

## **COMPARATIVE STUDY OF URBAN POPULATION DENSITY AND SEX RATIO IN MAHARASHTRA**

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### **ABSTRACT**

The main objective of this paper is to clarify the effect of urban population density and urban sex ratio on socio-economic characteristics of the urban communities with a special focus on Maharashtra State. The term urban density is multifaceted and covers a broad range of urban characteristics. Most studies on urban density are confined to demographic and other features of human settlement. The studies on population density have primarily focused on the constantly increasing human population and subsequent impact of this increase on the physical environment and the resources available. It is not easy to distinguish between cause and effect, while explaining the various planes of human density, and the type and depth of their relationships with different social aspects. The complex nature of population density also implicates the involvement of the socio-economic, environmental and historical factors that help to create a specific density spectrum and kind, like, linear, clustered or randomly distributed in respect to any type of urban community. However, there are many other features of urban density, which will be described later, which have a significant impact. Density is the measurement of population in unit or per sq.km. The census of India defines urban density as the number of persons in a square kilometer of urban area and the density figures are obtained by a simple division of total urban population by the area under urban statutory limits. Urban density is a term used in urban design and urban planning to refer to the number of people inhabiting a given urbanized region. The urban density of Maharashtra is increasing continuously. In 1991, the urban population density of Maharashtra is 3357 Sq. Km. In 2011; the density of Maharashtra is increased up to 5581 Sq. Km. The urban sex ratio of Maharashtra is increase. In 1991, urban sex ratio was 874 and 2011 is 903 per 1000 male in Maharashtra state.

**Key words:** Density, Urban communities, Growth Pattern, Sex ratio, Critical

## **INTRODUCTION:**

Density is the measurement of population in unit or per sq.km. The census of India defines urban density as the number of persons in a square kilometer of urban area and the density figures are obtained by a simple division of total urban population by the area under urban statutory limits. Urban density is a term used in urban design and urban planning to refer to the number of people inhabiting a given urbanized region. Urban density a function of area and population highlight the role of the size of the urban territory in terms of both its share of total area and share of total urban population. Any change in the boundary affects the area extent of the territory in this case, district, and consequently its population share. Many official changes in the district delimitation have occurred and are still going on. These are affecting the consistency and continuity of tracing the causes and directions of urbanization in Maharashtra on the desired spatial level of analysis for all districts. Thus, on a more generalized level it can be deduced that urban density is on rise as a result of interplay of economic and non- economic factors as recorded in cities which rather act as fixed points on the geographical space. The argument that compact cities are more sustainable than low density cities has been studied and argued extensively. The conclusions are inconclusive compact have significantly lower ecologic footprints and GDP per capita is generally higher in more densely populated cities. Many argue cities are not sustainable. However, from their very beginnings they have experienced environmental problems associated with overcrowding, air, water and noise pollution poor sanitation and housing.

Human population density has always been the chief centralization themes within geographical studies, co-relating the range and depth of the interrelationships that occur between society, individuals, and the surrounding physical environment and the nature of their mutual influence. A majority of the density related research work has centered upon the factor of measured density and have explored various aspects seeking resolutions for problems related to the services provided by the state. The studies on population density have primarily focused on the constantly increasing human population and subsequent impact of this increase on the physical environment and the resources available.

It is not easy to distinguish between cause and effect, while explaining the various planes of human density, and the type and depth of their relationships with different social aspects. The complex nature of population density also implicates the involvement of the socio-economic, environmental and

historical factors that help to create a specific density spectrum and kind, like, linear, clustered or randomly distributed in respect to any type of urban community.

The urban density of Maharashtra is increasing continuously. In 1991, the urban population density of Maharashtra is 3357 Km<sup>2</sup>. In 2011, the density of Maharashtra is increased upto 5581 Km<sup>2</sup>.

