

# GIS Mapping for Population Distribution in Surat

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**Abstract:** In India, especially in urban cities, the population is increasing mostly due to rural-urban migration in accomplishing higher standard of living. The current population of the world is growing at the rate of 1.13% per annum. These increased populations needing basic amenities for provision of which is challenging to the urban managers. To provide better and efficient facilities, the understanding of trend of population distribution and growth is essential. In light of the thought, this paper aims to map the population distribution of Gujarat's second populous city, Surat. Mapping of population distribution for last three decades i.e. from 1991 to 2011 for a study area of current administrative boundary Surat Municipal Corporation is performed using GIS tools. Results are aimed to help identification of the direction of population growth and in specific, geographical location of wards (or councils) that are acting as growth poles. The population density maps show most densely saturated wards. This research shall help urban planners in discovering the areas having a potential for development and abstracting out the loopholes for controlling the population distribution in the particular pockets.

**Keywords:** GIS, population density, population growth, Surat, Urbanization

## I. INTRODUCTION

The urban areas are facing population increase day by day, due to migration in search of betterment of economic conditions, providing basic amenities to these migrants are become difficult for the urban managers. If the sufficient basic amenities are not allocated, city areas will turn out to be the hub of slums and bloats city's beauty. Therefore, mapping of the population becomes necessary for the urban development authority to understand the trends of population distribution. The urban population maps will provide a "picture" that shall help in identification of the environmental and natural resources threatened by such growth, and suggests the likely future directions of population growth.

Surat is world's fourth fastest growing city (Cit16), and people is also increasing at a booming rate. To accommodate these growing population proper management should be there, so to achieve that this study will help to identify the population direction.

GIS technology is very useful in the formulation and implementation of spatial and temporal changes. These techniques are quite developed and becoming operational now. GIS tools for identifying and mapping the urban population will give efficient results than traditional methods, that too, in a shorter time.

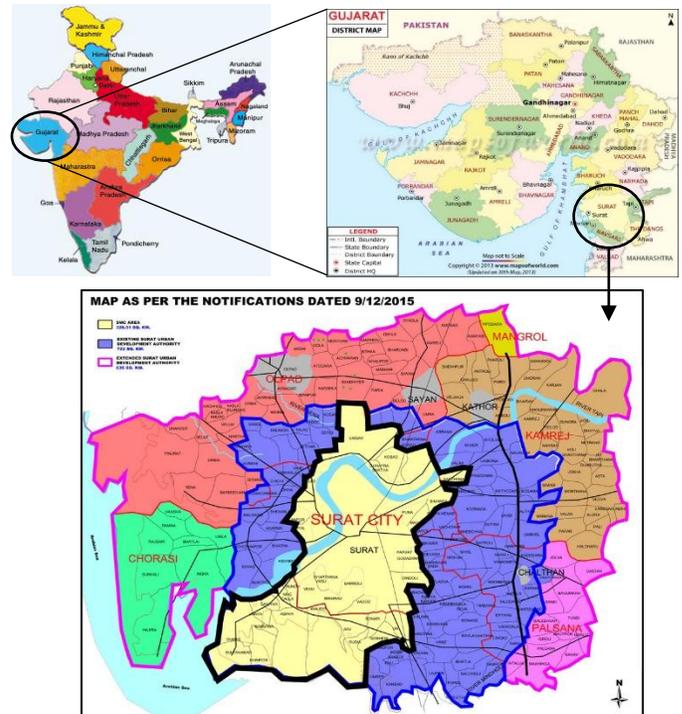
## II. OBJECTIVES

Below are the objectives of the current research work:

- Collection of ward-wise demographic data of last three decades from Census of India;
- Availing current census ward map of SMC from Surat Municipal Corporation;
- Mapping of population distribution and population density;
- Identify the geographical locations of wards that are acting as growth poles

## III. STUDY AREA

The present study is carried out in Surat, Gujarat, India. Surat is the second largest populous city of Gujarat and ranked seven largest populous cities in India (Registrar General & Census Commissioner, 2011). The population of the Surat is 44,61,002 (4.46 million), and area of the Surat Municipal Corporation (Surat Urban Development Authority, 2006) is 326.515 km<sup>2</sup> according to the census 2011. It is situated on the banks of Tapi river. Figure 1 below shows the location of Surat city. Surat is divided into seven administrative zones and 101 census wards.



