ISSN 2278-8808 SJIF 2013 = 4.194
An International Peer Reviewed & Referred
SCHOLARLY RESEARCH JOURNAL
FOR INTERDISCIPLINARY STUDIES

APPLICATION OF SPATIAL VARIATION URBAN DENSITY MODEL: A STUDY OF AHMEDNAGAR CITY, MAHARASHTRA, INDIA

S.A. Borude, Assistant Professor, PG, Dept. of Geography, Ahmednagar College, Ahmednagar, Maharashtra. (sharadborude@gmail.com)

S. W. Gaikwad, Ph.D, Associate Professor, P. G. Teaching and Research Centre Department of Geography, S. P. College, Pune, Maharashtra. (gaikwad97@gmail.com)

Abstract

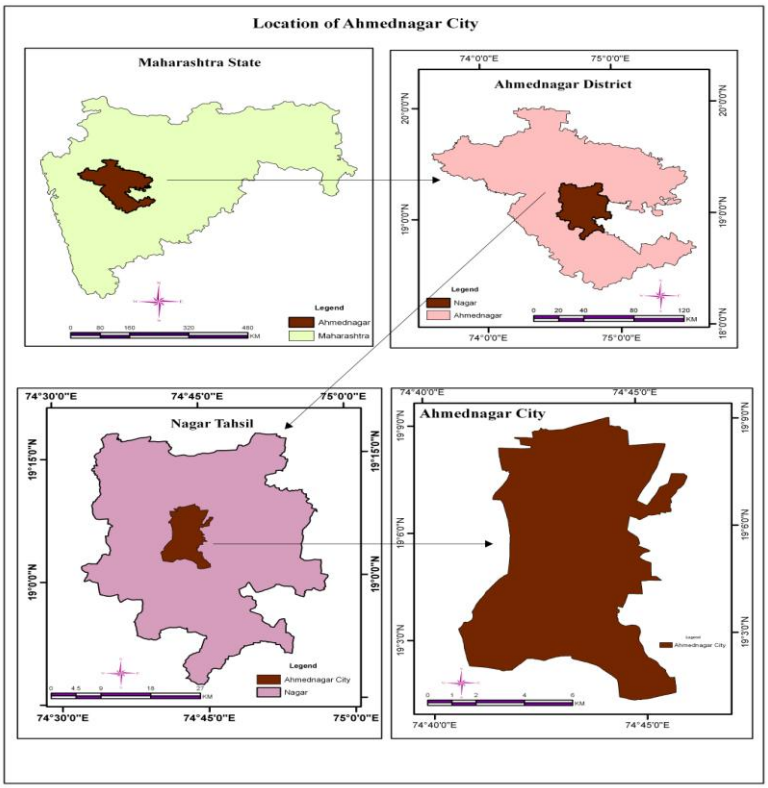
The term density of population refers to a ratio between population and land area. There are several means of describing the spatial distribution of population. Geographers, demographers, sociologist, and statisticians have made their contribution in developing the means to describe population distribution and concentration (RC Chandana, 2003). It is truism to state that population is not evenly distributed within the city. Since, however, the urban population is also not evenly distributed, (R. M Northam, 1975).Geographers have studied urban population densities and found that there are similarities and regularities in urban densities. The urban density models are developed by C Clark (1951), J. Tanner and G. Sherratt (1961), and B. Newling (1969) to express the statistical relationships between population densities and urban distance.In this research paper attempt is made to analyze spatial variation in urban density of Ahmednagar district and compare it with Ahmednagar city. The study of urban density of Ahmednagar city is the expression of general relationships, between distance and urban density. This association is a formalized for explaining the general situation of density and distances. B. Newling model of spatial variation in urban population densities is applied for study.

Key Wards: density, spatial variation, urban density, urban density models.

Introduction:

Population density is expressed in terms of number of persons per unit of area. However, the density of population is expressed in different ways to understand the population and resources relationship. These ratios have been designated as arithmetic density, physiological density, nutrition density, agricultural density and economic density. One expression of urban population density is the number of residents per unit of urban area, without considering the area devoted for particular function. The consideration here is simply for a unit of urban area, regardless of the function to which the unit area is utilized. This expression of urban population density is referred as gross density (GD) of population and is derived by the equation GD= P/GA. In this equation, population of the city (P) is divided by the total number of units of gross area of the city and expressed in square acres, square kilometer and square miles, of gross area (GA).

