

Implication of Census data for Urban Vulnerability Assessment– A case of Surat City

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Introduction

Gujarat is one of the most urbanized states in India. Today Gujarat accounts for 6% of total geographical area, 5% of the total population, 6.9% of urban population and 2.6% of slum population, 10% of factories, 12.7% of net value manufacturing and 24.6% export in the nation As per census 2011, total 2.57 cr. (42.58 %) people are living in the Urban Gujarat out of that 16, 80,095 are in identified slums. In five decades urbanization rate of the state have increased by 66%. In last decade in Urban Gujarat population has increased by 5.2%. In urban Gujarat proportion of scheduled caste population is 6.9% and scheduled tribe population is 3.5% (Census 2011), below poverty line population is 17.9% (2009-10). This data includes Gujarat state in to the list of rapidly urbanizing, industrializing business hub of the nation.

Gujarat has 8 municipal corporations, 159 municipalities, 195 statutory towns and 103 slums reported towns. Slum population has reduced by 1.2%. Improvement in literacy rate is 4.5% and women literacy rate is 6.5%. As per 2011 census literacy rate of slum dwellers is 60.4% ,proportion of Schedule cast and tribe population in slum is 11.0% and 7.5% respectively which is more than double of overall urban. Thus slums have social vulnerability due to poverty added by illiteracy, cast and tribes.

Vulnerability assessment in urban settings has become a crucial field for researchers, policy makers and administrators. The governing factors of vulnerability assessment studies mainly include scale of assessment; the kind of impact or hazard being considered; and the target group or system being assessed. Assessing vulnerability to climate change has several approaches and various methodologies have been used for such studies across the world. A review of these methodologies indicates that the scale of assessment is an important determinant of the kind of data collection required. Usually for micro level studies primary data is collected, and for macro level studies an analysis of broader scale indicators is done using secondary data. Vulnerability assessment can be at macro level, with a secondary data that can provide a base for micro level studies. Vulnerability Assessment is significant as it is an important method in developing policies and adaptation plans for specific vulnerable groups and areas. It thereby forms the basis for establishing response mechanisms towards climate change risk reduction.

Vulnerability indicators include physical, environmental, climate, economic, social, demographic, political, public and private sector services, For example, Physical vulnerability is one of the indicators of climate change and disaster. As per 2011 census in slums concrete housing is 78.9%, tap water supply is 84%, access to latrine is 64%, access to electricity is 92% and use of LPG / kerosene is 59%.

Rationale of the study

Climate change vulnerability assessment can be carried out with Macro level and micro level. Macro level approaches are demographic and make use of large scale existing data within

Government systems, E.g., Census in Indian context. On the other hand, micro level approaches are taxonomic and carried out regionally with cross sectional primary assessments. Often researchers make use of combination of both approaches for building substantial evidence. In this context, census data can be used for urban vulnerability profiling and understanding the scope of further micro-level studies to be carried out locally. The current study represents how macro-level vulnerability assessment using census data can provide backbone for micro-level studies.

Materials and Methods

Study Area

The study area is Surat city that is situated in the southern part of Gujarat state. It lies between 21.112° North latitude & 72.814° East longitudes. It is situated on the bank of river Tapi with flat coastal land. The administrative structure of Surat Municipal Corporation is decentralized into seven zones namely North, South, East, West, South West, and South East for provision of various public health services. It is one of the most dynamic cities of India with one of the fastest growth rate due to immigration from various parts of Gujarat and other states of India. Climate of the city is moderate with maximum temperature 44.5° C & minimum of 9.9° C the average rainfall is 60 inches. The total area of the city is 326.515 sq. km.

Study Design

The present study was a descriptive retrospective study based on secondary data. The study indicators selected from the census database can be summarized as follows

Inputs	Indicators	Output
Demographics	<ul style="list-style-type: none"> • Decadal Population growth • Density(sq.km) • Growth rate • Sex Ratio • Occupational Classification • Literacy rate • Area expansion 	Demographic profile
Socio economic characteristics	<ul style="list-style-type: none"> • Total no of census Households • Wholly residential houses • Partly residential houses • Vacant houses • Census Houses put to use • No of slum blocks • Slum Household • Slum population • SC and ST population • Houseless Population 	Social and physical vulnerability profile

Data analysis

Data collected from various records was entered in MS- Excel 2007 spreadsheet and later on processed and analyzed manually. The data was described and presented in form of graphs, charts, tables etc

Results

Demographic profile- Surat city

Surat is Gujarat's second largest city and India's eighth most populated city. Demographic profile of Surat city provides an overview of its population size, composition, and territorial distribution. The profile develops an understanding of how these characteristics have changed over time. The profile presents the data from Census of India for Surat Municipal Corporation area.

