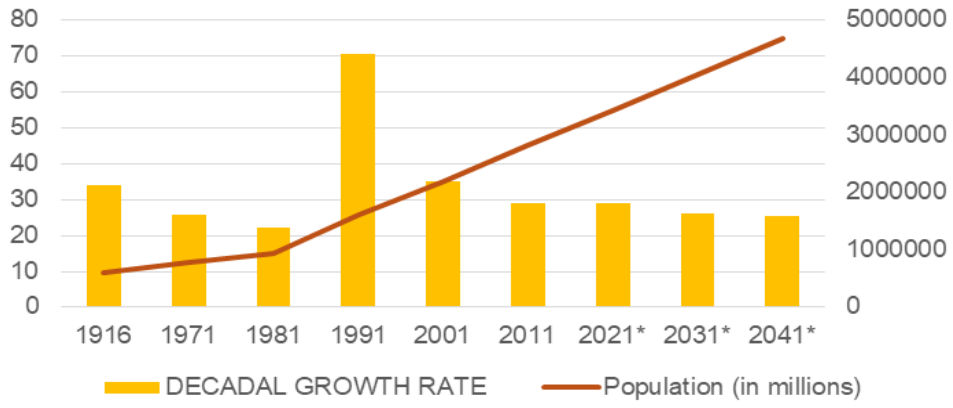
Population projection for Lucknow city: According to city development plans 2021, the projected average growth rate for the year 2021, 2031 and 2041 is 29.07%, 26.23% and 25.63%. There are various methods used to predict future population for Lucknow city such as Airthmetic progression, incremental method and geometric progression. The average population projection for the year 2021 is 36,36,066. The average population projection for the year 2031 and 2041 is 45,89,826 and 57,65,983. Population projection data given below shows the continuing urbanisation trend and positive population growth rate. This increase in population may pose threat to environmental and infrastructural management strategies.

Table 1: Population Projection for Lucknow city

Years	Census Population	Airthmetic Progression	Incremental Increase	Geometric Progression	Average	Population Growth Rate
1961	6,15,523	-	-	-	-	33.96%
1971	7,74,644	-	-	-	-	25.85%
1981	9,47,990	-	-	-	-	22.38%
1991	16,19,116	-	-	-	-	70.79%
2001	21,85,927	-	-	-	-	35.01%
2011	28,17,105	-	-	-	-	28.87%
2021	-	34,40,143	34,81,375	39,86,682	36,36,066	29.07%
2031	-	40,63,182	40,64,465	56,41,831	45,86,826	26.23%
2041	-	46,86,220	46,27,581	79,84,148	57,65,983	25.63%

Source: City Development Plans, Lucknow Municipal Corporation, 2021

Fig3: Decadal Growth rate and Population Trends (1961-2041).



*Source : Census of India and Lucknow Development Plans *Projected Data*

Industrial Growth

Lucknow has always been a centre of administration and commercial activites. There are various industrial estates in Lucknow district such as Talkatora, Chinhat, Sitapur Road, Kursi Road, Amousi and Sarojini Nagar. Lucknow has been famous for small scale industries. Industries related to agro based, cotton textile, woollen textile, jute based readymade garments, paper products and leather products are famous in Lucknow district. There are few area in the out skirts of the city such as Amousi, Sarojni Nagar at Kanpur Road where industrial development has taken place. Aish Bagh and Deva Marg is also

emerging industrial area. The development of Lucknow – Kanpur industrial Corridor and special economic zones like IT City is expected to foster future industrial growth and attracting investment in Industrial sectors.

Industrial growth has led to creation of many job opportunities in Lucknow city. In North India Lucknow is emerging as a key industrial and logistic hub and this has the potential to create more job in the upcoming years. Industrial sector also poses many challenges like creation of slums, air and noise pollution problem in Industrial region like Amausi and Talkatora.