#### **OBJECTIVES:**

- 1) To Comparative study of urban sex ratio and urban population density.
- 2) To analyze the decadal changes in sex ratio and urban population density.
- 3) Correlation between sex ratio and urban population density.

#### **STUDY AREA:**

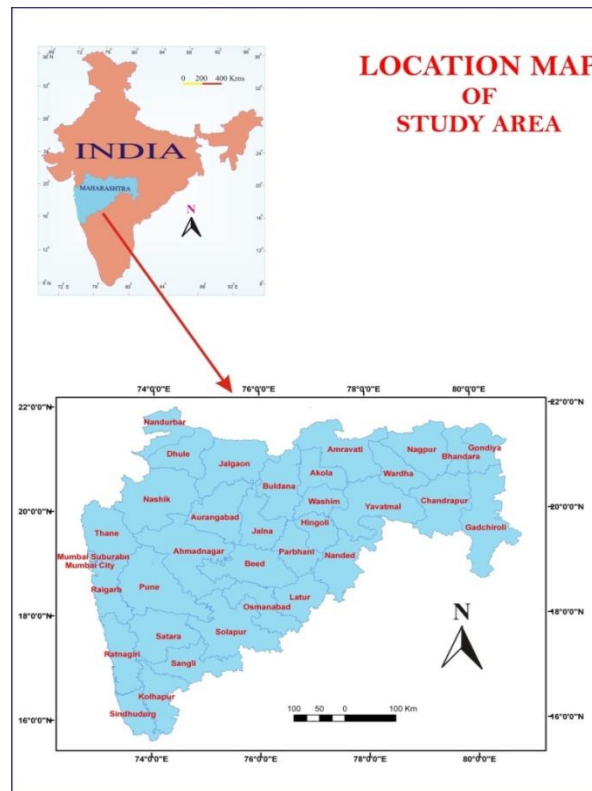
*The State of Maharashtra extends from 15° 45' to 20° 6' North Latitude and 70° 36' to 80° 54' East Longitude with Geographical area 3, 07,713 Sq. Km. It is bounded by Arabian Sea in the west, the State of Gujarat in the Northwest. Madhya Pradesh in the North, Chhattisgarh in the East, Andhra Pradesh in the Southwest, Karnataka in the South and Goa in the Southwest. Maharashtra occupies the western and central part of the country and has a long coastline stretching nearly 720 Km along the Arabian Sea. The state has 35 districts, Tahsils 355, census town are 279.*

#### **DATA BASE AND METHODOLOGY:**

The present study is based on secondary data collected from census Reports of Government of India. Covering urban population density of Maharashtra state, census handbook (1991, 2001 and 2011), Socio-economic review of Maharashtra statistical abstract. Population density is a measurement of the number of people in an area. It is an average number population density is calculated by dividing the number of people by area. Population density is usually shown as the number of people per square kilometre. The period from 1991 to 2011 is selected for the observation of pattern of population density changes. The collected data has been processed and analysed by using different quantitative, statistical technique. The tabulated data has been presented by graph. Spearman's Rank correlation method. The formula for computing spearman's rank correlation is as follows

$$P = 1 - 6 \frac{\sum d^2}{n^3} - n$$

**Where:** n= is the total number of observations. d= is the difference in the ranks of two variables in the observation.



### URBAN POPULATION DENSITY OF MAHARASHTRA:

The urban density of Maharashtra is increasing continuously. In 1991, the urban population density of Maharashtra is 3357 Sq. Km. In 2011; the density of Maharashtra is increased up to 5581 Sq. Km. In the two decades urban density is increased by 2224 persons per Sq. km. The density of urban population is increased due to industrialization, education facilities, entertainment facilities and availability of jobs in urban center of Maharashtra state.

### DISTRICT WISE SEX RATIO AND DENSITY OF URBAN POPULATION:

An analysis of density of population in urban areas reveals an utterly irregular, rather erratic trend of variation in the density and size of urban areas.