Particulars		India	Gujarat	Surat District	Surat municipal corporation
				(including SMC Area)	
Area (Sq.K.M.)		29,95,470	1,96,022	7,657	326.515
Population	Persons	1,21,05,69,573	6,04,39,692	60,81,322	44,66,826
	Male	62,31,21,843	3,14,91,260	34,02,224	25,43,145
	Female	58,74,47,730	2,89,48,432	26,79,098	19,23,681
Decadal population growth 2001 - 2011	Persons	181959245 (17.69 %)	9768675 (19.28%)	1086148 (21.74 %)	1590452 (55.29%)
	Male	90965071 (17.09 %)	5105683 (19.35%)	679685 (24.97 %)	912299 (55.94 %)
	Female	90994174 (18.33 %)	4662992 (19.20%)	406463 (17.89 %)	678153 (54.45 %)
Decadal growth rate	1971-81	24.65	27.67	39.53	-----
	1981 - 91	25.73	21.19	36.29	-----
	1991 -01	21.34	22.66	47	76.02%
	2001 -11	17.69	19.28	21.74	55.29%
Variation in growth rate	1991-01	-4.39	1.47	10.71	-----
	2001-11	-3.65	-3.38	-25.26	-20.73
Density of population		404	308	794	13680

Sex Ratio (Females per 1000 Male)		943	919	787	756
Population in the age group 0-6 (% Age)	Persons	164478150 (13.59%)	7777262 (12.87%)	736286 (12.11%)	549810 (12.31%)
	Male	85732470 (13.76%)	4115384 (13.07%)	401315 (11.80%)	304122 (11.96%)
	Female	78745680 (13.40%)	3661878 (12.65%)	334971 (12.50%)	245688 (12.77%)
Sex Ratio		919	890	835	808
Literates	Persons	763498517 (72.99%)	41093358 (78.03%)	4571410 (85.53%)	3442541 (87.89%)
	Male	434683779 (80.89%)	23474873 (85.75%)	2687468 (89.56%)	2042459 (91.22%)
	Female	328814738 (64.64%)	17618485 (69.68%)	1883942 (80.37%)	1400082 (83.44%)
Scheduled Cast	Total	201378086 (16.63%)	4074447 (6.74%)	158115 (2.60%)	105572 (2.36%)
Scheduled Tribe	Total	104281034 (8.61%)	8917174 (14.75%)	856952 (14.09%)	131552 (2.95%)

Population density

Density of population is one of the important indicators for studying population concentration and it is defined as number of persons living per square kilometer.

