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Impact of Geomorphic Features on Population Density in Sindkheda Tehsil of Dhule District (M.S)

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Abstract:

The purpose of this study is to provide an overview of the existing landform patterns and its impacts on population distribution and settlement in Sindkheda tehsil. Several factors are affecting on Population density mainly are influenced by physical, cultural and economic factors. Among these, physical factors play an important role on the spatial distribution of density. In the study area there is variation in physio-graphic factors. Therefore, Population density greatly influenced.The land forms are very important in distribution and development of any kind of structures and processes. In this study, the role of the land forms in Population density its spatial distribution was investigated and evaluated. For the multidisciplinary approach in this study, different data, maps and sources were used. The present study has major objective to investigate the impact of geomorphic features on population density.

Keywords: *Land Forms, Spatial Distribution. Density, Geomorphic, Population, Correlation, Regression.*

Introduction:

The interdependent relationship between humans and landscapes is an important but still under-developed concept in geomorphology. It is clear, from case studies introduced in various studies that a detailed understanding of how geomorphic impact found on processes and how, in turn, these processes impact on population, is an essential contribution towards the goal of a sustainable future.

Geomorphology offers a broad basis for uniting Geology and Geography and it incorporates the description, origin, composition, development and functions of land forms and offers an appropriate perspective for Geoarchaeology. The applications of geomorphic studies are manifold and varied.

The landforms on the earth's surface have effect on human life in diverse ways. Fertile plains have been designed by the rivers originating in the mountains. These rivers are our constant source of water for irrigation and other purposes hence favorable for dense population. The plateaus are often designated as the storehouse of minerals.

Land form is a dominant factor affecting the uneven distribution of population in study region. Landforms it influence the distribution pattern of population. The most important attributes of landforms which determine population density and distributions are the altitude and slope. The most striking evidence of the influence of altitude and slope on population density and distribution has been observed between hilly and plains region.

Population distribution and 'density' are two separate but closely related concepts. Distribution refers to how people enter the spatial distribution of their space. It is in the linear, dispersed, centrally integrated modes of colonization. Density, on the other hand, is related to population and area ratios. Thus, the distribution is related to the spread of the area of the people, while the density is proportional to the land of the human. Recognizing the role of environmental factors and their effectiveness in the determination of spatial position and in the formation of rural settlements are of great importance in geomorphology. The importance of geomorphology will become more apparent when the damages are enormous and beyond the human endurance, so to prevent this, detailed studies and subtle researches should be conducted.

Slope is one of the effective environmental agents in the distribution system of rural settlements, is the factor of slope. In this regard, the slope has been counted as one of the most important agents of changing and transformation of land surface roughness; therefore, affect the

human's life directly or indirectly.

Review of the Previous Literature:

Xiao Bei Yuana, etl (2018) the influence factors of ground settlement caused byshield tunnel construction is investigated by employing the method principal components analysis. The dimension of numerous variables was significantly reduced by introducing PCA. It is found that factors which have highly influence on ground settlement are different on each geomorphic unit.

Population distribution and its growth are very crucial for any developed or developing region because land use pattern changes drastically with the increasing population. The population distribution patterns are determine by physical factors alone, for within broad framework of physical attractions and constraints cultural factors strongly influence the pattern of distribution (Horneby and Jones, 1980)

The geomorphologic analysis both qualitative and quantitative of any area exposes the various environmental attributes where human adjustment with the former has resulted into the development of the ultimate cultural landscape (Ahmed, 1958).

The human landscape is dependent on physical landscape. These two have a close relation. The latter provides the space where the former is to be settled. In some areas, the natural phenomena(physical landscape) restrain habitation, occupation and communication and compel man to seek other favourable physical landscape. Thus for selecting a place of habitation man has to depend on physical landscape. To recognize rural settlements (Aurousseau, 1921)

Roy Sathi Sampad Jana N C (2015) Before establishing a habitation some general information regarding the area are always being considered by the inhabitants i.e. the nature of the area, climatic characteristics, availability of water, fertility of soil, transport facilities and availability of opportunities for fulfilling the daily needs and scope of earning livelihoods. But from the above discussions it can be clearly concluded that above all physical set up of an area has the main controlling power over the establishment of human habitation.