**Figure 1** Location of Surat

The above figure shows the administrative boundary of the Surat Urban Development Authority (SUDA) which acts as a controlling and regulating body for the urbanization (SUDA, Surat, 2013). In the above image, the central yellow portion is the

administrative limit of Surat Municipal Corporation and the area of the current research.

**IV. DATA SOURCE AND ANALYSIS**

Following data are used in this study to fulfil the objectives of the research.

- Ward-wise population data for the year 1991, 2001 and 2011 from the census of India;
- Census ward map of SMC and demographic data from the Surat Municipal Corporation.

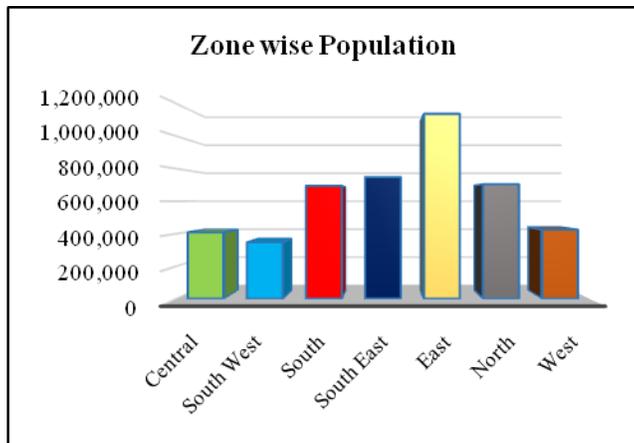
Below table show the information about seven zones that distributes the city geography.

**Table 1 Area of Zones in Surat city**

Sr. No	Zone	Area (in Km <sup>2</sup> )
1	Central	8.18
2	South West	111.912
3	South	61.764
4	South East	19.492
5	East	37.525
6	North	36.363
7	West	51.279
8	<b>Total</b>	<b>326.515</b>

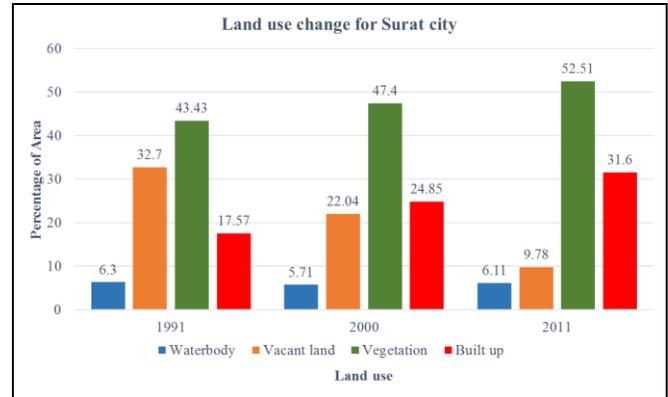
(Source: Surat Municipal Corporation, 2015)

Population in these zones are visualized in the chart below.



**Figure 2 Zone-wise population in Surat**

The GeoTiff Images of UTM Zone – 43 over Path 148 and Raw 45 for three decades were obtained from USGS Data. The images were captured by Landsat TM (Thematic Mapper) with seven bands having spatial resolution of 30 m. the images were applied with AOI layers and city boundary area was obtained. Data analysis was carried out using unsupervised classification wherein the built up area, water bodies, vacant lands and vegetation cover areas were identified. These images were further enriched with population data to generate thematic maps. Overall land use changes were identified as shown in chart below.



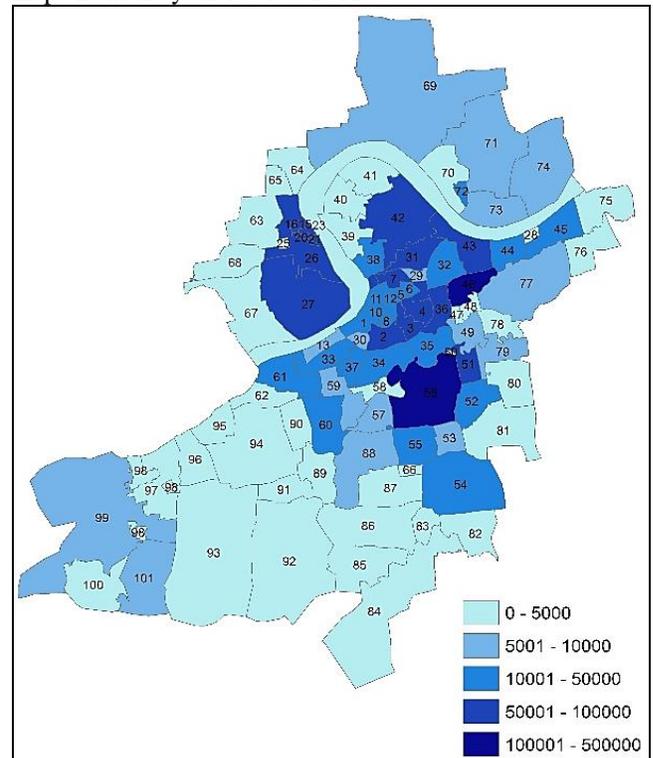
**Figure 3 Land use change in Surat over past three decades**