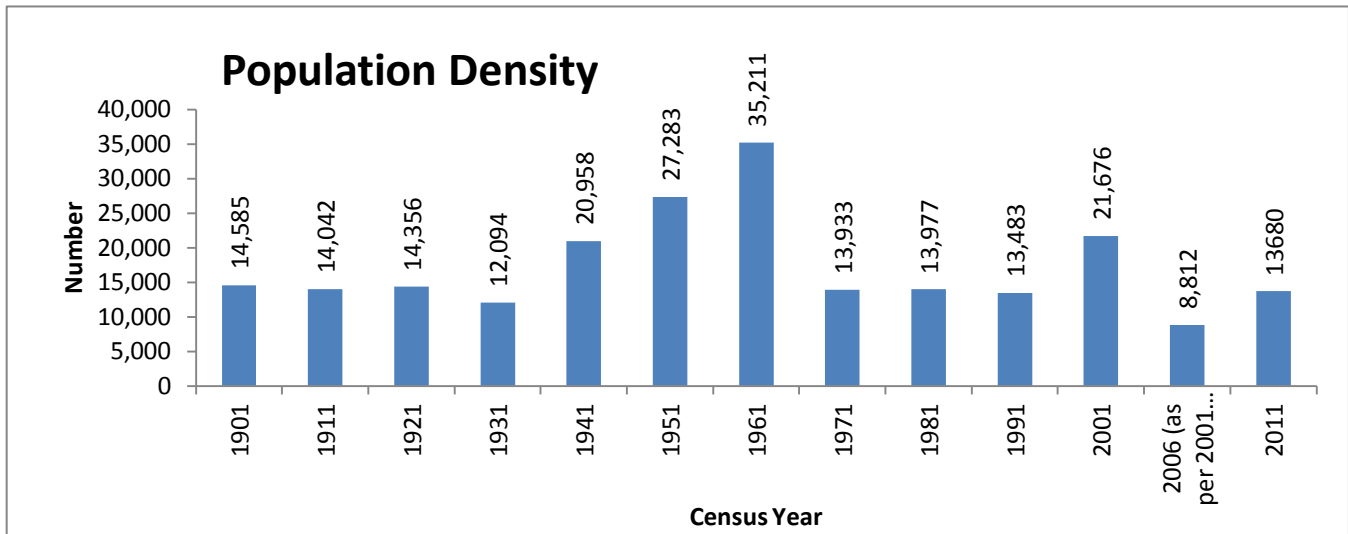


Figure 1: Population density of Surat

The trend of increase in population density is observed up to 1971 subsequently it is not showing positive correlation with increasing population due to increase in the city area as a result of extension of city limits. According to Census 2011, the density of population is worked out as 13680 persons per sq.km as against 21676 persons per sq.km.

Population growth rate

Surat is known for diamonds, textiles and recently for diamond-studded gold jewellery manufacturing. Real Estate is a new emerging business in Surat. The city houses 70% of the nations and 42% of the world's total rough diamond cutting and polishing business. It is the country's major man-made fabric producing area. Surat is one of the most dynamic cities of India with a very fast population growth rate due to immigration from various parts of Gujarat and other states of India.

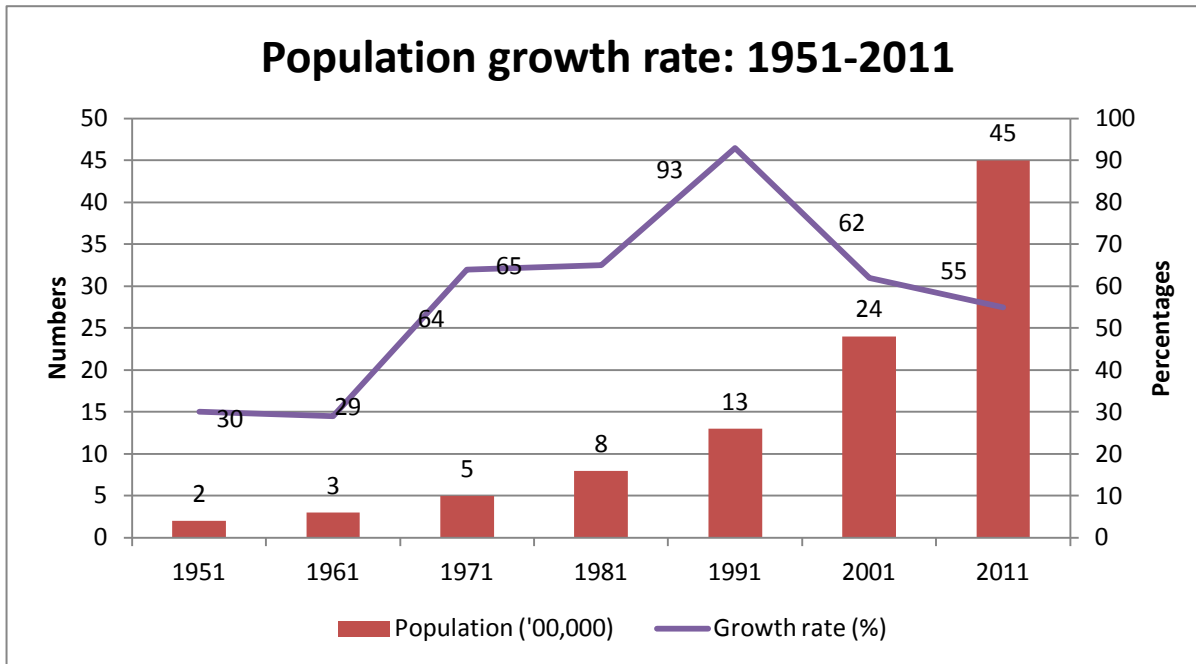


Figure 2: Population growth rate of Surat

The population growth rate was almost same from 1951 to 1961 (30) and from 1961 to 1971 (29). Population almost doubled up between 1961-1971 and 1971-1981. Growth rate of population of Surat city is more influenced by influx of migrant population and the trend indicates influx doubling up the population at two years interval. The growth rate between 2001 and 2011 comes to 55%.