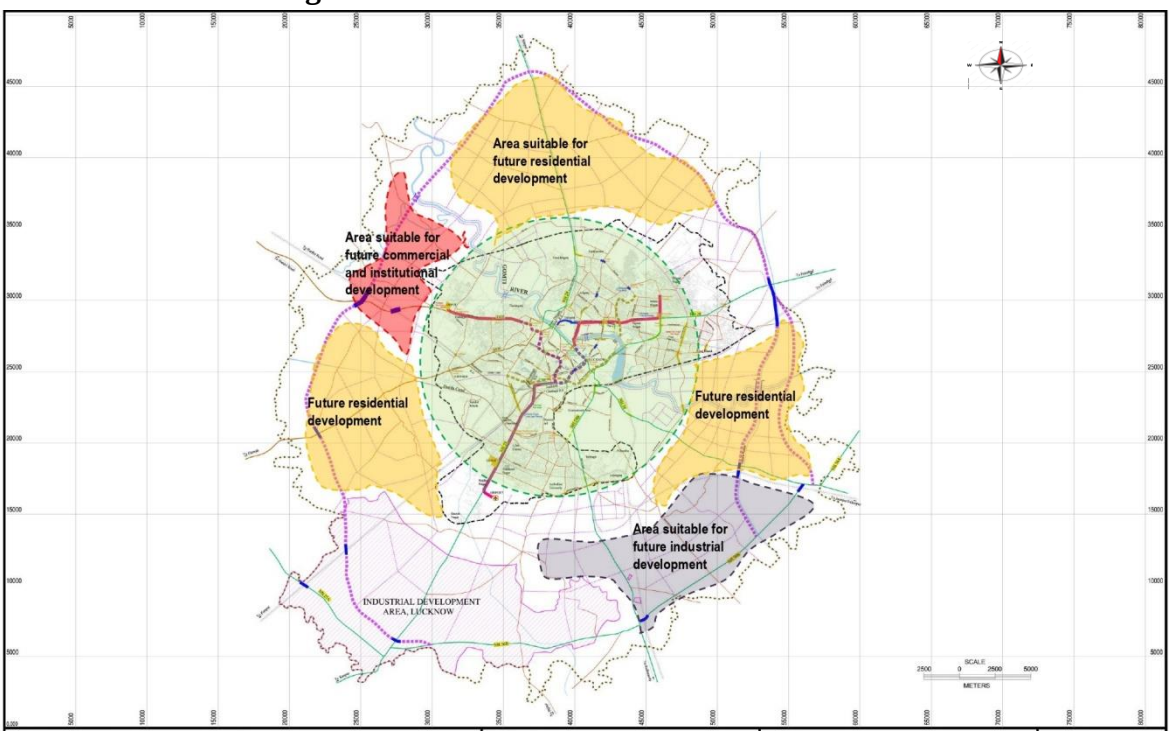
We have taken data of Industrial growth data of Lucknow district. According to District Industries Centre, Lucknow there are total 8836 registered industrial unit in Lukcnow district. Below given data shows that Chinhat acquires more than 600 acre of land in industrial production and total 103 units are currently running in production activites.

Table2: Name of Industrial Esates In Lucknow

Name of Industrial Estates	Land Acqiured (in acre)	No. of units in production
Talkatora	48.66	104
Chinhat	671.12	103
Sarojni Nagar	235.09	93
Amousi	236.90	63

Source: District Industries Centre, Lucknow

Fig 4 : Future Growth Direction In Lucknow



Source: Lucknow Municipal Corporation

Ecological consequences of the Expansion of Lucknow City's Urban-Industrial Ecosystem

Ecological degradation is the major problem of metropolitan cities like Delhi, Mumbai and Chennai etc, is also emerging issues for Lucknow city. Ecological degradation refers to deterioration of the environment through depletion of resources like quality of air, water and soil and the damage humans cause to the environment.

Changes in Land Use Pattern

Land is the major factor of production that supports all living organisms, human existence and ensure surviving. Land serves essential human activities such as food production, shelter, infrastructure development and extraction of natural resources (Gessess, 2018). Monitoring and modelling of urbanisation in metropolitan cities can be done with modern tools and techniques (Sapena and Ruiz, 2015). Lucknow experiences significant changes in land cover and land pattern.

Table 3: Land Use Distribution in Lucknow City 2010-11

S.NO.	Land Use Category	Area(ha) 2010-11	% in total
1.	Residential	10278.68	41.99
2.	Commercial	623.14	2.55
3.	Institutional	888.76	3.63
4.	Industrial	940.57	3.84
5.	Public Services	2137.26	8.72
6.	Transportation	7842.74	32.04
7.	Recreational Areas	997.71	4.08

Source: Lucknow Master Plan, 2031

Table 4: Proposed Land Use for Lucknow Urban Agglomeration, 2021

S.No.	Land Use Category	Area(ha)	%in total
1.	Residential	18480	45
2.	Commercial	1450	3.5
3.	Institutional	520	1.3
4.	Industrial	1665	4.1
5.	Public Services	2500	6.1
6.	Transportation	6405	15.5
7.	Recreational Areas	10055	24.5

Source: Lucknow Master Plan, 2031

Residential areas showed drastic increase from 4486 ha in 1987 to 10,278 hectare in 2010-11. In context to proposed data of 2021 the residential areas are expected to hold 18480 hectare. The reason behind increase in residential pattern is mainly due to increase in migration, rapid population growth and building of new colonies by LDC/LMC.