Density of population helps us to understanding nature of population distribution. It indicates natural resources; it also becomes easier to know possibilities for region. While introducing new transporting network it is essential to know density of population of a region. (Sawant, Athavale 1994) Population density is the most fundamental demographic process with which all other demographic attributes are directly or indirectly associated. Population growth determines density, distribution pattern and composition of population. (Ghosh 1985).

Zaheri (2007) elicited that the role of topography in shaping the physical body of the rural dwellings and the amount of their desirability for East Azerbaijan. In a study, which was conducted by Hasani Mehr (2010), the role of natural factors, particularly climate, topography, vegetation, geology and water resources on the housing construction is undeniable.

Sidharth k and mukharji s (2012) focus on the social and physical system of urbanization and the interaction between them in term of spatial attributes, including dimensions, densities, scale relationships, associations and patterns.

Sarmah et al (2012)carried out a morphometric analysis of a highland microwatershedWahUmbah area by using remote sensing and GIS techniques. Drainage map of the area was prepared from the high resolution satellite image and SOI toposheet. This map was updated using IRS-1D PAN sharpened LISS-III analog data.

Hari Ballabh, Srinivasan Pillay and Viratha Hariram (2014) analyzed that the Dhunsir Gad valley displays an impressive array of morphological attributes that would have presented serious environmental forcing challenges to initial settlers of the region.

Rathod H.B.(2012) In his paper A study of growth and density of population in Udgir tehsil. The aim of this paper is to study the density of population, the density of agricultural of the Udgir tehsil. The physical factors such as climate, soil, socio-economic factors, irrigation, industry, transport are found that the density of population is higher and also agricultural density is more in

Udgir tehsil.

Bhavsar Sandip S. and Nile Uttam V. (2015) elaborately worked on Spatio temporal analysis of changing tribal population Density in Dhule district. They show the relationship of geomorphic factors and concentration of tribal population.

Patil, Borse and Jog (1992) and Patil (1993) have analysed the development of ravines and badlands along Tapi channel and their impact on settlements located on the river banks.

Noteworthy contribution in the field:

Several indian scholar have worked on density of population mookherjee debnath (1981) wrote on population concentration and consideration of density measures and co ralates. Singh Jhuzar and gosal (1986) density of rural population in an Indian situation. Sidharth S and Raju k (1992) density of population: a Panchayat level study in kerala. Morphometric factors influences greatly on Density of population. Studies carried out by Kharkwal (1990), Panda (1990), Patil (2007), Singh (1988), Singh (1980), Vats (1983),Sharma R.K.(2004),are related with the impact of landforms and morphometric factors on Density of population .

Study region:

Shindkheda is one of the tehsil in the Dhule district of Maharashtra. The city is situated on the west side of the Burai River. Shindkheda Tehsil is located in the Northern hilly zone of Dhule District. The latitudinal extent of the tehsil is 21005' to 21025' North and Longitude 74030' to 74055' E. The Shindkheda tehsil is mainly rural in character and has 141 villages and 1 town according to 2011 census.The area of the district is represented in Survey of India degree sheets no. 46G, 46H, 46K, 46L, and 46O, on the scale of 1:50,000. The study area is bordered by Barwani district of the Madhya Pradesh to the north, Jalgaon district to the south east, Dhule tahsil to the south, Nandurbar district to the west.

Physio-graphically the study area is the part of the Deccan Plateau. It is located in the middle of Tapi basin. The study region represents unique topographical features and landforms. This region is characterized by mountain chain, hill ranges, valleys, dykes, lineaments, a belt of fertile alluvial deposits, pediment plain, eroded river banks etc. The lowest elevation is 109 m. from msl along Tapi River near village Takarkheda in Shindkheda tehsil. The physical features of the Shindkheda tahsil can be grouped under divisions as follows:

Objective:

1. To study the geomorphic attributes of the stud area.
2. To identify relationship between geomorphic factors and density of population.
3. To identify changing population density.
4. To find out the spatial variation in population density.