**Table 1 District wise Sex ratio and density of Urban Population in 2011**

Sr. no	District	Urban population	Urban area in Sq. Km	Density	Sex Ratio
1	Akola	719741	84	8568	953
2	Amravati	1037287	243	4269	956
3	Buldhana	548860	121	4536	944
4	Washim	211413	81	2610	947
5	Yavatmal	598153	167	3582	962
6	Aurangabad	1620170	310	5226	922
7	Beed	514298	159	3235	932
8	Hingoli	178733	57	3136	945
9	Jalna	377429	107	3527	943
10	Latur	624980	85	7353	932
11	Nanded	913898	242	3776	936
12	Osmanabad	281057	130	2162	934
13	Parbhani	569806	113	5043	958
14	Mumbai	3085411	159	19406	831
15	Mumbai Suburban	9356962	446	20980	859
16	Raigad	970195	267	3634	912
17	Ratnagiri	263723	119	2216	1014
18	Sindhudurg	107006	65	1646	979
19	Thane	8514678	1099	7748	865
20	Bhandara	233831	73	3203	981
21	Chandrapur	775378	291	2665	949
22	Gadchiroli	118033	76	1553	965
23	Gondia	225930	95	2378	988
24	Nagpur	3178759	483	6581	954
25	Wardha	423300	90	4703	955
26	Ahmednagar	912617	467	1954	942
27	Dhule	571036	117	4881	934
28	Jalgaon	1342711	348	3858	926
29	Nandurbar	275474	61	4516	893
30	Nashik	2597373	647	4014	920
31	Kolhapur	1230009	341	3607	946
32	Pune	5751182	808	7118	903
33	Sangli	719357	355	2026	972
34	Satara	570378	436	1308	959
35	Solapur	1399091	364	3844	971
	Maharashtra	50818259	<b>9106</b>	5581	903

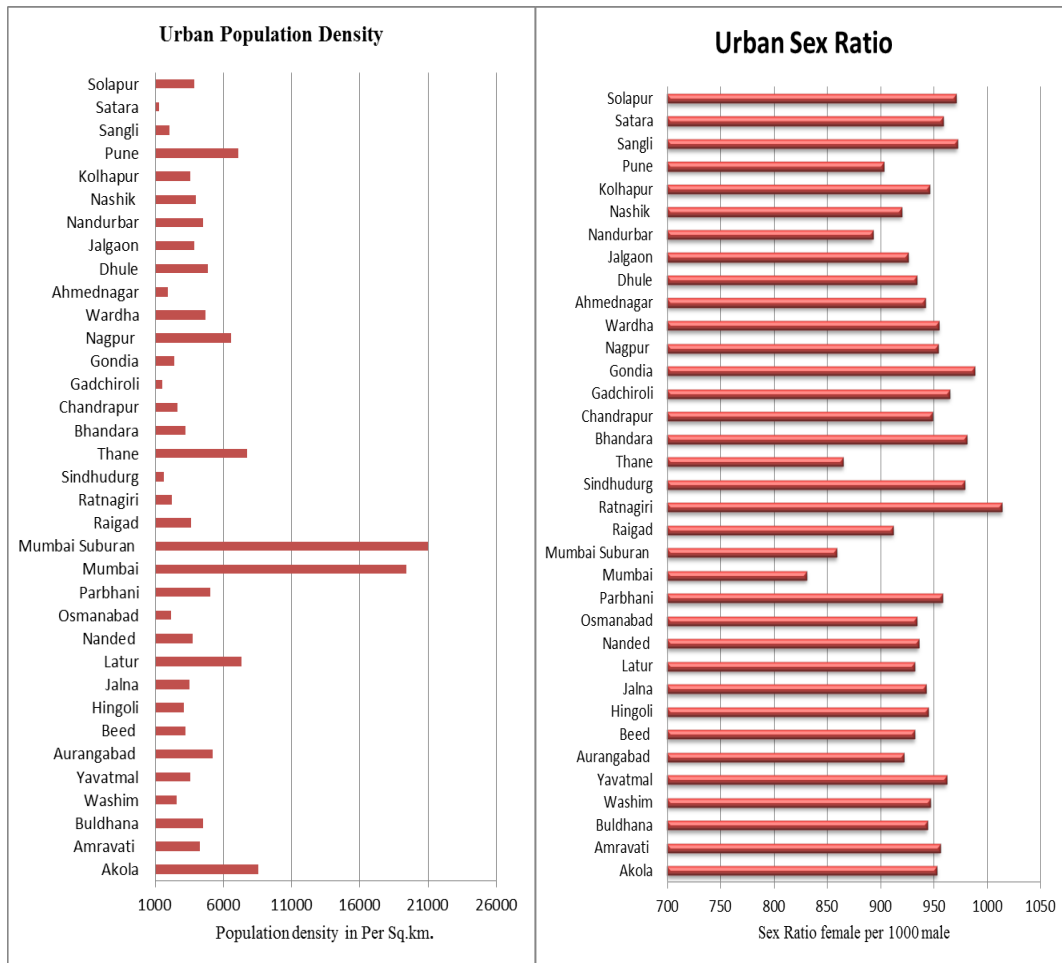
The districts which have small urban areas recorded very high density vice versa. For example, in 2011, Mumbai Suburban district has urban area 446 sq.km. and density is 20980 persons per sq.km. and Satara district has area 436 sq.km. while urban density is only 1308 persons per sq.km. This erratic