Commercial space grew significantly from 623.14 ha in 2010-11 to 1450 ha in 2021 according to proposed data of 2021. Hazraganj, Aminabad and Chowk are the some important commercial area of Lucknow

Industrial Area witnessed growth from 596 ha (1987) to 940 ha (2010-11). According proposed industrial land use it is expected to hold 1665 ha in 2021. Major industrial development has been taken place in Amausi, Sarojini Nagar, Aish Bagh and Deva Marg.
The land use pattern shows a strong emphasis on expansion of residential area, enhancing public spaces and balancing commercial and industrial growth aiming to support Lucknow's development.

Air Pollution

Air pollution is the major problem of Lucknow. Vehicular emission have been identified as the primary contributors to the alarming rise in air pollution. While additional factors like such as residential garbage burning and ongoing construction projects also play role in increasing the city's Air Quality Index (AQI). According to world Air Quality Report (IQ Air, 2019), Lucknow has placed on 11 rank among the most 15 polluted cities of the world. Total Nine air quality monitoring system located in different area of Lucknow city out of which four in Residential (Aliganj, Vikas Nagar, Indira Nagar and Gomti Nagar) five in Commercial (Hussainganj, Charbagh, Alambagh and Aminabad, Chowk) and one industrial area (Amausi).
For the assessment of air quality in Lucknow city, the air quality data published by CSIR-IITR for the year 2006, 2011, 2016 and 2021. Both the pre monsoon and post monsoon data of air quality has been analysed to understand the variations in five year interval. In the year 2006 highest concentration of RSPM is recorded in Charbagh (206.5 ug/m^3). Charbagh consistently recorded high concentration of RSPM, SO^2 and NOX in both pre-monsoon and post-monsoon data across more year because Charbagh is a major transport hub and also a commercial hub and high number of vehicular traffic contribute significantly to the emission of gases.
According to National Ambient Air Quality Standard (NAAQS) report the permissible limt for RSPM in residential area is 60 µg/m3. But in residential, commercial as well as in Industrial area RSPM is above permissible limit. RSPM is showing increasing trends in areas like Aliganj(residential), Charbagh, Alambagh (commercial) and Amausi (industrial).
Charbagh consistently showing high RSPM level from 2006 to 2021, with a peak in 2016 at 230.9 ug/m^3. Alambagh showing significant increase in RSPM level in the year 2011 (250.4 ug/m^3) after that slight decline in subsequent years.
Area like Charbagh and Alambagh are affected by high traffic volume which contribute significantly to RSPM and NOX levels. Amausi being a industrial area show high level of RSPM and NOX level which can be attributed to industrial activites.
SO^2 level shows a decreasing trend from 2006 to 2021 across most years which shows that. This reduction is due to adaptation of CNG in public transportation and vehicles, introduction of BS6 (Bharat Stage) norms has led to reduction in sulphur emission and many industries are using low sulphur alternative like CNG and LPG instead of high sulphur fuels like coal and petroleum in industrial activites.
NOX level is showing inconsistency trends over the years with highest trends in the areas like Indira Nagar and Amausi indicating a link to traffic and industrial emission. NOX level is reaching 52.2 ug/m^3 in Indira Nagar and 48.8 ug/m^3 in Charbagh.
Residential area like Indira Nagar showing increasing trends in emission level this is due to construction activites and vehicular pollution.

The global Covid 19 Pandemic led to widespread lockdowns and restricted movement in 2020 and 2021. This resulted into significant reduction in vehicular traffic, industrial activities and construction activities which resulted into low emission of RSPM, SO^2 and NOX level which can be seen in below given table.