**V. RESULTS AND DISCUSSION**

After obtaining required data, maps are prepared for the population distribution and population density using GIS tools. Maps are prepared for the year 1991, 2001 and 2011. These maps contain the boundary of each census zone, ward number, and the population or population density of that particular ward.

**A. Population distribution maps**

Following maps are of the population distribution (in persons) maps from the year 1991 to 2011.



**Figure 4 Population distribution map 1991**

Population distribution maps indicate the direction of population growth in which the people of the core part of the city is increasing and spreading to the outskirts of the city.

It is found in a result that four wards are acting as growth poles of the population distribution. These four wards are marked in the figure 4 which are Ward No. 27 (Adajan), Ward No. 42 (Katargam), Ward No. 77 (Puna) and Ward No. 56 (Udhna).

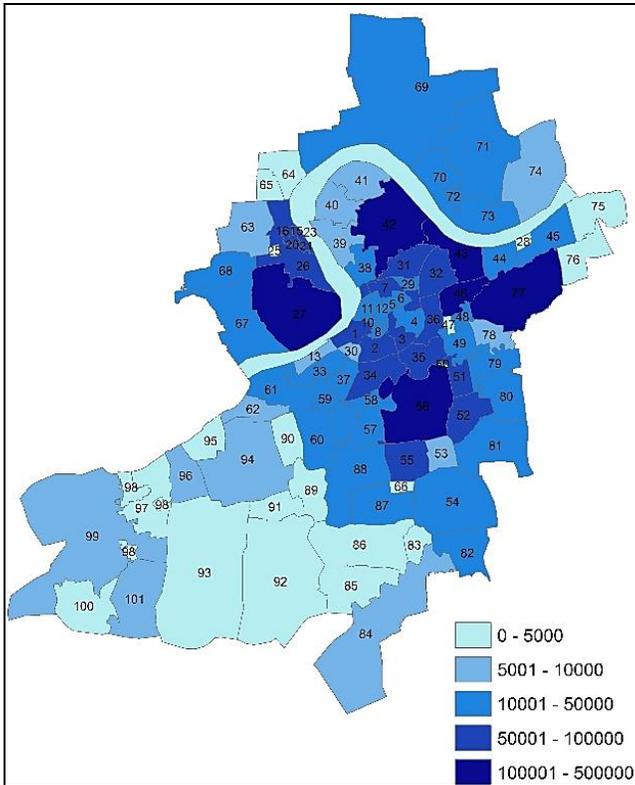


Figure 5 Population distribution map 2001

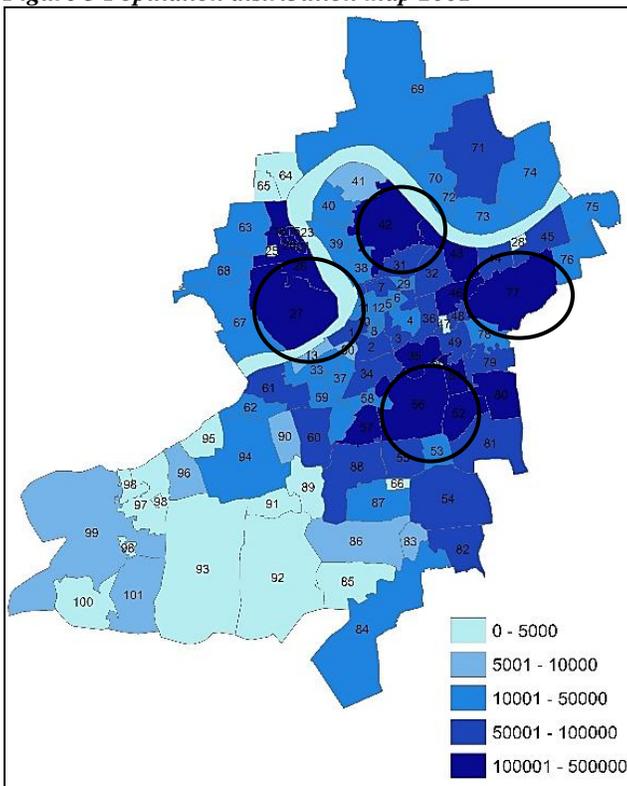


Figure 6 Population distribution map 2011

Thoroughly inspecting three population distribution maps it can be seen that population is increasing in and around these four wards. The major population change is in Puna ward where population goes from 8.5 thousand in 1991 to 346.5 thousand in