Study Area:



Map.1. Location of Ahmednagar city

Ahmednagar city, the head-quarters of the district is located between 19^0 01' 11" North to 19^0 09' 4.7" North Latitude and 74^0 40' 37.52" East to 74^0 46' 8.28" East longitudes. The height of city is 656.54 meters from mean sea level; a contour of 660 meter surrounds the city. Ahmednagar city is situated in the central part of the Deccan plateau, in the upper 'Seena' basin on the eastern flank of Harishchandra hill ranges.

Objectives:

1) To analyse the urban population density of Ahmednagar city and district.

2) To study spatial urban population density of Ahmednagar city.

3) To analyse urban density and distance relation within Ahmednagar city.

4) To apply spatial variation urban density model to Ahmednagar city.

Database and methodology:

The preset research work is entirely based on secondary sources of data collected from Department of Census, District census hand books, District Socio -economic abstracts, books and research articles. The collected information is presented by using cartographic techniques like bar Graph, polygraph and choropleth maps etc. B. Newling model of spatial variation in urban population densities is applied for the analysis.

Analysis:

1. Comparative Urban Population Density of District and City:

Ahmednagar district has average density 237 persons per sq. km (2001). This is much lower than the state average density 315 persons per sq. km. keeping with general tendency, Ahmednagar district too display a considerable high urban density i.e.1966 persons per sq. km. in urban area, and 194 persons per sq. km in rural area of the district, with compare Maharashtra state average it is less than urban as well as rural density of the state which is 5588 and 186 persons per sq. respectively.

Table:1.Urban Population Density 1901-2011

Census Year	Urban Population Density (Persons per sq. km.)	
	Ahmednagar District	Ahmednagar City
1901	607	1801
1911	623	1705
1921	641	2510
1931	738	2108
1941	922	2727
1951	1668	4070
1961	1454	4817
1971	2177	5950
1981	1983	7244
1991	1543	9915
2001	1966	3810
2011	2640	4374

Source: Census of India: 2011

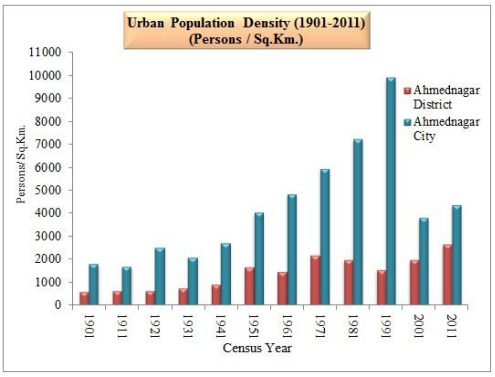


Fig.-1: Urban Population Density 1901-2011

Temporal urban population density of Ahmednagar district is given in table: 1, for the period of last fifty years. From 1901 to 1951 it increases three times i.e. from 607 to 1668 persons per sq. km. In 1961 due to redefinition of urban settlements, number of urban centers decreases from 8 to 5 urban centers. Hence population of urban settlement in Ahmednagar district decreases by net 57517 persons. During 1971 to 2001 fluctuating trend of urban population density is observed in Ahmednagar district.

Density of Ahmednagar city from 1901 to 1991 shows continuous increasing trend. Population density Ahmednagar city was 1801 persons per sq. km. in 1901and it is increases up to 5.5 times in the span of ninety years and it was 9915 persons per sq. km. in 1991. In 2001 density of city population were 3835 persons per sq. km. which was decreased by 6080 persons /sq. km. in 2011. It is a result of increase in area of city, 12 villages (60.30 sq. km. area) are included and city area becomes to 80.72 sq. km which was 18.23 sq. km. in 1991. This four times areal expansion of city reduced density of population in 2001 however it is again increased in 2011.

2. Urban Density of Ahmednagar City:

For the study of spatial variation of population density, Ahmednagar city area is divided in to three parts i.e. 1.Gaonthan area, 2. Outer area and 3. Extended area. Ahmednagar city Gaonthan area is old core of city having more than five hundred years long history of growth. Gaonthan is most congested area of city having heighest population density of 30607 persons per sq. km. Due to horizontal expansion, city spread beyond Gaonthan and it becomes moderate densely populated part of city having population density of 7704 persons per sq. km. in extended

area which is newly added area of city and having agricultural background so it shows lowest population density that is 1661 persons per sq. km. and it is below average of city population density of 3810 persons per sq. km.