Sex ratio

Sex ratio is very important demographic indicator and represents one of the social characteristics of population. It is defined as number of females per 1000 males.

Male-female distribution, Surat: 1901-2011

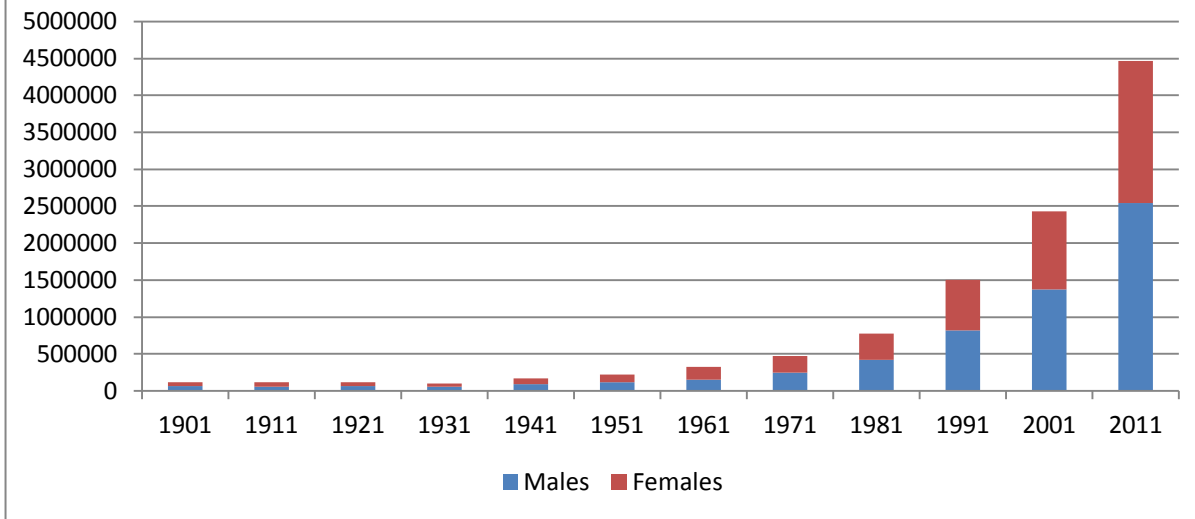


Figure 3: Male-female distribution, Surat city

Sex ratio of India, Gujarat and Surat

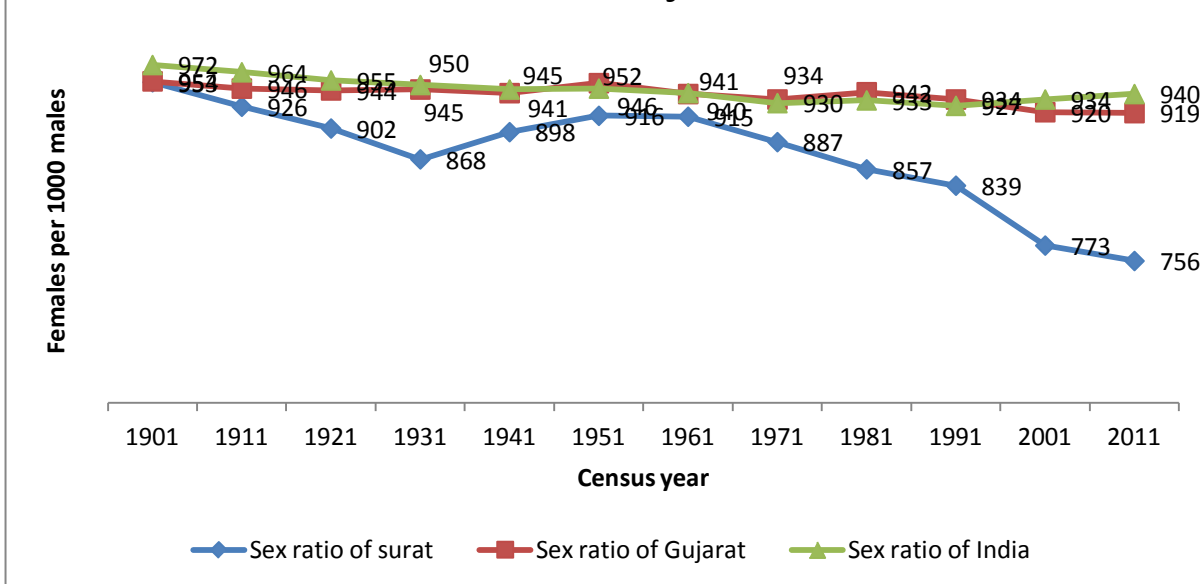


Figure 4: Sex-ratio of India, Gujarat and Surat city

The city has low sex ratio in 2011, of 756 female per 1000 males. The corresponding figure of sex ratio at all India is 940 and for Gujarat state is 919. There is consistent significant decline in sex ratio of city in last three decades and it has always remained considerably lesser as compared to state and country.

