A Spatial Analysis of Population Distribution, Density and Growth in Lucknow City

Vijay Kumar Singh Rathore, Geography Department,
Anjani Kumar Singh, (Ph.D.), Geography Department,
K.S. Saket P.G. College, Ayodhya, Uttar Pradesh, INDIA

ORIGINAL ARTICLE

Corresponding Authors
Vijay Kumar Singh Rathore,
Geography Department,
Anjani Kumar Singh, (Ph.D.), Geography
Department,
K.S. Saket P.G. College, Ayodhya, Uttar Pradesh,
INDIA

shodhsamagam1@gmail.com

Plagiarism Checker X - Report
Originality Assessment

Overall Similarity: **7%**

Date: Sep 3, 2022
Statistics: 297 words Plagiarized / 4509 Total words
Remarks: Low similarity detected, check with your supervisor if changes are required.

ABSTRACT

This article discuss the trend in the growth of the population and its prediction as well as the pattern of distribution and density of population in the Lucknow Municipal Area. Lucknow is the capital city of Uttar Pradesh and has been experiencing substantial population growth over the last few decades due to various political, economic, social and infrastructural issues. Rapid population growth exerts enormous pressure on the resources of a region and it needs serious concern. The study aims to highlight the trends of population growth, identify the densely and sparsely populated areas, analyse the distribution of population as well as predict the future expected population of Lucknow City. Data obtained from secondary sources were used in the study. Data related to the population of Lucknow was taken from the state and district census handbook of 2001 and 2011. Different Statistical and cartographic techniques like decadal growth rate, population projection methods and representation of population distribution and population density using a choropleth map were used in the study for analysis purposes. It is found that the city's population has been continuously growing over time with a significant growth rate and concentrating significantly in the outer areas of the city. It has been found through the population prediction analysis that the population size of 2011 will nearly double within a short period in 2051.

KEYWORDS

Choropleth Map, Population Density, Population Distribution, Population projection methods.

July to September 2022   **www.shodhsamagam.com**
A Double-blind, Peer-reviewed, Quarterly, Multidiciplinary and Multilingual Research Journal

Impact Factor
SJIF (2022): 6.679

924

INTRODUCTION

Growth of population, its distribution and density over a region are the very general terms used in day-to-day life by not only geographers and demographers but also by policy planners, economists and advocates of social welfare. Population growth, distribution and density over a region depend upon many geographical factors so to properly understand the phenomenon of population growth and its effects on an area, its geographical analysis is necessary.

Population growth implies the change in the number of people in a specific period over a region and it can be positive and negative. It is a good indicator of economic development, social awareness, historical and cultural background and political motives. It is the basis of the demographic dynamism of a region and all other components of the population are related to this (Chandana, 2016). But rapid population growth is very dangerous for a region. It put pressure on the resources and infrastructure of a region. It shows down the economic development process.

Population over a region is not uniformly distributed. Population distribution and its density are also affected by many geographical factors such as economic development, society, culture, historical importance, job opportunity, economic sectors, education, health, trade and market, etc. Knowledge of population distribution and density is essential for planners and proper management purposes (Lal, 1986).

Many developing countries are facing the problem of high population growth in recent decades and India is also among them. Indian cities are also confronting the repercussions of high population growth. Their proper planning has become a challenging task. Lucknow is at the 12th position on the list of 53 million-plus cities in India according to the census 2011. In Uttar Pradesh, it follows Kanpur only. Lucknow is a million-plus city since 1991. The city area is expanding in an unplanned way to accommodate the huge population. Lucknow is also facing the problem of overpopulation, unplanned way of development, congestion on roads, slums, and lack of infrastructure facilities like water, sanitation, roads, power, etc. So, to overcome these problems, to understand the nature of population-related problems and for good planning, it is necessary to study the population growth, its distribution and the pattern of the density of Lucknow city. Its predictions should also be known for future planning and to access the capacity of the city to accommodate future population growth. It should be known that the Census 2021 had been postponed due to the spread of the Corona Virus in India. The present study aims to analyse the population growth, distribution and density of the Lucknow Municipal area. The main objectives of the study are: (1) to analyse the population growth on a decadal basis from 1901 to 2011, (2) to predict the future population for 2021, 2031, 2041, and 2051, (3) to find out the distributional pattern of population and (4) to find out distribution pattern of population density. In the present study in analysing the growth, data related to population growth on a decadal basis is used and migration data, birth and death-related data are not used.

Study area

Lucknow is the capital city of Uttar Pradesh which is the most populous state of India according to the Census, 2011. Lucknow is the historical and classical city of India. Lucknow is the 5th largest populous city of Uttar Pradesh having a huge population of 4,589,838 according to the Census, 2011. It has a population density of 1816 persons per sq. km. to the census, of 2011. Lucknow is situated in the centre of Uttar Pradesh. Geologically it is situated on the Gangetic fertile plain. Gomti river, which is a tributary of the river Ganga, passes through the middle of the city dividing it into two parts i.e., Trans-Gomti and Sis-Gomti.