situation occurs mainly due to the fact that the urban areas embrace widely varying proportions of vacant land within their statutory limits and the resultant density figures give somewhat a wrong impression.

Under these circumstances, it was occurred more rational to calculate urban density by urban population upon total area which shows the density per sq.km. in total area of the district. It also shows the relationship between urban population and the areal size of the district. The spatial variation of urban density is affected by socio-economic factors viz. the distribution of resources, growth of industries, development of transportation, I.T. industry, infrastructural facilities and administrative centers etc. To facilitate an analysis, on the basis of urban density, the districts of the Maharashtra state have been grouped into six categories.

**Table 2 District wise density of Urban Population**

Class	1991	2001	2011
<b>Below 1000</b>	Satara, Gadchiroli Sindhudurg(3)	Gadchiroli, Satara(2)	-
<b>1000 to 2000</b>	Ahmednagar, Raigad Ratnagiri, Washim Sangli, Osmanabad Yavatmal, Gondia Chandrapur(9)	Sindhudurg Gondia, Ratnagiri Ahmednagar Sangli, Osmanabad(6)	Satara, Gadchiroli Sindhudurg Ahmednagar(4)
<b>2000 to 3000</b>	Bhandara, Amravati Hingoli, Beed Nashik, Kolhapur Aurangabad, Jalna Jalgaon, Solapur Nandurbar, Nanded	Raigad, Washim Chandrapur, Beed Bhandara, Jalna Hingoli, Yavatmal Nanded, Nashik	Sangli, Osmanabad Ratnagiri, Gondia Washim, Chandrapur(6)
<b>3000 to 4000</b>	Dhule, Thane Wardha, Parbhani Buldhana, Pune (6)	Jalgaon, Kolhapur Nandurbar, Aurangabad, Dhule Amravati, WardhaBuldhana, Solapur, (9)	Hingoli, Bhandara Jalna, Yavatmal Kolhapur, Beed Raigad, Nanded Solapur, Jalgaon(10)
<b>4000 to 5000</b>	Latur, Nagpur (2)	Parbhani (1)	Nashik, Amravati Nandurbar, Dhule, Buldhana, Wardha(6)
<b>Above 5000</b>	Akola, Mumbai Mumbai Suburan (3)	Pune, Thane Nagpur, Latur, Akola, Mumbai Mumbai Suburan(7)	Parbhani, Pune Aurangabad, Thane Nagpur, Latur Akola, Mumbai Mumbai Suburan(9)



**Positive Correlation:**

Positive correlation is a relationship between two variables in which both variables move in tandem. A positive correlation exists when one variable decreases as the other variable decreases or one variable increases while the other increases.