Methodology and Techniques:

Correlation of Population Distribution and Landform

1. To prepare population density maps used Arc GIS 10 and Global Mapper 20 GIS software. Census data were used for generating attribute data.
2. To prepare correlation ship between population density and Landform maps used Arc GIS 10 Spatial Statistic Analysis extension.
3. First prepare Landform ranking weight age data according to population characteristics suitability. Population characteristic ranking weightage prepare as per its favourable values. Very High favourable rank has been 5th rank and descending ranking up to very low favourable rank 1st rank. Thematic weight rank value show as.
4. Using Arc GIS 10 Spatial Statistic Analysis Autocorrelation extensions prepare correlations ship between population density and Landform maps. The term spatial auto correlation defines that the presence of systematic spatial variation in a mapped variable. Where adjacent observations have been similar data values the map shows positive spatial auto correlation. Where adjacent observations tend to have very opposing values then the map shows negative spatial autocorrelation.

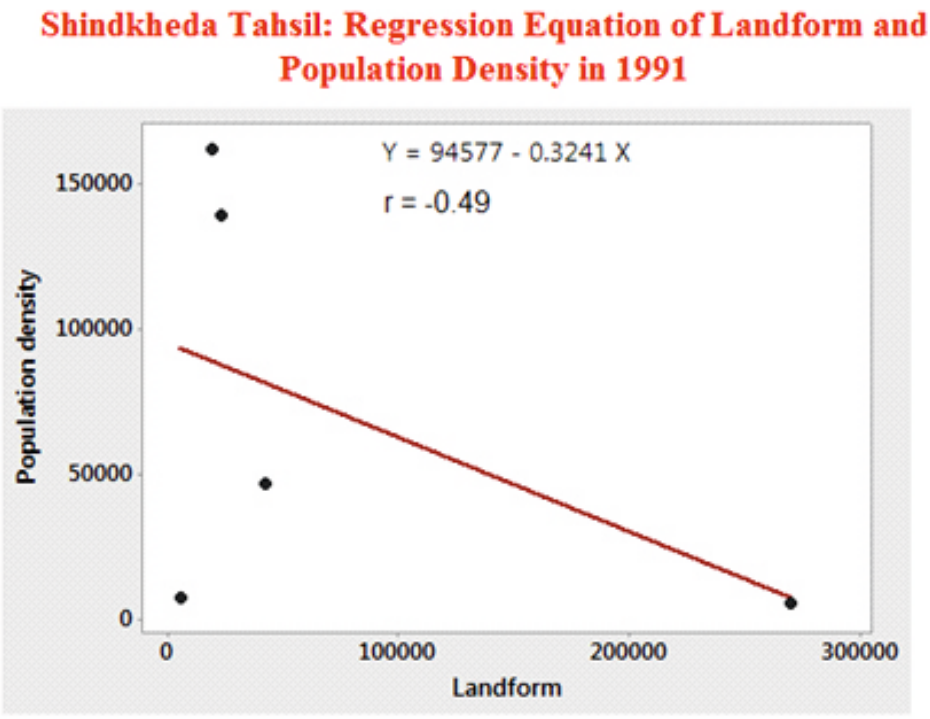


Fig no 1.1

Fig. no. 1.1 shows that regression equation of landform and population density in 1991. Researchers calculate the value of regression coefficient equation as a Y= 94577 – 0.3241X r = -0.49