The latitudinal and longitudinal extent of the Lucknow district is from 26° 30' N to 27° 09' N and from 80° 33' E to 81°13' E respectively. Lucknow district covers an area of 2528 square kilometres

July to September 2022   www.shodhsamagam.com
A Double-blind, Peer-reviewed, Quarterly, Multidiciplinary and Multilingual Research Journal

**Impact Factor
SJIF (2022): 6.679**

925

(Map 1).   Lucknow district is bordered by Hardoi and Sitapur in the north, Barabanki in the East, Raebareli in the south and Unnao in the west.   The north-south and east-west extents of Lucknow district are approximately 65 kilometres and 51 kilometres respectively. The average height of the district from the mean sea level is 123 meters.
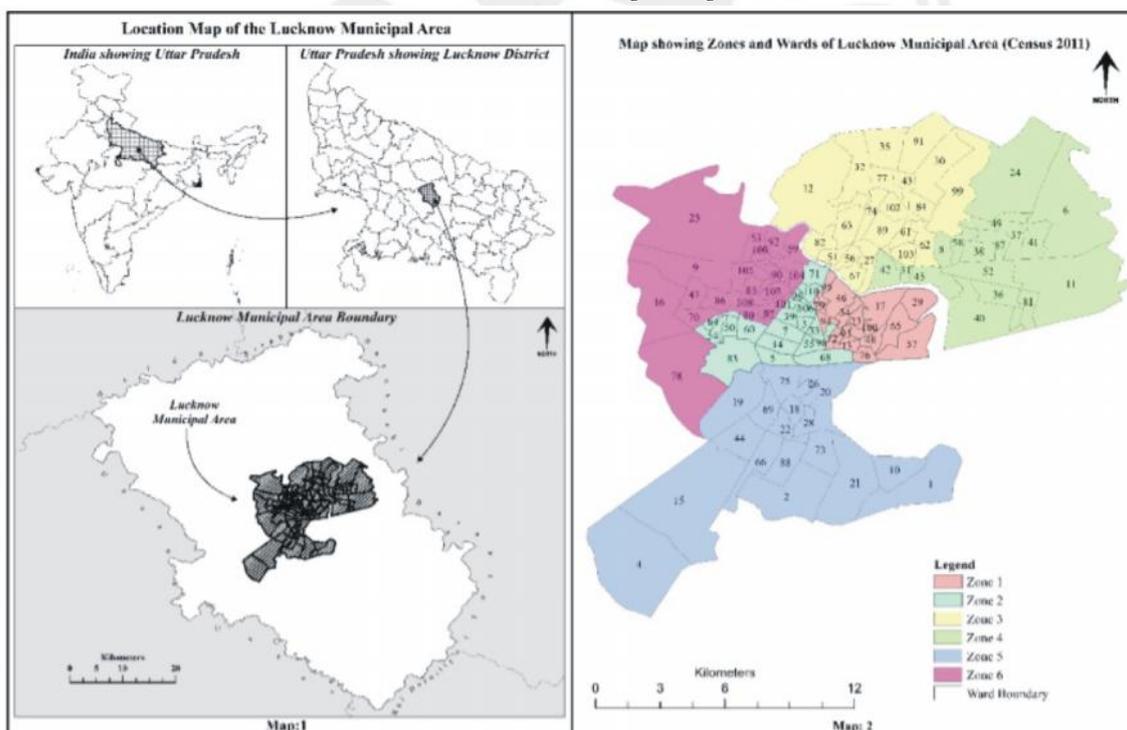
Lucknow is a major political, commercial, and economical hub of Uttar Pradesh. It is well connected to the surrounding major cities like Kanpur, Allahabad, Agra, Gorakhpur and Varanasi with highways and expressways. In recent decades, there has been a boom in tourism, economic activities and infrastructural development. That's why Lucknow attracts many migrants from neighbouring small towns and villages of the state to pursue their studies, businesses and services from lower to a higher order.

According to the Census of India 2011, Lucknow Urban Agglomeration has been classified under the category of class I towns. The total population of Lucknow urban agglomeration is 2,902,920 as per the Census of India 2011.   It is among the 53 million-plus Urban agglomerations with the rank of 12th (Census of India 2011). Lucknow Metropolitan area is governed by the Lucknow Nagar Nigam (Lucknow Municipal Corporation - LMC). The area under Lucknow Nagar Nigam is divided into 6 zones and 110 wards (Table 1 & Map 2). LMC is responsible for urban planning, water supply, public health, sanitation, solid waste management and overall development of cities.