Literacy

Literacy is one of the population development indicators, which are worked out during the course of population census.

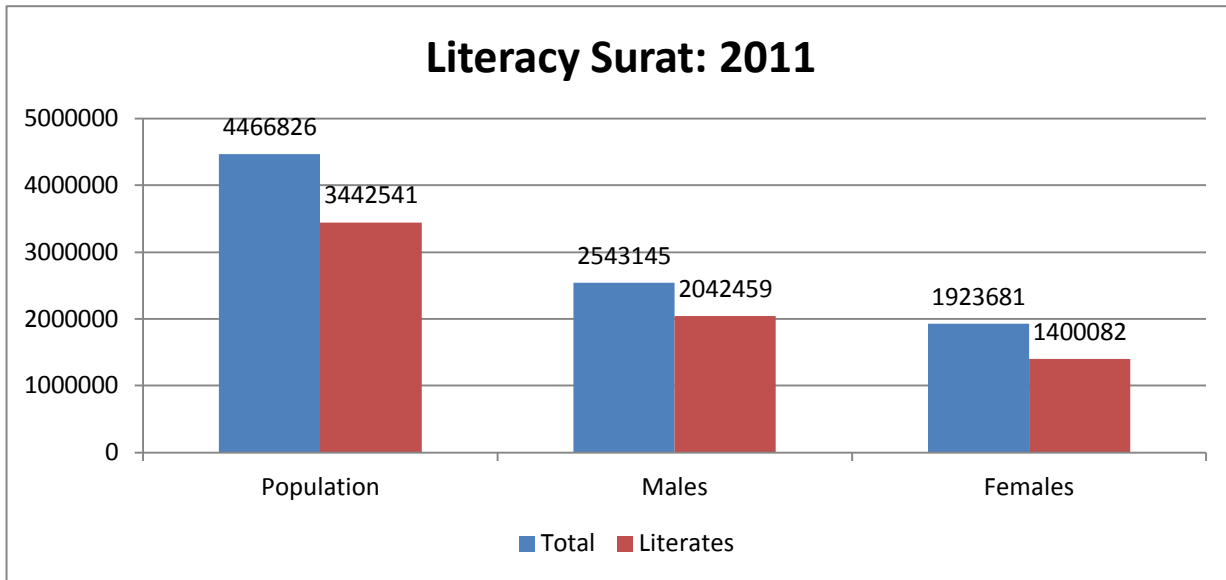


Figure 5: Literacy in Surat

Overall literacy rate for year 2011 is 87.89% while by sex; it is 91.22% for males and 83.44% for females

Age distribution

Child Population in regard to census is described as children in the 0-6 age group. According to the census 2011, Surat amounts to 12% child population to the total population. Child female population is greater than male child population.