Fig no 1.2

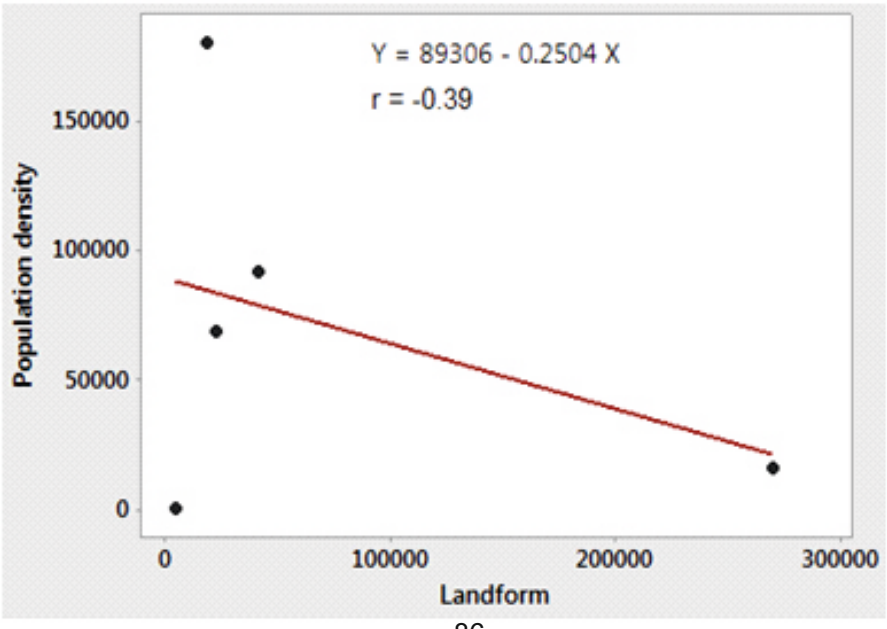


Fig. no.1.2 shows that regression equation of landform and population density in 2011. Researchers calculate the value of regression coefficient equation as a,
Y= 89306 – 0.2504X
r = -0.39

Table No. 1.1
Shindkheda Tahsil: Decadal Growth of Population Density (1971-2011)

Sr. No.	Year	Total Population	PopulationDensity (per km^2)	Decadal Changes in Population Density (percent)
1	1971	201730	155	-----
2	1981	229976	176	13.54
3	1991	262511	201	14.20
4	2001	287517	221	9.95
5	2011	323033	248	12.21
Source: District Census Handbook of Dhule, 1971 to 2011				

Decadal Growth of Population Density (1971-2011)

Table no.1.1 clearly shows the variation of Decadal Density of Population in 1971 to 2011. The uneven spatial distribution of population density is observed in the study region. In 1971 population density of the study region was 155 it rises in 1981 up to 176 in 1991 it was 201 in 2001 it was reaches up to 221. According to 2011 census the density of population of the tehsil was 248 persons per square kilometre. Density of population ranges from 155 to 248 persons per square kilometre in the study area. It is increased continuously in1971-81it was13.54 percent in 1981-9114.201991-2001 was 9.95and 2001-201112.21 percent respectively, because of increasing population over a period.

Table No. 1.2
Shindkheda Tahsil: Circle wise Changes in Population Density (1991-2011)

Sr. No.	Name of Circle	Population Density		Changes in Population Density in %
		1991	2011	
1	Dondaicha	157	206	31.21
2	Vikharm	145	163	12.41
3	Virdel	164	187	14.02
4	Shindkheda	303	383	26.40
5	Varshi	206	242	17.48
6	Nardane	220	263	19.55
7	Betawad	228	257	12.72
8	Khalane	128	155	21.09
9	Chimthane	125	155	24.00
Shindkheda Tahsil		**201**	**248**	**23.38**
Source: District Census Handbook of Dhule, 1991 to 2011				

Table no 1.2 clearly reveals that circle wise density of population in census year 2011. The Shindkheda circle has recorded the maximum density with 383 persons / km. followed by Nardane, Betawad, Varshi and Dondaicha circles with 263, 257, 242 and 206 persons/ km. km, respectively. This is mainly due to the increase in irrigated area, expansion of infrastructural facilities, as well as the implementation of developmental activities. The Khalane and Chimthane has recorded the minimum density with 155 persons/ km. followed by Vikharm and Virdel circles with 163 and 187 persons/ km. respectively. Since last 20 years comparatively in these circles the population density is extremely low, because these circles are situated on undulating surface of low accessibility. Beside that the developmental programs are not properly implemented. There is found low literacy and ignorance about the developmental activities.

In 1991 to 2011 highest population density changes found in Dondaichacircle with 31.21 percent followed by Sindkheda, Chimthane, Khalaneand Nandane with 26.40,24.00,21.09 and 19.55 percent respectively. Lowest population density changes observed in vikharan with 12.41 percent followed by Betawad, Virdel, and Varshi with 12.72,14.02, and 17.48 percent respectively.