Table 1: Zone-wise distribution of wards of Lucknow Municipal Corporation.

Zone	Ward Numbers	Total Number of wards
1	13, 17, 23, 29, 34, 46, 48, 57, 65, 72, 76, 79, 93, 94, 95, 100	16
2	3, 5, 7, 14, 33, 39, 50, 54, 55, 60, 64, 68, 71, 83, 96, 98, 106, 110	18
3	12, 27, 30, 32, 35, 43, 51, 56, 61, 62, 63, 67, 74, 77, 82, 84, 89, 91, 99, 102, 103	21
4	6, 8, 11, 24, 31, 36, 37, 38, 40, 41, 42, 45, 49, 52, 58, 81, 87	17
5	1, 2, 4, 10, 15, 18, 19, 20, 21, 22, 26, 28, 44, 66, 69, 73, 75, 88	18
6	9, 16, 25, 47, 53, 59, 70, 78, 80, 85, 86, 90, 92, 97, 101, 104, 105, 107, 108, 109	20

(Source: Lucknow Nagar Nigam)

July to September 2022   www.shodhsamagam.com
A Double-blind, Peer-reviewed, Quarterly, Multidiciplinary and Multilingual Research Journal

**Impact Factor
SJIF (2022): 6.679**

926

Methodology

Secondary data was used for the present study. Required population-related data was collected from the database originally prepared by the Census Department of India. This data is available from online sources. Lucknow metropolitan area boundary was obtained by the ward boundary map. Ward maps and related information were also collected from the Census department in Lucknow. Ward maps were digitized using GIS software and information about each ward was incorporated into the digitized layer of the ward. Ward boundary used in the census 2011 was used in the study. The Choropleth map generation technique was used for the study to prepare maps of ward-wise population distribution and population density. In this technique densities of the data are shown using hatching or different shades of colour from low to high based on the administrative boundary. Here in this study high-density area is shown by high-density hatching while the low-density area is shown by low-density hatching. The required information was extracted from the tabulated data. For the prediction analysis, three mathematical methods were used and their averages were calculated. It is worth mentioning here that population growth is the result of natural increase and net migration. In this study data related to birth rate, death rate and migration were not used. Maps were prepared using ARC GIS software.

Result and Discussion

The result and discussion section of the paper is divided into four sections which include the decadal population growth trend, future trend of population growth, zone-wise population distribution and zone-wise population density of the Lucknow Municipal Area.

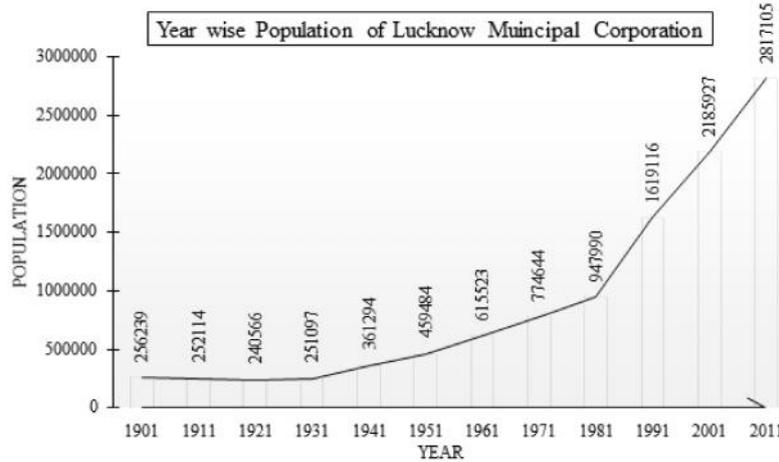## Decadal Population Growth Trend of LMC

The decadal population growth of the Lucknow municipal area is given in table 2. The table provides the data on the population starting from 1901 to 2011. Decadal change in population and decadal growth rate in percentage is also included in the columns of table 2. Graph 1 and Graph 2 also provide a graphical representation of the decadal growth of the population and the growth rate in percentage. After observing table 2 and graph 1, it is evident that the population of Lucknow municipal area has been showing a continuously increasing trend from the year 1901 till 2011. In 1901, only 2.5 lakh persons were living in LMC and after 110 years in 2011, the population residing in LMC was more than 28 lakhs. A tremendous increase of 1000 % in population was observed in the LMC during the 110 years. In the first two decades of the 20th century i.e., 1901-1911 and 1911-1921 the area experienced a negative population growth of (-) 1.16% and (-) 4.58% respectively, in Lucknow Municipal area. After 1921 LMC always experienced a high level of population growth. The highest population growth was recorded during 1981-1991, which was 70.79% and in this period 671126 persons became the new residents of LMC. After this highest growth, the second highest population growth was observed in 1931-1941 having 43.89% growth in population. Minimum positive growth was recorded in 1921-31, having only a 4.38% increase in population which added only 10531 persons to the existing population. By observing graph 1, a pattern of population growth is seen. The researcher has divided the 110 years of the period into 3 phases based on the population growth of LMC. The duration of the 1st phase was from 1901 to 1931. In this phase, population growth was very slow clearly shown by the low slope of the line in graph 1. Phase 2 which extends from 1941 to 1981 is the phase of moderate growth of population represented by the steep slope of the line. Phase 3 from 1981 to 2011 is the period of high growth of population demonstrated by the very steep slope of the line.