**High Sex ratio and High density:**

These classes include only five districts of Maharashtra i.e. Akola, Amravati, Nagpur and Wardha.

**Medium Sex ratio and Medium Urban Density:**

The medium sex ratio and medium density include ten district of Maharashtra, the district are Washim, Beed, Hingoli, Jalna, Nanded, Osmanabad, Raigad, Chandrpur, Jalgaon and Kolhapur.

**Low sex ratio and Low Density:**

This class is no districts are found.

**Negative Correlation:**

Negative Correlation is a relationship between two variables increases as the other decreases and vice versa. In statistics, a perfect negative correlation is represented by the value -1.00 while a 0.00 indicates no correlation and +1.00 indicates a perfect positive correlation.

**High sex ratio and Low Density:**

This class is observed in only three districts i.e. Satara, Gadchiroli and Sindhudurg.

**Low sex ratio and High Density:**

These classes include only four districts in Maharashtra state i.e. Mumbai, Mumbai Suburban, Thane and Nandurbar. Urban population is linearly correlated to industrialization and urbanization; these districts have very high proportion urban population.

**Table no. 3 Correlation between Sex ratio and Density in Maharashtra 2011**

Sr. no	District	Sex Ratio	Density	R <sub>1</sub>	R <sub>2</sub>	d	d <sup>2</sup>
1	Akola	953	8568	22	33	11	121
2	Amravati	956	4269	25	22	3	9
3	Buldhana	944	4536	17	24	7	49
4	Washim	947	2610	20	9	11	121
5	Yavatmal	962	3582	28	15	13	169
6	Aurangabad	922	5226	8	28	20	400
7	Beed	932	3235	10	13	3	9
8	Hingoli	945	3136	18	11	7	49
9	Jalna	943	3527	16	14	2	4
10	Latur	932	7353	11	31	20	400
11	Nanded	936	3776	14	18	4	16
12	Osmanabad	934	2162	12	6	6	36
13	Parbhani	958	5043	26	27	1	1
14	Mumbai	831	19406	1	34	33	1089
15	Mumbai Suburban	859	20980	2	35	33	1089
16	Raigad	912	3634	6	17	11	121
17	Ratnagiri	1014	2216	35	7	28	784
18	Sindhudurg	979	1646	32	3	29	841
19	Thane	865	7748	3	32	29	841
20	Bhandara	981	3203	33	12	21	441
21	Chandrapur	949	2665	21	10	11	121



22	Gadchiroli	965	1553	29	2	27	729
23	Gondia	988	2378	34	8	26	676
24	Nagpur	954	6581	23	29	6	36
25	Wardha	955	4703	24	25	1	1
26	Ahmednagar	942	1954	15	4	11	121
27	Dhule	934	4881	13	26	13	169
28	Jalgaon	926	3858	9	20	11	121
29	Nandurbar	893	4516	4	23	19	361
30	Nashik	920	4014	7	21	14	196
31	Kolhapur	946	3607	19	16	3	9
32	Pune	903	7118	5	30	25	625
33	Sangli	972	2026	31	5	26	676
34	Satara	959	1308	27	1	26	676
35	Solapur	971	3844	30	19	11	121
							<b><math>\Sigma d^2 =</math> 11228</b>

( $R_1$ = Rank of sex ratio,  $R_2$ = Rank of density,  $d$ = differences in the rank of two variables)

$$P = 1 - 6 \Sigma d^2 / n^3 - n$$

$$P = 1 - 6 \times 11228 / (35)^3 - 35$$

$$P = 1 - 67368 / 42875 - 35$$

$$P = 1 - 67368 / 42840$$

$$P = 1 - 1.57$$

$$P = -0.57$$

It is observed from the above calculation that there is a negative correlation between sex ratio and density i.e. -0.57. This shows that there is significant correlation between these two variables. This means with increasing sex ratio there is slight increase in density.