Table No. 1.3
Shindkheda Tahsil: Number of Villages and Population Density in 2011

Sr. No.	Name of Circle	Number of Villages and Population Density Categories				
		Bellow 100	101-200	201-300	301-400	Above 401
1	Dondaicha	3	5	7	2	2
2	Vikharm	1	9	4	0	1
3	Virdel	2	9	4	2	0
4	Shindkheda	1	6	4	2	3
5	Varshi	0	5	8	0	2
6	Nardane	0	4	8	1	3
7	Betawad	1	4	2	2	1
8	Khalane	3	5	3	3	1
9	Chimthane	4	8	1	2	3
ShindkhedaTahsil		**15**	**55**	**41**	**14**	**16**

Source: Compiled by the Researcher

Map No. 1.1 and table no 1.3 show the Correlation of Population Density and landform of Shindkheda tahsil from 1991 to 2011. In the last two decades few variations in the correlation of population density and landform were noticed in the circles. Very low correlation observed in 1991 to 2011 in Vikhran southern part of Dondaicha, Chimthane and Shindkheda circles villages of Shindkheda tehsil. In northern, east, and south-east, south side villages of study region show the low correlation of landform and population density. The same centre villages have been Virdel, Shindkheda and Chimthane, circles available for moderate correlation. The study region same northern, eastern, and western border side villages available Active Flood plain, Older Alluvial Plain, Pedi plain, and Water Body - River landform impact have been noticed on population density. This area shows that high and very high correlation.

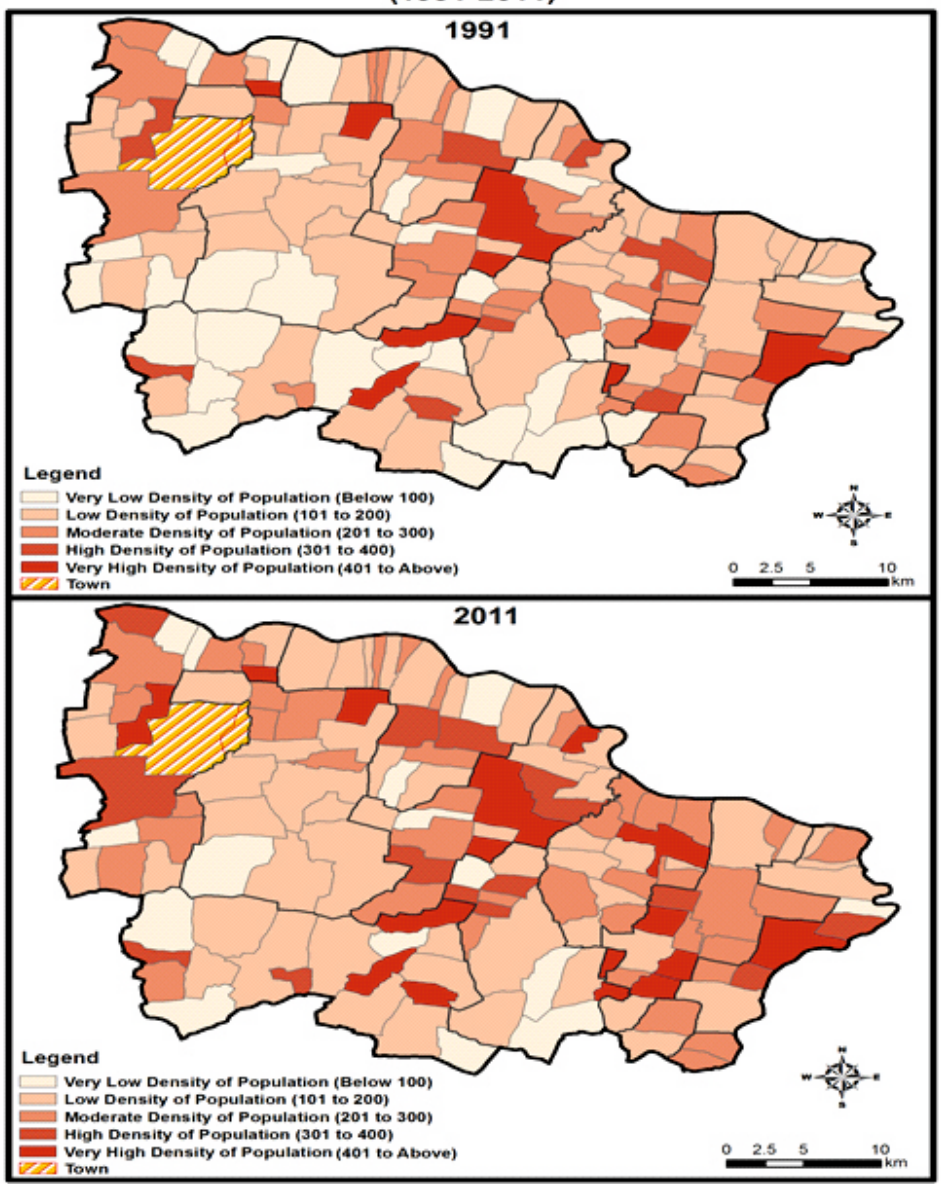
The case studies are useful in illuminating particular intricacies of the population distribution and landform relationship, they are not readily compared. In order for them to be comparable, a general framework of study would need to be developed and applied systematically to review areas in very different circumstances.