July to September 2022   www.shodhsamagam.com
A Double-blind, Peer-reviewed, Quarterly, Multidiciplinary and Multilingual Research Journal

**Impact Factor
SJIF (2022): 6.679**

927

Table 2: Population of Lucknow Municipal Corporation (Nagar Nigam) from 1901 to 2011.

Sr. No.	Year	Population of Lucknow M C	Decadal Change	Decadal Growth Rate (%)
01	1901	2,56,239	---	**---**
02	1911	2,52,114	-4125	-1.16 %
03	1921	2,40,566	-11548	-4.58 %
04	1931	2,51,097	+10531	4.38 %
05	1941	3,61,294	+110197	43.89 %
06	1951	4,59,484	+98190	27.18 %
07	1961	6,15,523	+156039	33.96 %
08	1971	7,74,644	+159121	25.85 %
09	1981	9,47,990	+173346	22.38 %
10	1991	16,19,116	+671126	70.79 %
11	2001	21,85,927	+566811	35.01 %
12	2011	28,17,105	+631178	28.87 %

(Source: Census of India)

Graph 1: Graph showing the year wise population of Lucknow Municipal Corporation.

Graph 2: Graph showing the decadal growth rate in % of the population of Lucknow Municipal Corporation.
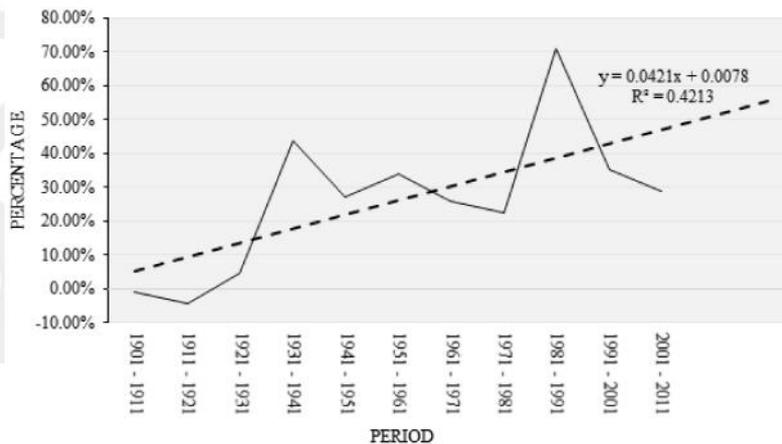
Future Trend of Population Growth

Population predictions were done for LMC using three mathematical population projection methods as arithmetical increase method, geometrical increase method and incremental increase method. All the above methods are based on different assumptions and applied under different conditions. In the arithmetical increase method, it is assumed that the population increases at a constant rate. This

July to September 2022   www.shodhsamagam.com
A Double-blind, Peer-reviewed, Quarterly, Multidiciplinary and Multilingual Research Journal

**Impact Factor
SJIF (2022): 6.679** | 928

method is applied to project the future population of old and developed towns where the rate of population growth is nearly constant. In the geometric increase method, it is assumed that the percent growth rate of the population is constant. This method is adopted for the young and developing towns where the rate of growth of the population is proportional to the population at present. The incremental increase method is adopted for averaged-sized towns under normal conditions where the rate of population is not constant i.e., it is increasing or decreasing. It is the combination of the arithmetic increase method and geometric increase method (Aryal, 2020). It is to be mentioned here that the above methods do not incorporate the data related to birth rate, death rates and migration. Formulas and descriptions of the above methods are provided in table 3.

Table 3: Description of Population Projection Method and their formulas.

Sr. No.	Population Projection Method Name	Formula	Description
1	Arithmetic Increase Method	$Pn = Po + n\bar{x}$	Pn = Population predicted after n number of decades Po = Last known Population n = Number of decades between Po & Pn $\bar{x}$ = Average rate of increase of population
2	Geometric Increase Method	$Pn = Po\left(1 + \dfrac{r}{100}\right)^n$	Pn = Population predicted after n number of decades Po = Last known Population n = Number of decades between Po & Pn r = Growth Rate = (Increase in population / initial population * 100) %
3	Incremental Increase Method	$Pn = (Po + n\bar{x}) + \left[\dfrac{(n.(n+1))}{2}\right] * \bar{y}$	Po - last known population, Pn - population predicted after 'n' number of decades, n - number of decades between Po and Pn, $\bar{x}$ - mean or average of increase in population and, $\bar{y}$ - algebraic mean of incremental increase (an increase of increase) of population.