Table 5 : Concentration (ug/m^3) of RSPM, SO^2 and NOX during Pre-Monsoon

AREA	LOCATION	2006			2011			2016			2021		
		RSPM	SO2	NOX	RSPM	SO2	NOX	RSPM	SO2	NOX	RSPM	SO2	NOX
Residential	Aliganj	161.1	21.3	32.8	136.8	12.5	26.1	193.2	12.5	34.4	111.9	ND	33.4
	Vikasnagar	169.9	20.9	27.4	158.9	12.5	27	186.1	12.1	37.6	117.3	ND	ND
	Indira Nagar	199.9	25.7	36.6	244.8	22.4	30.1	175.4	13.1	52.2	124.5	ND	ND
	Gomti Nagar	141.9	18	28.5	186.4	22.4	24.9	204.6	10.4	33.7	128.7	ND	ND
Commercial	Charbagh	206.5	32.4	46	214.1	14.5	34.8	230.9	14.4	48.8	143.8	18.5	32.8
	Alambagh	169.5	28.8	38.4	250.4	18.6	35.1	209.4	14.6	39.5	133.9	10.1	31.8
	Aminabad	190.4	21	27	183.9	17.4	29.6	203.3	12	37.1	109.8	19.8	28.7
Industrial	Amausi	141.4	17	20	163	14.3	36.9	238.3	11.9	45.3	152.5	14.6	32.4

Source: Assessment of Ambient Air Quality of Lucknow City, CSIR-IITR

Table 6: Concentration (ug/m^3) of RSPM, $S0^2$ and NOX during Post- Monsoon

	LOCATION	2006			2011			2016			2021		
		RSPM	SO2	NOX	RSPM	SO2	NOX	RSPM	SO2	NOX	RSPM	SO2	NOX
Residential	Aliganj	130	23.4	31	170	26.1	39.4	162.8	17.8	52.8	131.6	13.7	35.4
	Vikas Nagar	108	21.7	29.2	166.3	22.4	37.8	175	16.2	47.9	140.9	11.6	38
	Indira Nagar	140	30	37.1	173.1	29.7	48.5	216.8	21.4	70.4	123.6	13.4	28.4
	Gomti Nagar	144	25	32.2	159.2	26.5	38.9	168.8	17.5	55.7	130.3	12.5	35.1
Commercial	Charbagh	168	37.1	46.2	227.4	33.5	76.9	207.4	21.3	67.3	159.4	16.1	41.9
	Alambagh	157	34.7	54.5	172.5	32.6	63.2	192.3	18.3	647	163.3	15	43.7
	Aminabad	143	30.6	46.6	171.1	27.6	46.4	179.7	17.4	54.5	195.7	15.1	41.9
Industrial	Amausi	122	31.3	40.8	145	25.7	48.8	212.9	17.2	55.6	193.5	16.1	34.2

Source: Assessment of Ambient Air Quality of Lucknow city, CSIR-IITR

Vehicular Concentration

Lucknow is not famous for it's industrial units. The rapid increase in the number of vehicles is the other major source of air pollution in Lucknow city. There were 8,24,,003 vehicles in the year 2006 which got 29,79,734 during 2024 according to the data published by Environment Monitoring Division CSIR-IITR, Lucknow. The report highlighted the concerning 5.8% increase in the the city from the last 2022-2023 period. Traffic congestion intensifies air pollution levels because idling vehicles emit fumes especially in densely populated region.

From 2006 to 2011, there was a 46.81% increase in registered vehicles, while during 2011 to 2016 there was a 41.31% increase in registered vehicles and during 2016 to 2021 there was a 55.02% increased in registered vehicles.

Table 7: Total Number of Registered Vehicles

Years	Total Number of Registered Vehicles
2006	8,24,003
2011	12,09,745
2016	17,09,662

2021	26,50,286

Source: Assessment of Ambient Air Quality of Lucknow City, CSIR – IITR, 2011 – 2021

Noise Pollution

Urban growth significantly impact noise pollution. Increasing urban growth leads to high vehicular density, traffic congestion leads to elevated noise levels. Urbanisation leads to numerous construction activites leads to noise from heavy machinery and construction related activites. Prolonged exposure to high noise level can lead to hearing impairment and various health issue such as anxiety and bad mental health.

The area like Vikas Nagar and Gomti Nagar in residential zone show a clear trend of increasing noise level due to urbanisation and construction activities. Aminabad, a commercial area shows a consistent rise in noise level after 2011, possibly due to commercial activities and increased market activities. Amausi, a industrial region shows increase in noise level from 2011 to 2016 indicates a rise in industrial activity and high machinery uses .

The increasing population pressure in Lucknow city has led to rise in housing demand and vehicles population, both of which significantly contribute in increasing noise pollution levels.