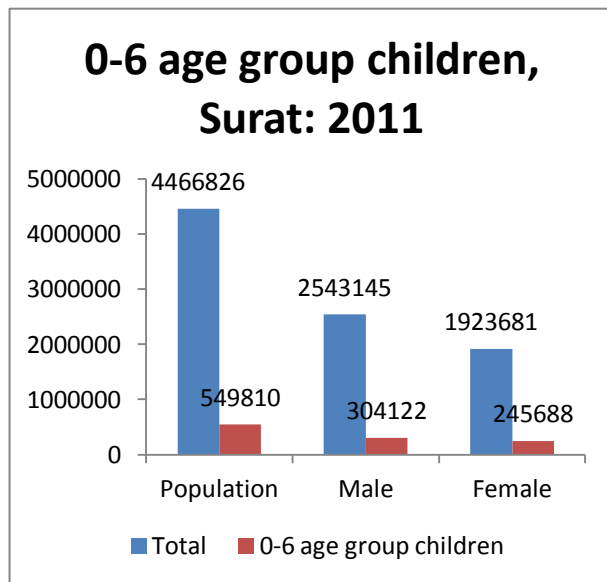


Figure 6: 0-6 year age group children, Surat

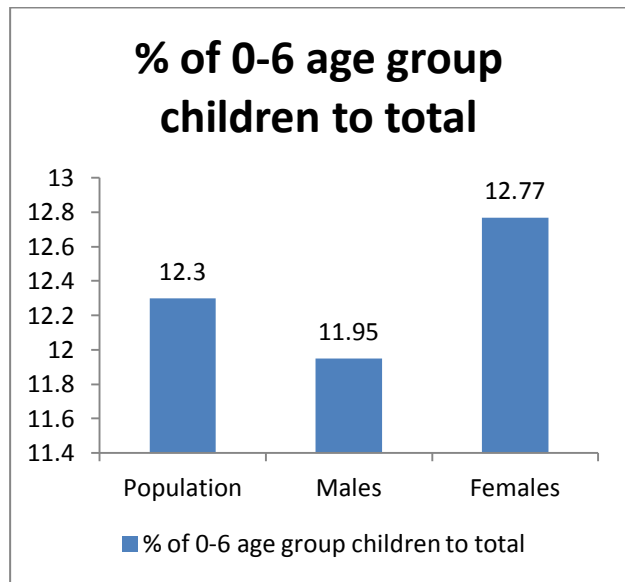


Figure 7: Percentage to total population

Work Force classification

It is seen from census 2011 that the workers are classified based on their work. Work is taken as the basis to identify various workers. The two main categories of classification are workers and non

workers. The working population is again further classified into main workers, marginal and other workers. Surat city constitutes about 40% of total workers (1764968) and 60% (2643592) of non workers to the total population

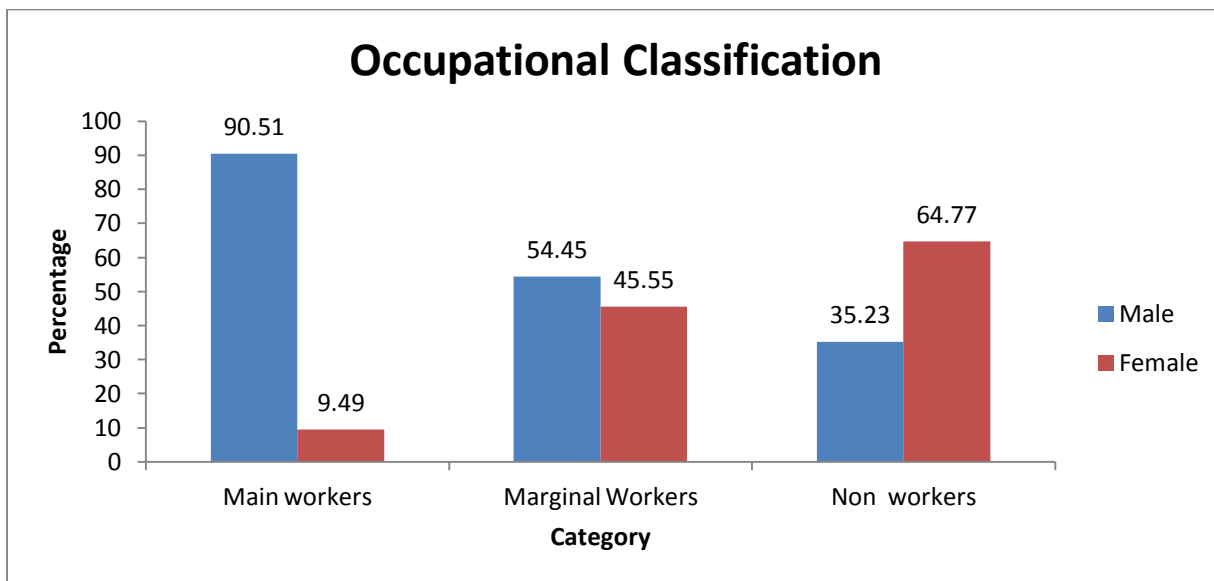


Figure 8: Categorization of workers in Surat –Census 2011

Social and physical vulnerability profile

Census data provides detailed data on zones and wards of Surat city. This data can help in building the vulnerability profile of each zone which in turn is useful in policy planning, planning resilience strategies for various shocks and disasters.

Zone-wise population distribution

Surat city has been divided into seven different administrative zones, namely West zone (Rander), Central zone, North zone (Katargam), East zone (Varachha), South zone (Udhana), South-east zone (Limbayat) and South-west zone (Athwa). Following are the details of zone-wise distribution of city population. However, as detail population of enumeration block of Census 2011 is not available So Zone wise Population is approximate.