For the calculations, the base year is taken as 1921. Values of the projected population are provided in table 4. All three methods provided different values so an average value was also calculated from the values obtained from three methods. The population of Lucknow city in 2021, 2031, 2041 and 2051 will be 3286420, 3849546, 4524759 and 5335256 respectively.

Table 4: Description of Population Projections in 2021, 2031, 2041 and 2051.

Sr. No.	Population Projection Method Name	Projections for 2021	Projections for 2031	Projections for 2041	Projections for 2051
1	Arithmetic Increase Method	3103387	3389669	3675951	3962233
2	Geometric Increase Method	3574906	4536556	5756890	7305493
3	Incremental Increase Method	3180968	3622412	4141437	4738043
	Average	3286420	3849546	4524759	5335256

(Source: Calculations by the researcher)

Ward-wise Population Distribution

The area under Lucknow Municipal Corporation was divided into 6 zones and 110 wards. Census 2011 for LMC was conducted using this ward dataset. However, in 2017 the area under LMC has been increased following the population increase, including surrounding peripheral areas. The names of some wards and their areas were also changed, still, there are 110 wards but the number of zones has been increased to 8. In the present study, the researcher has taken the area and names of wards used in the census 2011. Ward wise population of 2011 is provided in table 5. A choropleth map of the ward-wise population distribution of Census 2011 of LMC is presented in Map 3. Population distribution is one of the effective measures of various population characteristics of a region. Using this measure, we can find out the highly populated areas, medium populated areas and less populated areas. The distribution of population provides very valuable information about a region for planning purposes

July to September 2022   www.shodhsamagam.com
A Double-blind, Peer-reviewed, Quarterly, Multidiciplinary and Multilingual Research Journal

Impact Factor
SJIF (2022): 6.679 | 929

because resource distribution and their proper utilisation depend upon the population size of that area.

Table 5: Ward-wise population of 2011, area in sq. km. and population density (persons / km^2) of 2011

Ward Number	Ward Name	Area (km^2)	Population 2011	Population Density 2011
1	Ibrahim Pur	3.87	43282	11184
2	Raja Bijali Pasi	8.29	41971	5063
3	Tilak Nagar	0.63	17988	28552
4	Sarojani Nagar I	8.96	22717	2535
5	Ambedkar Nagar II	2.31	21960	9506
6	Shaheed Bhagat Singh	8.93	38910	4357
7	Malviya Nagar	1.19	18999	15966
8	Lal Bahadur Shastri I	5.42	25553	4715
9	Kanhaiya Madhavpur	3.76	50574	13451
10	Kharika	3.51	38053	10841
11	Chinhat	8.76	54513	6223
12	Faizulla Ganj II	11.81	55227	4676
13	Lal Kuan	0.26	19668	75646
14	Ambedkar Nagar I	2.31	19946	8635
15	Sarojni Nagar II	10.61	46057	4341
16	Haider Ganj II	5.6	55566	9923
17	Hazratganj	12.03	16072	1336
18	Om Nagar	0.77	23292	30249
19	Keshri Kheda	19.57	23588	1205
20	Guru Givind Singh	8.93	19054	2134
21	Sharda Nagar	9.18	68993	7516
22	Guru Nanak Nagar	1.08	27010	25009
23	Jagdish Chandra Bose	1.97	19263	9778
24	Indira Priyadarshni	5.45	35400	6495
25	Balaganj	16.39	35312	2154
26	Babu Kunj Bihari Lal Nagar	1.39	19965	14363
27	Nirala Nagar	0.96	18326	19090
28	Geetaplalli	2.1	25218	12009
29	Raja Ram Mohan Rai	3.36	22318	6642
30	Shankar Purwa II	4.14	53630	12954
31	Nishat Ganj	0.55	11065	20118
32	Faizulla Ganj I	5.73	52328	9132
33	Rajendra Nagar	0.67	17224	25707
34	Rani Lakshmi Bai Aminabad	1.22	15832	12977
35	Jankipuram I	4	31756	7939
36	Rajiv Gandhi I	6.46	26795	4148
37	Ismil Ganj I	4.35	21207	4875
38	Maithli Sharan Gupt	2.79	20544	7363
39	Aishbagh	0.42	14829	35307

July to September 2022   www.shodhsamagam.com
A Double-blind, Peer-reviewed, Quarterly, Multidiciplinary and Multilingual Research Journal