2011. In Katargam ward also population increased from 71.1 thousand in 1991 to 328.4 thousand in 2011.

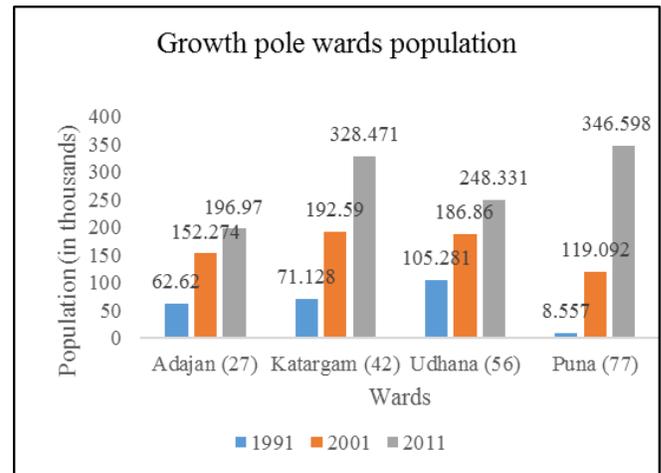


Figure 7 Growth pole wards population

Chart above shows the population growth of that four wards which indicate that population is increasing very hugely in these four wards.

### B. Population density maps

Following maps are of the population density (in ppha - Persons Per Hectares) maps from the year 1991 to 2011.

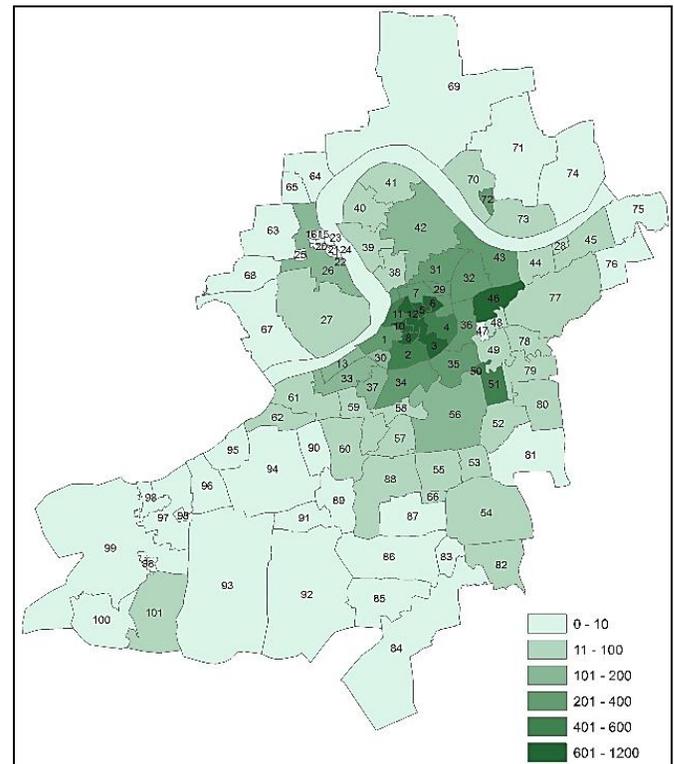


Figure 8 Population density map 1991

Population density maps are showing the fullwards regarding population density. The density of the core part is growing and decreasing to the outwards. Some wards like Anjana, Magob, and Karanj, have density more than 1000 ppha.