The research conducted on population density and geomorphic landform change has been identifying and quantifying the set of innovative connections between demographic and landform development. The researcher has focused on documentation between geomorphic landform changes and demographic factor rather than describe the particular causes for specific changes.

In northern, east, and south-east, south side villages of study region show the low correlation of landform and population density. The most important attributes of landforms which determine population density and distributions are the altitude and slope. The study region same northern, eastern, and western border side villages available Active Flood plain, Older Alluvial Plain, Pedi plain, and Water Body - River landform impact have been observed on population density. This area shows that high and very high correlation of landform and population density. In the Shindkheda tehsil low-lying plains, river valleys, lands with fertile soil have a habit of to have high population densities. The hilly areas with steep slopes and poor-quality soil have a tendency to have low population densities. Besides that, the density of population is also inclined by the landforms.

Map no 1.1

Shindkheda Tahsil: Villagewise Density of Population (1991-2011)



In the wide variations in pattern of population density among the circles in the region has been recorded. The table no. 1.1 also shows a change in percentage of 1991-2011population density. In this decade, the highest changes recorded in Dondaicha circle with 31.21 per cent followed by Shindkheda, Chimthane, Khalane and Nardane circles with 26.40, 24.00, 21.09 and 19.55 per cent, respectively. In the Vikharm circle the lowest changes found with 12.41 per cent followed by Betawad, Virdel and Varshi circles with 12.72, 14.02 and 17.48 per cent, respectively.

Village wise Density of Population in 2011:

Villages of Very Low Density of Population (Below 100 persons per Sq. km.):

Table no.1.4 shows that in 1991 the villages with incredibly low density of population are considered which have below 100 persons per sq. km. are 15 villages existed in study region. These villages are Rudane, Ghusre, Bhilane D., Satare, Sondale, Chawalde, Kalwade, Chimthawal, Pimpri, Chandgad, Chaugaon Kh, Anjanvihire, Achhi, Alane and Vadade

The researcher observed that due to modernization, Industrialization and health facility the death rate in study region rapidly declined. Hence population increased in tremendous proportion, as well as the density of population in rural areas is affected. Not only the population density in circles has changed but the regions all over density have also changed. In 1991 the population density in the region was 201 persons per sq km which has increased to 248 persons just in last two decades.

On plains, population density is higher than the population density on sloppy land, mountains, and hills. About 3/4 population lives in the plains area of study region. It is possible to have better farming, mobility, transport, and communication, etc. in the plains than on rocky lands. In the past, civilizations developed mostly in the plains. In the hilly areas, the amount of cultivable land is small, productivity is low, cost is high and physical existence is uncomfortable.

Villages of Low Density of Population (101 to 200 persons per Sq. km.):

Low density of population observed in 55 villages of Shindkheda tahsil in 2011. These villages are Dangurne, Arave, Dhandarne, Varzadi, Methi, Akkalkos, Vikhurle, Degaon, Sahur, Akadsa, Kamkhede, Darana, Dalwade P.s., Gorane, Kodade, Kumbhare, Temlay, Shirale, Parsole, Vadode, Chirne, Waghadi Kh, Hispur, Mandal, Wadi, Vadli, Tamthre, Zirwe, Mudawad, Babhalde, Mukati, Ranjane, beside that the another villages are

Langhane, Varsus, Shewade, Khalane, Vaipur, Amalatha, Sulwade, Chaugaon Bk, Vikhram, Kurukwade, Daswel, Jogshelu, Vikwel, Sonshelu, Kharde B.k, Kampur, Daul, Dattane, Kumrej, Valkhede, Vasamane, Warpade and Dhawde. It is noted that study region is predominantly an agricultural and population depends on agricultural activity in study region.