Impact Factor
SJIF (2022): 6.679

930

40	Rafiq Ahmad Kidwai	9.59	31412	3275
41	Ismil Ganj II	2.52	34903	13850
42	Colvin College	1.48	16816	11362
43	Lala Lajpat Rai	1	24961	24961
44	Chitragupta Nagar	3.76	29270	7785
45	Paper Mill Colony	0.61	29036	47600
46	Gola Ganj Pir Zalil	0.25	24264	97056
47	Haider Ganj I	12.03	32543	2705
48	Mahatma Gandhi	1.97	21552	10940
49	Babu Jag Jeevan Ram	2.33	21023	9023
50	Hardeen Rai	1.07	18196	17006
51	Kadam Rasool	1	22192	22192
52	Gomti Nagar	3.21	21938	6834
53	Mallahi Tola I	1.56	29006	18594
54	Kunwar Jyoti Prasad II	0.78	17086	21905
55	Moti Lal Nehru	0.78	17087	21906
56	Dali Ganj	0.63	16353	25957
57	Vikramaditya	4.91	17016	3466
58	Lal Bahadur Shastri II	5.42	23299	4299
59	Huasainabad	2.39	22074	9236
60	Labour Colony	1.63	18365	11267
61	Begum Hazrat Mahal	0.76	17218	22655
62	Maha Nagar	2.01	24040	11960
63	Triveni Nagar	3.65	30739	8422
64	Kunwar Jyoti Prasad I	1.32	17919	13575
65	Ramtirth	0.61	15583	25546
66	Hind Nagar	7.73	32880	4254
67	Mankameshwar	1.23	20828	16933
68	Chandra Bahnu Gupt	0.41	14747	35968
69	Ram Ji Lal Nagar	1.02	24770	24284
70	Sadatganj	2.26	34253	15156
71	Neta Shubhash Chandra Bose	1.67	13367	8004
72	Ganesh Ganj	0.25	17657	70628
73	Vidyavati Devi II	1.7	39612	23301
74	Maha Kavi Jai Shankar Prasad	1.22	23256	19062
75	Sardar Patel Nagar	1.87	16314	8724
76	Babu Banarsi Das	0.55	20055	36464
77	Bhartendu Harishchandra	2.92	20361	6973
78	Alam Nagar	10.63	36173	3403
79	Masak Ganj	0.16	19524	122025
80	Sheetla Devi	0.65	20501	31540
81	Rajiv Gandhi II	2.78	26055	9372
82	Ayodhya Das	1.19	37800	31765
83	Rajaji Puram	0.99	16256	16420

July to September 2022   www.shodhsamagam.com
A Double-blind, Peer-reviewed, Quarterly, Multidiciplinary and Multilingual Research Journal

Impact Factor
SJIF (2022): 6.679

931

84	Lohiya Nagar	0.86	26103	30352
85	Ambar Ganj	0.81	26973	33300
86	Kashmiri Mohalla	0.53	24452	46136
87	Indira Nagar	2.39	22154	9269
88	Vidyavati Devi I	1.2	26217	21848
89	Aliganj	0.27	22266	82467
90	Acharya Narendra Dev	0.16	24495	153094
91	Jankipuram II	5.07	34352	6776
92	Daulatganj	1.44	27897	19373
93	Yadunath Sanyal	0.29	13780	47517
94	Maulvi Ganj	0.21	17606	83838
95	Vazeer Ganj	0.27	13468	49881
96	Bashirat Ganj	0.38	19274	50721
97	Bhawani Ganj	0.29	22774	78531
98	Yahiya Ganj	0.46	14342	31178
99	Shankar Purwa I	2.66	37468	14086
100	Nazar Bagh	0.26	17353	66742
101	Asharfabad	0.52	19155	36837
102	Bajaranj Bali	1.71	14384	8412
103	Viveka Nand Puri	1.49	17010	11416
104	Bazar Kali Ji Chauk	0.3	18788	62627
105	Gadhi Pir Khan	2.18	41909	19224
106	Kundri Rakab Ganj	0.63	19082	30289
107	Maulana Kalbe Abid I	0.29	23720	81793
108	Maulana Kalbe Abid II	0.33	12195	36955
109	Mallahi Tola II	1.56	23179	14858
110	Raja Bazar	0.26	18404	70785

(Source: Census of India 2011)