One fourth of the population is in East zone (Varachha), One third (33%) of the population is in South (Udhna) and South east (Limbayat) zone which is industrial zone with thickly populated slums. These two regions are near to creeks and vulnerable to damage during creek floods.

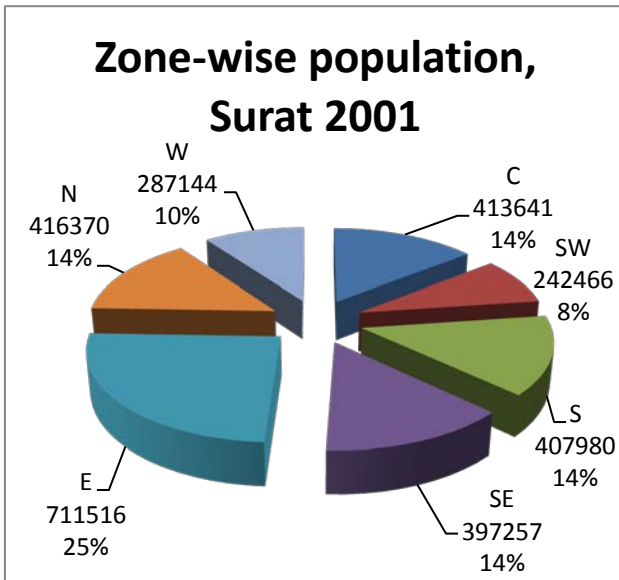


Figure 9: Zone-wise population distribution of Surat 2001

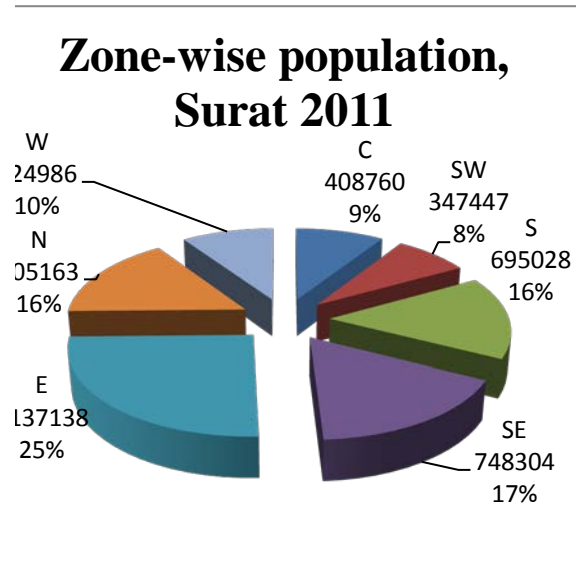


Figure 10: Zone-wise population distribution of Surat, 2011

West zone (Rander) and North zone (Katargam) with 10% and 16% of city population respectively has higher risk of river flooding with high flood levels in 2006. South west (Athwa) zone is a posh area of the city with almost zero slum and industry contributes to 8% of total population of the city and a route of storm and flood water drain towards river. South West and South zones with 24% population are located on two sides of riverbank and they are nearer to sea shore with geographically high risk during floods. SW zone also has population on sea coast and is at risk to coastal erosion hazard. North zone (Katargam) with 16% population is on the river bank, with high risk of river flooding and high flood levels. This region was the center of index case for Plague (1994) and Leptospirosis (2006)

Comparing the zone-wise population of years 2001 and 2011, it is evident that the population of central zone has significantly declined from 14% to 9%. The population percentage of East, West and South-west zone show no change. On the other hand, there is increase in population by 2-3% in case of North, South and South-East zones.

Zone-wise shift of population

Movement of population from old city area (central zone) to other parts of the city is almost a four decade process. Surat city in 1961 was only old city area, which was subsequently developed in to seven zones with extension old city limits adding population of periurban area.