Table-2: Density of Ahmednagar City-2001

City Area	Population Density of Ahmednagar City -2001		
	Area sq. km.	Area Population	Density per/ sq. km.
Gaonthan	2.19	67093	30607
Outer Area	18.23	140417	7704
Extended Area	60.30	100105	1661
Average of City	80.72	307615	3810

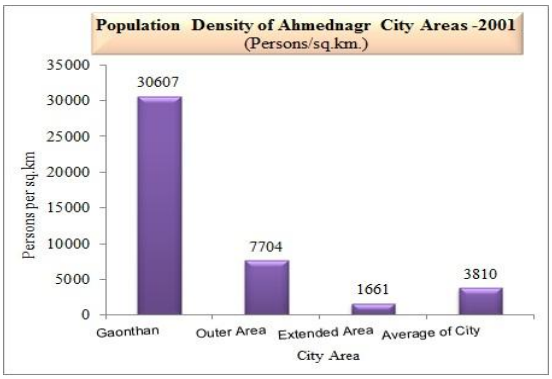


Fig.-2: Ahmednagar City Population Density -2001

2.1. Population Density of Gaonthan:

Ward wise population density is given in table-3. Gaonthan area shows highest population density in smallest ward in area of city. Ward 42 in Gaonthan area occupy 0.03 sq. km. area and shows highest density of 88,286 person per sq. km. Average density of Gaonthan area was 30607 persons per sq. km. of which, only ward no.30 with 0.11 sq per km area shows density below Gaonthan average. Word 37 and ward 44 to 48 are the central city core area of Ahmednagar city representing density around 40,000 persons per sq. km. These commercial core wards of city shows less density of population than peripheral wards of Gaonthan, wards like 38 to 42 and 31 to 36 are showing population density above 60,000 persons per sq. km. (Table. no. 3)

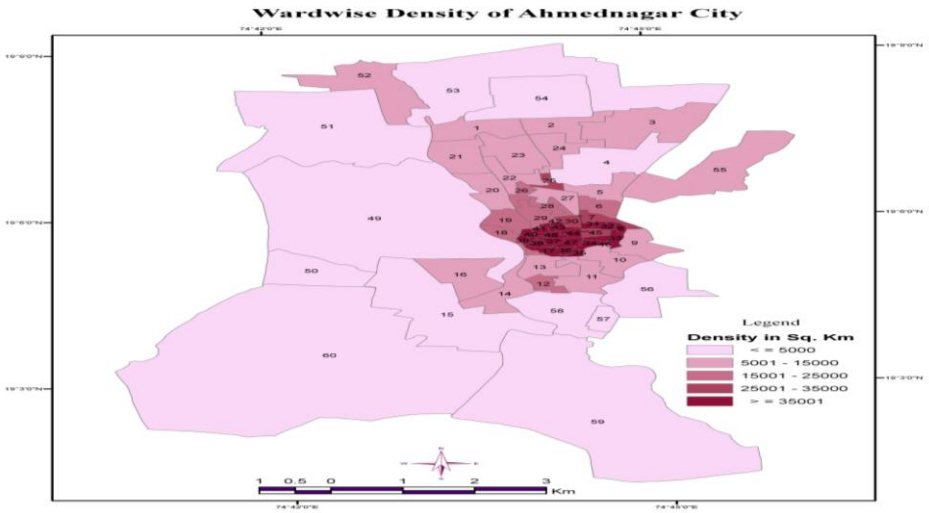
2.2. Population Density of Outer Area:

Average population density of outer area is above 7704 persons per sq. km. Ward no.7, 26 and 27 are small wards in area and shows highest density of population i.e. above 20,000 persons per sq. km. All wards to the north of Gaonthan shows high density than average density of outer area. Adjoining wards to the Gaonthan also represents high density. Ward 4, 15 and 21

of outer area shows below average population density of outer area. Ward 4 having low density because in this ward area is under defence land use.

Table-3: Ward wise Population Density of Gaonthan, Outer and Extended Area.