Ward wise population of Lucknow is divided into 6 classes as given in table 6. The numbers of wards of the corresponding class interval are also provided. It is clear from table 6 that there are 83 wards which have a population between 10,000 to 30,000 persons. There are only 27 wards which have a high population of more than 30,000 persons. Ward number 31 Nishat Ganj ward is the least populated ward with only 11,065 persons while ward number 21 Sharda Nagar is the most populous ward with a population of 68,993 persons. A pattern is seen from map 3 of ward-wise population distribution that wards having a population of less than 30,000 are found along the centre of the city while wards having a population of more than 30,000 are found along the outer areas of the city.
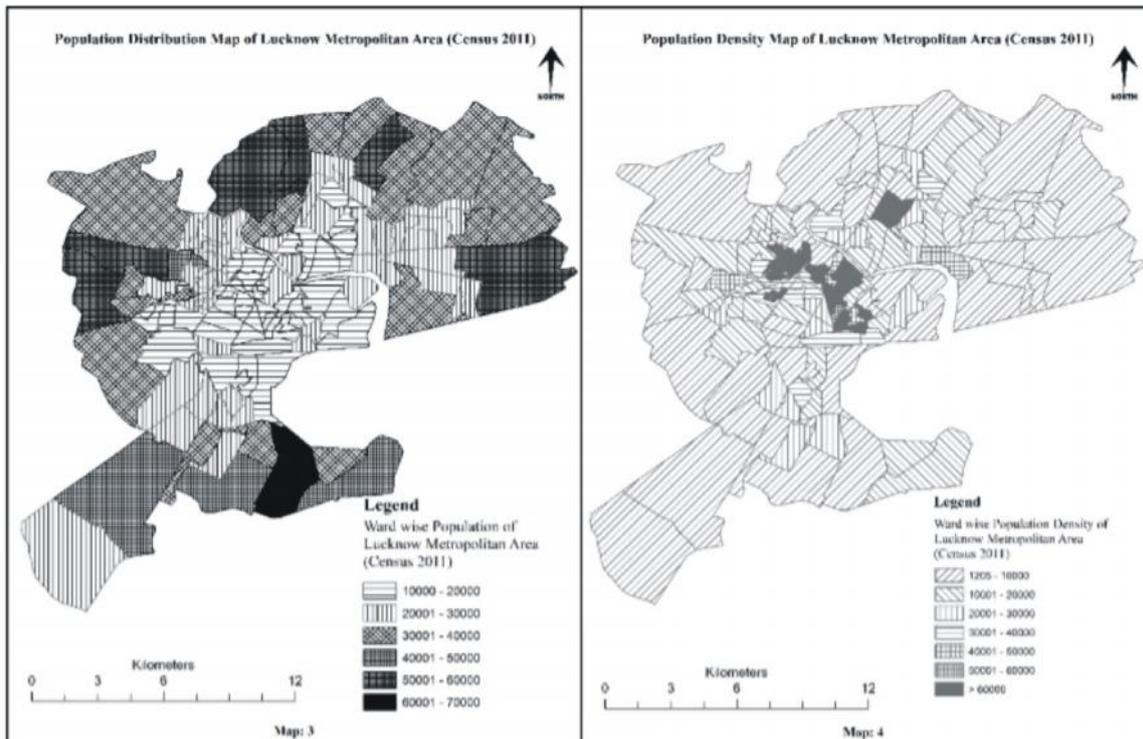
July to September 2022   www.shodhsamagam.com
A Double-blind, Peer-reviewed, Quarterly, Multidiciplinary and Multilingual Research Journal

**Impact Factor
SJIF (2022): 6.679**

932

Table 6: Table showing class intervals of population and their respective wards

Sr. No.	Class Intervals	Wards	Total Number of wards
1	10,000 – 20,000	3, 7, 13, 14, 17, 20, 23, 26, 27, 31, 33, 34, 39, 42, 50, 54, 55, 56, 57, 60, 61, 64, 65, 68, 71, 72, 75, 79, 83, 93, 94, 95, 96, 98, 100, 101, 102, 103, 104, 106, 108, 110	42
2	20,001 – 30,000	4, 5, 8, 18, 19, 22, 28, 29, 36, 37, 38, 43, 44, 45, 46, 48, 49, 51, 52, 53, 58, 59, 62, 67, 69, 74, 76, 77, 80, 81, 84, 85, 86, 87, 88, 89, 90, 92, 97, 107, 109	41
3	30,001 – 40,000	6, 10, 24, 25, 35, 40, 41, 47, 63, 66, 70, 73, 78, 82, 91, 99	16
4	40,001 – 50,000	1, 2, 15, 105	4
5	50,001 – 60,000	9, 11, 12, 16, 30, 32	6
6	60,001 – 70,000	21	1