**Table 4 District wise Sex ratio of Urban Population**

Class	1991	2001	2011
<b>Below 850</b>	Mumbai, Thane (2)	Mumbai, Mumbai Suburban, Thane (3)	Mumbai (1)
<b>851 to 900</b>	Aurangabad, Latur, Chandrapur, (3)	Raigarh, Pune, Nashik (3)	Mumbai Suburban, Thane, Nandurbar(3)
<b>901 to 949</b>	Akola, Amravati, Buldhana, Yavatmal, Beed, Jalna, Nanded, Osmanabad, Parbhani, Raigarh, Gadchiroli, Nagpur, Wardha, Ahmednagar, Dhule, Jalgaon, Nashik, Kolhapur, Pune, Sangli, Satara, Solapur(22)	Akola, Amravati, Buldhana, Washim, Aurangabad, Yavatmal, Beed, Hingoli, Jalna, Latur, Nanded, Osmanabad, Parbhani, Ratnagiri, Chandrapur, Nagpur, Wardha, Ahmednagar, Dhule, Jalgaon, Nandurbar, Kolhapur, Sangli, Satara (24)	Bhandara, Wardha, Aurangabad, Beed, Hingoli, Jalna, Latur, Nanded, Osmanabad, Raigarh, Chandrapur, Ahmednagar, Dhule, Jalgaon, Nashik, Kolhapur, Pune (17)
<b>950 to 1000</b>	Ratnagiri, Sindhudurg, Bhandara(3)	Sindhudurg, Bhandara, Gadchiroli, Gondia, Solapur(5)	Akola, Amravati, Yavatmal, Parbhani, Sindhudurg, Bhandara, Gadchiroli, Gondia, Nagpur, Wardha, Sangli, Satara, Solapur(13)
<b>Above 1001</b>	---	---	Ratnagiri(1)

**DIVISION WISE SEX RATIO AND DENSITY OF URBAN POPULATION**

In the Maharashtra state, there are six divisions namely as Amravati, Aurangabad, Konkan, Nagpur, Nasik and Pune. As per the location of division, the density also varies from division to division.

Table three shows the division wise urban density of Maharashtra state. In 1991, Aurangabad, Nagpur, Nashik and Pune divisions show the low urban density. Medium urban density is shown in the Amravati division. Konkan division shows the very high density of urban population.

**Table 5 Division wise density and Sex ratio of Urban Population in 2011**

Sr. no	Division	Urban population	Urban area in Sq. Km	Density	Sex Ratio
1	Amravati	3115454	696	4476	954
2	Aurangabad	5080371	1203	4223	934
3	Konkan	22297975	2155	10347	862
4	Nagpur	4955231	1108	4472	956
5	Nashik	5699211	1640	3475	925
6	Pune	9670017	2304	4197	927
	<b>Maharashtra</b>	<b>50818259</b>	<b>9106</b>	<b>5581</b>	<b>903</b>

**Table 6 Division wise density of Urban Population**

Class	1991	2001	2011
<b>Below 3000</b>	Nashik, Pune, Aurangabad Nagpur (4)	Nashik (1)	----
<b>3000 to 4000</b>	Amravati (1)	Aurangabad, Pune, Nagpur, Amravati (4)	Nashik (1)
<b>4000 to 5000</b>	----	----	Pune, Aurangabad, Nagpur, Amravati (4)
<b>Above 5000</b>	Konkan (1)	Konkan (1)	Konkan (1)

In 2001, low density of urban population is shown in Nashik division. Amravati, Aurangabad, Nagpur and Pune divisions show medium urban density and only Konkan division shows the very high urban density.