Ward No.	Density per/ sq. km.	Ward No.	Density per/ sq. km.	Ward No.	Density per/ sq. km.	Ward No.	Density per/ sq. km.
Population Density of **Gaonthan Area**							
8	77912	33	39862	38	59929	43	50439
17	37356	34	43364	39	86150	44	39212
30	26042	35	71478	40	58315	45	33663
31	42210	36	62172	41	76396	46	54692
32	55358	37	42863	42	88283	47	41076
Ave.	30607	-	-	-	-	48	42146
Population Density of **Outer Area**							
1	8479	9	8364	16	6352	24	10633
2	13396	10	8539	18	16256	25	25729
3	6322	11	6708	19	16122	26	22410
4	4128	12	16708	20	11712	27	13251
5	7503	13	8346	21	5362	28	22357
6	15429	14	8997	22	12809	29	15545
7	25882	15	1238	23	8531	Ave.	7704
Population Density of **Extended Area**							
49	344	52	5661	55	8418	58	3994
50	764	53	1043	56	4080	59	364
51	1349	54	3689	57	1036	60	1725
Ave.	1661	-	-	-	-	-	-



Map.2: Ward wise Population Density

Ward 15 is largest in area (3.69 sq. km.) and supports 1238 persons per sq. km. Ward 21 also represent below average density because in this ward considerable land is under agricultural use (Table. no. 3).

2.3. Population Density of Extended Area:

Average density of extended area is 2706 persons per sq. km. There is large variation in population density in extended area. Ward 55 represents Mukund nagar area having highest density (8418) in extended area. Ward 49 represents Nalegaon and ward number 59 represent Burudgaon having low density i.e. 344 and 364 persons per sq. km. respectively. Ward no. 50 (Nalegaon), 51 (Bolhegaon), 53 (Bhistbag) 57 and 60 (Kedgaon) shows density of population below average of extended area. Ward no. 42 of Gaonthan with 88283 persons per sq. km. is area of heighest population density and ward 49 of extended area with 344 persons per sq. km. is lowest population density ward in Ahmednagar city (Table. no. 3).

3. Density and Distance Relation / Density Model:

From the above analysis it is observed that there are spatial differences and patterns in the density of population within the city. It is very natural that the culture of the area within which the city is located, the age of the city, the economic functions performed by the city, the size of the city's population, and the physical setting in which the city exists all has a bearing on spatial patterns of population densities within cities.

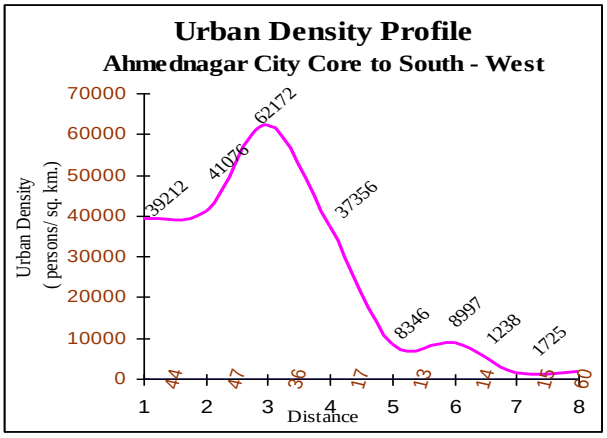
Many scholars have developed the model for the study of spatial variation in urban density. The models by C. Clark dealing with urban population density stated that urban population densities outward from the center of the city declines exponentially with distance in decreases until the outer limits of the city. However, since this is an exponential decline in density, it proceeds at a much greater rate nearer the city center, and the density decline at a lower rate in the margins of the city. An alternate model of urban population densities was developed independently by J. Tanner and by G. Sherratt. This model suggests that densities decrease rather slowly in the first incremental distance zone outward from the city center, then the decline accelerates appreciably until the outer margins of the city are approached at which the distance decrease and density slows again. Still later, another alternate formulation of urban population densities model was developed by B. Newling.