Villages of ModerateDensity of Population (201 to 300 persons per Sq. km.):

Table no.1.3 shows that moderate population density which varies with 201 to 300 persons per square kilometre was observed in 41 villages in 2011. These villages are Nishane, Vani, Melane, Rewadi, Warud, Rahimpur, Bhadne, Sukwad, Bamhane, Chudane, Babhulde, Nirgudi, Jatode, Ajande Kh, Dalwade P. Nandurbar, Humbarde, Salwe, Suray, Hol P.b., Waghadi Bk, Shendwade, Jasane, Dabli, Kalgaon, Vaghode, Kanchanpur, Mhalsar, Nimgul, Pathare, Tavkhede P.b., Mandane, Dabhashi, Gavhane, Pashte, Lohgaon, Dongargaon, Varul, Karle, Pimparkheda, Tavkhede P.n. and Newade. The increase in density is associated with increase of population. Therefore, increased population needs increase in economic opportunities in various sectors like primary, secondary, and tertiary, in study region.

Villages of High Density of Population (301 to 400 persons per Sq. km.):

High density of population observed in 14 villages of Shindkheda tahsil in 2011. These villages are Takarkhede, Ajande Bk, Patan, Darkhede, Jakhane, Chilane, Kadane, Mahalpur, Padhawad, Hatnur, Virdel, Pimprad, Malpur and Devi. This trend of density clearly reveals that during the last decades, there has been consistent increase in the density of population, all these villages have recorded remarkably high population density, because of the region impact of Active Flood plain, Gullied Tract, Pediplain, Gullied Land and Older Alluvial Plain geomorphic landform available in this

area have generally remarkably high population density.

Villages of Very high Density of Population (401 to Above persons per Sq. km.):

Very high density of population observed in 16 villages of Shindkheda tahsil in 2011. These villages are Rohane, Sonewadi, Sarwe, Kalmadi, Varshi, Malich, Amarale, Dhamane, Rami, Chimthane, Parsamal, Betawad, Zotwade, Vitai, Shindkhede and Nardane. There are number of factors responsible for the variations in the density of population. Some of them have already being discussed in the preceding discussion. Even though, the nature of terrain, proportion of land under agriculture, degree of urbanization and industrialization are some of the important factors responsible for the variations in density of population in the Shindkheda tehsil.

Table No. 1.4
Shindkheda Tahsil: Category Wise Changing Population Density (1991-2011)

Sr. No	Category of Population Density	Changing Population Density			
		1991	Percent	2011	Percent
1	Bellow 100	29	20.56	15	10.63
2	101-200	61	43.26	55	39.00
3	201-300	34	24.11	41	29.07
4	301-400	08	05.67	14	09.92
5	401-Above	09	06.38	16	11.34
	Total	141	100.00	141	100.00

Source: Compiled by the Researcher.

Category Wise Changing Population Density (1991-2011)

Table no 1.4 shows the population density category wise changes in number of villages and population density in 1991 to 2011. Overall, these studies observe of that the number of villages having exceptionally low and low density of population decreased in 2011 as compared to 1991.According to 1991 census, extremely low population density was recorded in 29 villages of study region. These numbers of villages have been decreased up 15 villages because of natural growth of population in last two decades. 61 villages have 101 to 200 persons per Sq. km., 34 villages have 201 to 300 persons per Sq. km. population density. 08 villages have 301 to 400 persons per Sq. km. More than 401 persons per Sq. km density of population observed with 09 villages in 1991. But it increased and reaches up to 16 villages.

Conclusion:

Finally, this research analyzes the correlation between the geomorphic landform and population density in Shindkheda tehsil and the result shows that the landform is an important factor affecting the density of population. Researchers find out the population distribution and geomorphic landform relationship, it is fundamental to consider both numbers of people and their impact. Population density influences landform patterns in association with depletion study region peoples. In the study region northern, eastern, and western border side villages due to existence of Active Flood plain, Older Alluvial Plain, Pedi plain, and Water Body - River landform impact have been found on population density. This area shows that high and very high correlation of landform and population density. In the Shindkheda tehsil low-lying plains, river valleys, lands with fertile soil have a habit of to have high population densities. The hilly areas with steep slopes and poor-quality soil have a tendency to have low population densities. Besides that, the density of population is also inclined by the landforms.

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