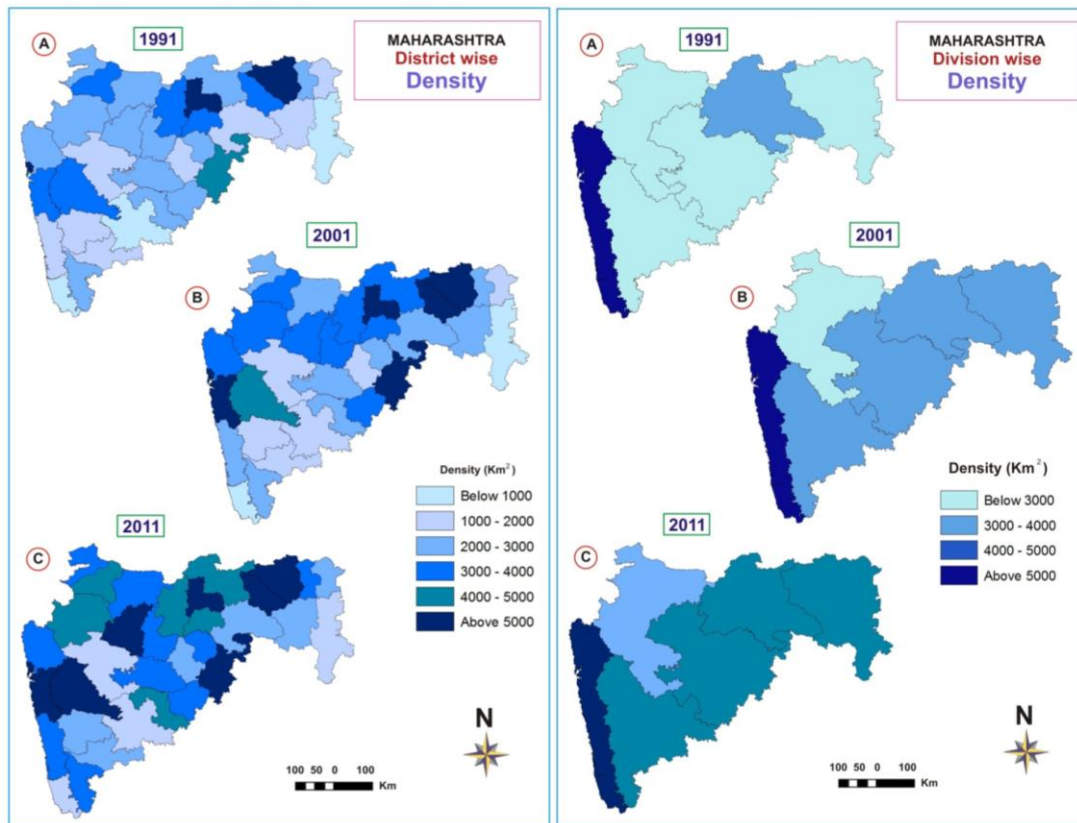
In 2011, there is no division in the group of low urban population density. The medium urban density is observed in Nashik division. Amravati, Aurangabad, Nagpur and Pune divisions show the high urban density. Only Konkan division shows the very high urban density.