Table8: Noise Level (Db)

Area	Location	Noise level Db (A)			
		2006	2011	2016	2021
Residential	Aliganj	69.9	54.7	64.2	62.8
	Vikas Nagar	72.7	57.4	63.9	65.2
	Indira Nagar	75.5	59.1	67.1	61.2
	Gomti Nagar	66.8	56.7	64.8	63.8
Commercial	Charbagh	74.4	65	72.1	66.7
	Alambagh	75.8	63.5	70.1	59.7
	Aminabad	66.8	60.7	61.5	62.3
Industrial	Amausi	71.9	63	69.3	66.8

Source: Assessment of Ambient Air Quality of Lucknow City

Growth of slums

Slum is defined as those residential area which are unfit for human habitation. As per UN Habitat a slum is defined as those area where there is lack of durable housing, lack of acess to safe water and inadequate sanitation facility. Being the capital city Lucknow attracts migrants from nearby rural and urban areas. Migrants who come mostly work in informal sector and contribute to the growth of slums. As per Rajiv Awas Yojana (RAY) report Lucknow city has total 609 slums out of which 502 are notified. As per census 2011 26% of total population lives in slum areas. Ibrahimpur area of Lucknow city has maximum number of slum population of 31,800. More than 60% slum are located in the core city.Chinhat and Sarojini Nagar are recognised as important industrial region. Many workers employed in the industries around these areas works in informal sectors and they prefer to live nearby. Residential areas like Indira Nagar and Aliganj home to both established neighborhoods and underdeveloped slum areas. The lack of affordable housing options drive this population into slums. Chinhat ward has total slum population of 28,700 and has total 17 slums. Sarojini Nagar has a total slum population of 24,900 and has total 11 slums.

Discussion

The above discussion reveals that various activities associated with urbanisation which is industrial growth, migration, changes in land use pattern and ecological degradation. In Lucknow city there is unchecked growth of vehicles, slums and city sewerage is also degrading the environment.

In the year 1951, total area of LMC was only 48 sq.km and in the span of 40 year there is an increase of 302 sq.km. The major driving force for the expansion of the city was capital city, educational hub, trade and commerce activities and administrative hub which continuously attracted migrants from nearby rural and urban areas.

According to Projected data taken from city development plans shows that growth rate is positive and the population in numbers is also increasing. This increase is due to the reason that the development of residential and commercial sector in Lucknow city provide the major facilities to the urban dwellers.

The in migration is more in number than out migration which shows that people are attracting from nearby rural and urban areas. People are mainly attracted from adjoining district of Hardoi, Barabanki, Raiebareilly and Sitapur district in search of better employment, better living standard while the people of Lucknow are migrating towards other metropolitan cities like Delhi, Mumbai and Bangalore.

Residential and commercial areas are expanding rapidly in Lucknow city which shows increasing migration towards cities from surrounding states and peripheral areas. Increase in commercial area shows that economic activities are flourishing.

On the one hand Urban and industrial growth leads to economic growth, improved infrastructure and create employment oppotunities but on the other hands it also leads to many challenges like increase in number of slums, rise in vehicular concentration, air and water pollution.

There are various problem related to ecological degradation due to expansion of the city. Residents of Lucknow city are facing the problem of pollution and heavy traffic congestion at the Amausi (Industrial Area) Charbagh, Aminabad and Alambagh (Commercial Area) and Indira Nagar (Residential Area).

High Noise level are faced in the area like Vikas Nagar, Gomti Nagar, Aminabad and Amausi. Noise level is showing increasing trends in commercial and residential areas due to traffic and construction activities.

Slum can be mainly seen around industrial area like Sarojini Nagar and Chinhat. Workers employed in these industries mainly work in informal sectors they always prefer to live around industries to save rent and commuting cost which ultimately promotes the growth of slums.

Besides, the urbanisation process of Lucknow city is taking place at a rapid rate with an unplanned and unchecked way. The city of Lucknow extended and sprawling towards the periphery of Lucknow.

Suggestions

Integrating sustainable urban planning into development projects. Improving housing policies to accommodate the growing population this can prevent the formation of slums near industrial areas and provide healthier living conditions.

The effect of urban expansion on air quality can be minimised by promoting public transport and installing of dry mist fountain at major point that witness heavy traffic congestion and promoting green building.

Noise pollution can be lessened by enforcing permissible noise level for different zones and divert the route of heavy vehicles from residential and commercial zone like outer ring road.

Efforts should be made to restore and protect natural ecosystem. Eco friendly approach such as implementing cleaner production technologies and ensuring compliance with environmental regulation should be adopted by industrial zones like Amausi and Chinhat. To enhance environmental quality, it is essential to raise awareness and integrate environmental education as a mandatory subject at both school and college levels.

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