Ward-wise Population Density

Population density is the ratio between the population of a region to its area. It is expressed as the persons per sq. km. The average population density of the municipal area of Lucknow is 8460 persons per sq. km. as per the census 2011. Data of ward-wise population density is divided into 7 classes. Class intervals of ward-wise density and its corresponding wards are provided in table 7. It is evident from map 4 that the highest density wards are found in the central parts of Lucknow due to their small areas. Ward no. 90 Acharya Narendra Dev is the densely populated ward of LMC having a population density of 153094 persons per sq. km. while ward no. 19 Keshri Kheda is the most sparsely populated ward of LMC having a population density of 1205 persons per sq. km. followed by Hazratganj ward No.17 with 1336 persons per sq. km. In LMC 67 wards possess the less population density which is less than 20,000 persons / sq. km., 17 wards have the highest population density between 40,001 to 60,001 persons per sq. km. while only 26 wards are having moderate population density between 20,001 to 40,000. High density in the core areas of the city is attributed to the Central Business District, old city, unplanned housing, congested streets, etc. Less population density of outer wards is due to the more spatial extent of the wards compared to the small inner wards.

July to September 2022   www.shodhsamagam.com
A Double-blind, Peer-reviewed, Quarterly, Multidiciplinary and Multilingual Research Journal

Impact Factor
SJIF (2022): 6.679

933

Table 7: Table showing class intervals of population density and their respective wards.

Sr. No.	Class Intervals	Wards	Total Number of wards
1	1205 – 10,000	2, 4, 5, 68, 11, 12, 14, 15, 16, 17, 19, 20, 21, 23, 24, 25, 29, 32, 35, 36, 37, 38, 40, 44, 47, 49, 52, 57, 58, 59, 63, 66, 71, 75, 77, 78, 81, 87, 91, 102	41
2	10,001 – 20,000	1, 7, 9, 10, 26, 27, 28, 30, 34, 41, 42, 48, 50, 53, 60, 62, 64, 67, 70, 74, 83, 92, 99, 103, 105, 109	26
3	20,001 – 30,000	3, 22, 31, 33, 43, 51, 54, 55, 56, 61, 65, 69, 73, 88	14
4	30,001 – 40,000	18, 39, 68, 76, 80, 82, 84, 85, 98, 101, 106, 108	12
5	40,001 – 50,000	45, 86, 93, 95	4
6	50,001 – 60,000	96	1
7	>60,001	13, 46, 72, 79, 89, 90, 94, 97, 100, 104, 107, 110	12

CONCLUSION

Being the capital city of Uttar Pradesh, Lucknow is known for various economic, social and political activities and it is a hub of educational and healthcare facilities, especially in eastern Uttar Pradesh. Over the last few decades, it has become a fashion and a status symbol for the people living in the nearby district to purchase a plot and make their houses in Lucknow city. Peripheral areas of Lucknow have been mostly occupied by migrants and this trend has emerged at a very fast pace in the last decade. Now the population pressure has created many challenges and problems for authorities. To analyse the basic cause of the problem, the population growth trend, its distribution and density characteristics were discussed in this study. The distribution of population and its density is shown through the choropleth map technique on a Lucknow ward basis. The population of LMC has shown an increasing trend since 1931. The maximum rate of decadal growth was seen during 1981-1991 when a growth of 70.79% was observed. After 1991 decadal growth shows a decreasing trend. Population predictions for the years 2021, 2031, 2041 and 2051 were calculated using three mathematical methods as arithmetic increase method, geometric increase method and incremental increase method. The average of the predicted values for each year was calculated. Data shows that in 2021, 2031, 2041, and 2051 population of Lucknow will be 3286420, 3849546, 4524759 and 5335256 respectively. Choropleth map for ward-wise population distribution shows that middle wards of the city are less populated while wards situated in the peripheral areas have a high population. Ward wise population density map of Lucknow shows that the ward having high population density is found in the middle of the city while the outer ward has a low population density. It is due to the differences in the area of wards. The knowledge of major population characteristics like population growth, distribution and density are essential for the proper planning of a city. The content of this paper will be very helpful for policy planners and various government agencies in making their plans. Government agencies should take the initiatives to decrease the rate of population growth.

REFERENCES

1.   Aryal, G.R. 2020. Methods of Population Estimation and Projection. Journal of Population and Development, June 2020.
2.   Census of India 2001 and 2011.
3.   Chandana, R.C. 2016. *Geography of Population: Concept Determinants and Pattern.* Kalyani Publishers, New Delhi.
4.   City Development Plan Lucknow, (Govt. of Uttar Pradesh, Feedback Ventures Pvt. Ltd. 2006)
5.   Lal, H. 1986. Population Geography. Vasundhara Publication, Gorakhpur.
6.   Master Plan of Lucknow-2021. Lucknow Development Authority, Lucknow

****

July to September 2022   www.shodhsamagam.com
A Double-blind, Peer-reviewed, Quarterly, Multidiciplinary and Multilingual Research Journal

Impact Factor
SJIF (2022): 6.679

934