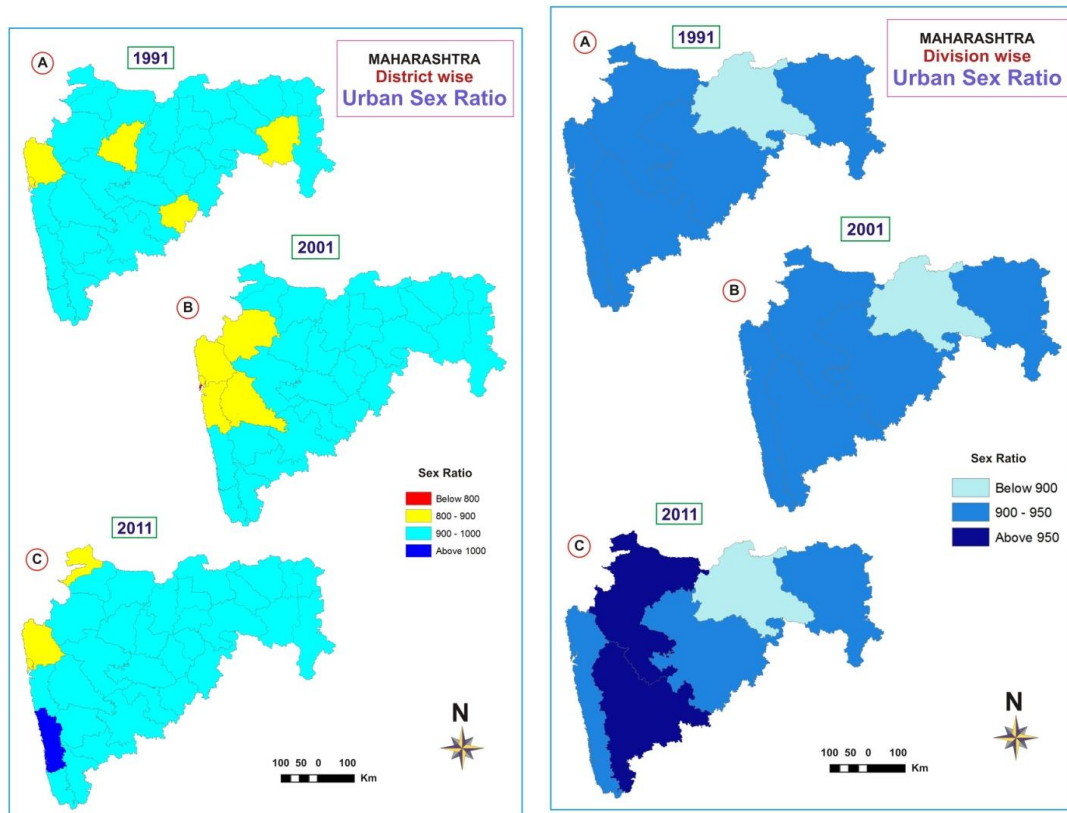
Urban population density shows remarkable growth in Aurangabad, Nagpur and Pune divisions. As per the 1991 census, four divisions have low urban density out of that three divisions converted into medium urban density group in 2001 and in 2011 most of the divisions are shifted in high urban population density group. This is caused by the migration from rural area to the urban centres.

High sex ratio observed in the two division of Maharashtra i.e. Amravati (954) and Nagpur divisions (956), above than the state average sex ratio. Medium sex ratio was observed in Aurangabad, Nashik and Pune division i.e. 934, 925 and 927 respectively. Only one division show the very low sex ratio was observed in Konkan division i.e. 862 females per 1000 male, Konkan division sex ratio was lower than the state average sex ratio i.e. 903 female.

### **CONCLUSIONS:**

A negative correlation between sex ratio and density i.e. -0.57 observed. This shows that there is significant correlation between these two variables. This means with increasing sex ratio there is slight increase in density. The urban density of Maharashtra is increasing continuously. In 1991, the urban population density of Maharashtra is 3357 Sq. Km. In 2011; the density of Maharashtra is increased up to 5581 Sq. Km. The urban sex ratio of Maharashtra is increase. In 1991, urban sex ratio was 874 and 2011 is 903 per 1000 male in Maharashtra state. Very High Urban Density Mumbai, Mumbai Suburban has the highest density in the state. In the overall analysis in 1991, most of the districts have density below 3000 persons per sq.km. After two decades in 2011, twenty four districts have the density above 3000 persons per sq.km. The high sex ratio was observed in total 13 districts of Maharashtra in 2011. Low sex ratio observed in Mumbai, Mumbai Suburban, Thane and Nandurbar.





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