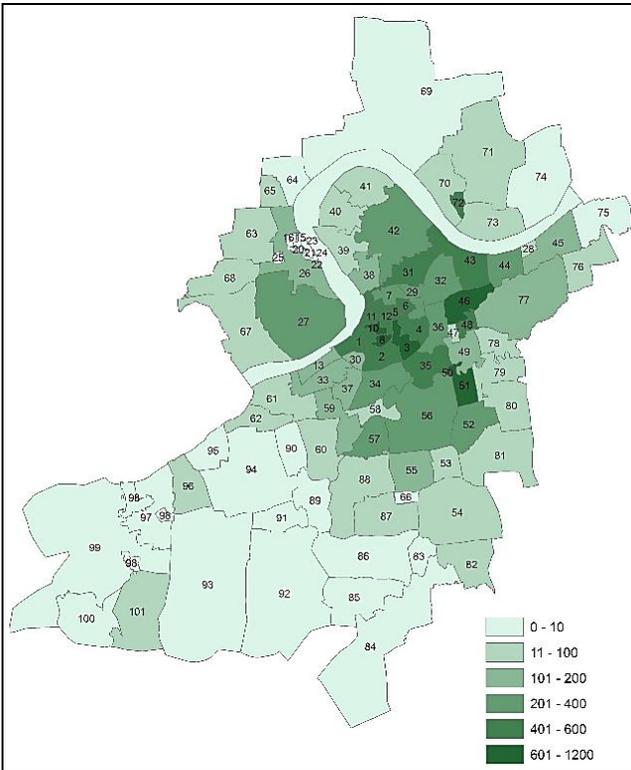


Figure 9 Population density map 2001

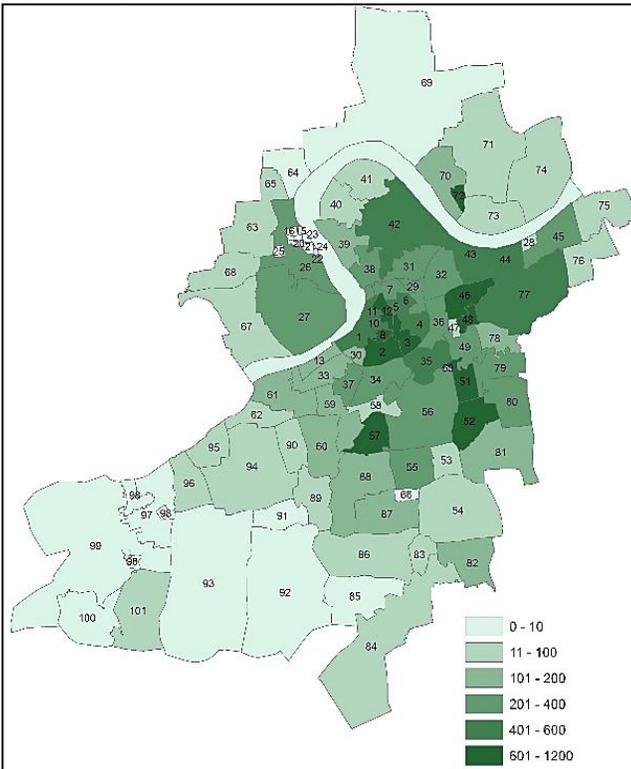


Figure 10 Population density map 2011

Chart below shows the population density of the wards which are having huge increment in their population density from year 1991 to 2011. Highest increment in population density noticed in ward no 50 Magob in which it goes from 40 ppha in 1991 to 1099 ppha in 2011.

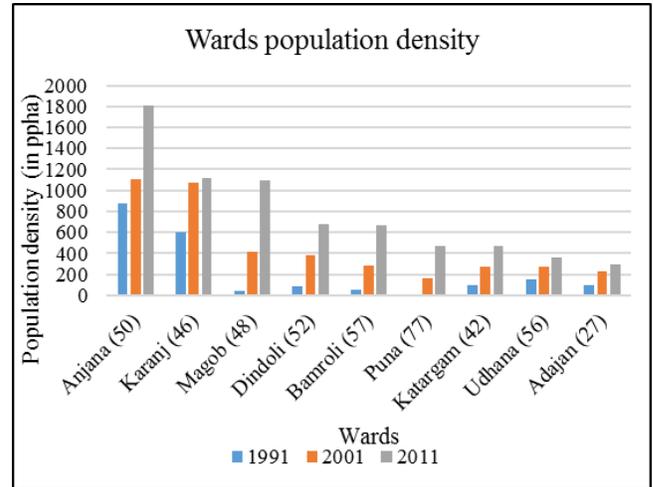


Figure 11 Wards population density

## VI. CONCLUDING REMARKS

This study identified and mapped the population direction and growth in ageographical manner which will help to urban planners in planning land use schemes according to the trend of population growth that also helps in providing better and efficient basic amenities which will eliminate the problems like slums. It can also assist in making a future strategy to control the population growth in the particular area. Study will also help in identifying area of rapidly increasing population and population density.

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