The concept of B. Newling is a further extension of the model of Tanner and Sherratt. It suggests that relatively low density near the core of the city, and densities increasing in the incremental zone nearest the city center and reaching maximum density levels some distance from the center of the city. Just beyond the outer margin of the central district and there exists a density rim or crest which surrounds the density crater of the central business district. Outward from the density rim, the densities decline in a negative exponential manner to the urban fringe. The study of Ahmednagar city shows that the urban density pattern is observed as stated by B. Newling. (fig. on. 3 and 4)

3.1. Density Model: Core to South -West:

Table.-4: Density Distance for Core to South -West

Ward No.	Distance from City Core (In kms.)	Density Persons / sq. km.
44	0	39212
47	0.33	41076
36	0.66	62172
17	1.1	37356
13	1.4	8346
14	1.65	8997
15	2.95	1238
60	5.7	1725



3.2. Density Model: Core to North: Table-5. Density Distance from core to North

Ward No.	Distance from City Core (In kms.)	Density Persons / sq. km.
44	0	39212
47	0.33	41076
36	0.66	62172
17	1.1	37356
13	1.4	8346
14	1.65	8997
15	2.95	1238
60	5.7	1725

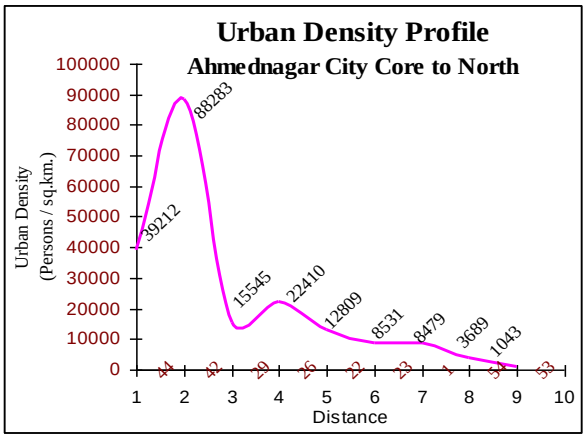


Fig.-4: Density profile Core to North

4. Findings and Conclusions:

A comprehensive analysis of the data indicates that, four distinct stages in urban development can be recognized in Ahmednagar city each with a different structure of population densities. The first stage which is recognized as Stage of *youth* during which the population is relatively concentrated near the business core of the city. The densities during this stage are closely approximated by the model of Clark. In the second stage, developmental process is early *maturity* which is characterized by areal expansion of the city beyond its earlier margins and greatly increased density adjacent to the commercial core. This is in general accord with the concepts of Tanner and Sherratt. The third stage of *late maturity* is typified by still greater peak densities and areal extent of the population around the density crater that emerges in this stage and there exists a density rim representing high population densities in areas adjacent to the CBD. In the fourth stage, still greater areal expansion of the city from the commercial core of the city and is identified as the *old age stage* of urban development. The analysis of the study of spatial variation in urban density of Ahmednagar city shows that the concept suggested by B. Newling model is applicable to this study. It is recognized that there is areal expansion of the city as well as a redistribution of the city's population at a certain stages in the developmental process of the city. In the case of areas from core to north (Nagar -Manmad Road) and core to South-west (Nagar-Pune road) the density of population is low at the city center and it suddenly

increases after city core and again it progressively declines to the peripheral area of city which very much resembles to Newling's model. Ahmednagar city is a secondary city in Maharashtra, having a long history of more than 500 hundred years of urbanization it represents, typical characteristics of old *age stage* of urban development, as suggested by B. Newling in his model.

References:

Chandana R. C. (2003), Population Geography", Kalyani Publication, New Delhi.

Census of India, CDs 2001 and 2011.

District Census Handbooks, 1951-1991.

Development Plan (DP) repots, Ahmednagar Corporation, Ahmednagar.

Jack P. Gibbs, (1966): "Urban Research Methods", East- West press PVT. LTD, New Delhi.

Premi, M. K., (1991): "India's Urban Scene and Its Future Implications", Demography India, 20 (1).

R L Singh,(1973): "Urban Geography In Developing Countries", National Geographical Society of India, Varanasi.

Ray M. Northam, (1975):" Urban Geography", John Wiley and sons, INC, New York, (pp. 268-69)

Sulochana Shekhar, (2001), 'Colonial urban development in India a conceptual clarification', Transaction, Institute of Indian Geographers, vol.23 no1&2, 2001, pp 29-38

Socio Economic Abstract - Ahmednagar District 2010.