Contribution of Central zone population to Surat city: 1961- 2011

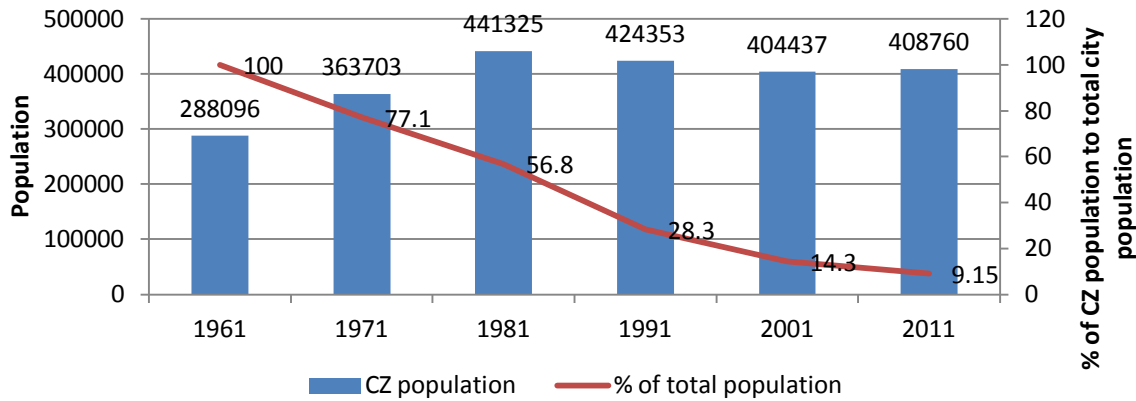


Figure 11: Zone-wise shift of population, Surat

Old city population increase up to 1971 resulted in to migration of families from old city area to new developing periphery and migrants predominantly settling in to the new developing zones resulted in to fall in the proportionate contribution of old city area to total population. As per current scenario central zone is less residential but more a business activity zone and more a medical institute zone.

Zone wise- Slum population

Surat city has a total of 773 slum blocks with a total of 481658 slum population. Slum pockets are spread in all the seven zones of the city with predominant slum blocks in South East zone, thereby contributing to highest slum population in the city. North zone and South zone also harbor 130 and 140 slum pockets respectively. This highlights the vulnerability of the respective zones

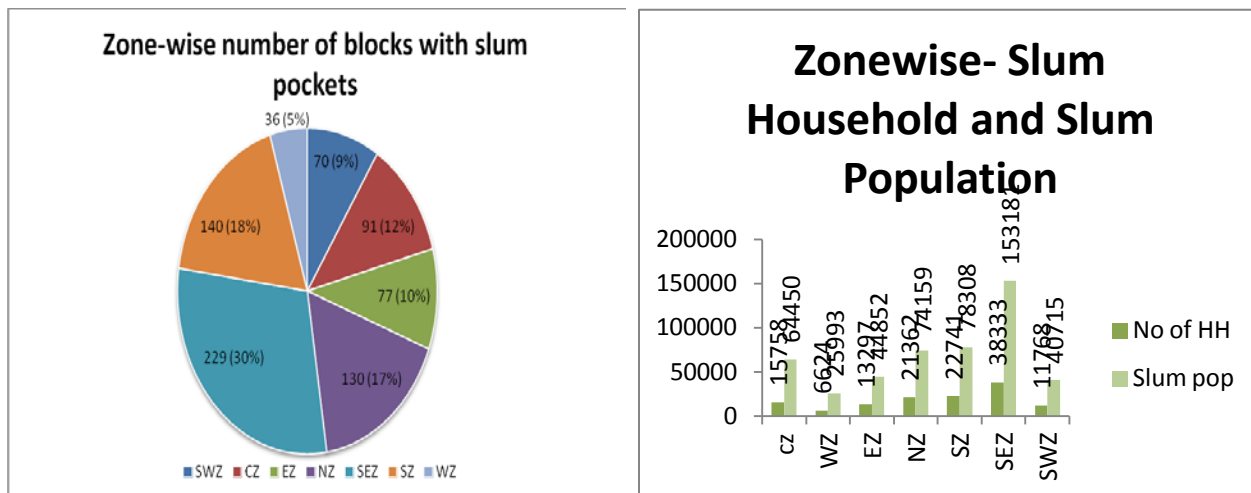


Figure 12: Zone-wise slum details Surat

Zone wise- Occupied and Vacant Houses and houses put to other use

The occupied census houses can be put to various uses such as residence, residence-cum-other use, non-residential use like shop/office, school/ college, hotel/lodge/ guest house etc. At the national level, the maximum utilization of occupied houses is for residential purposes at 79.9 percent while 19.7 percent utilization is seen for non-residential use; where 5.8 percent is used for shop/office, 0.7 percent for school/college etc., 0.2 percent for hospital/dispensary and 11.0 percent for other non-residential use. In Surat on an average 60 % of the occupied houses is for residence and 15% of the houses are vacant. Apart from residency 16% of the census house is used for other purposes. West zone has highest occupied houses for residency and South west zone has the highest vacant houses compared to other zones. Central zone shows the highest percentage of houses put to other use apart from residency.

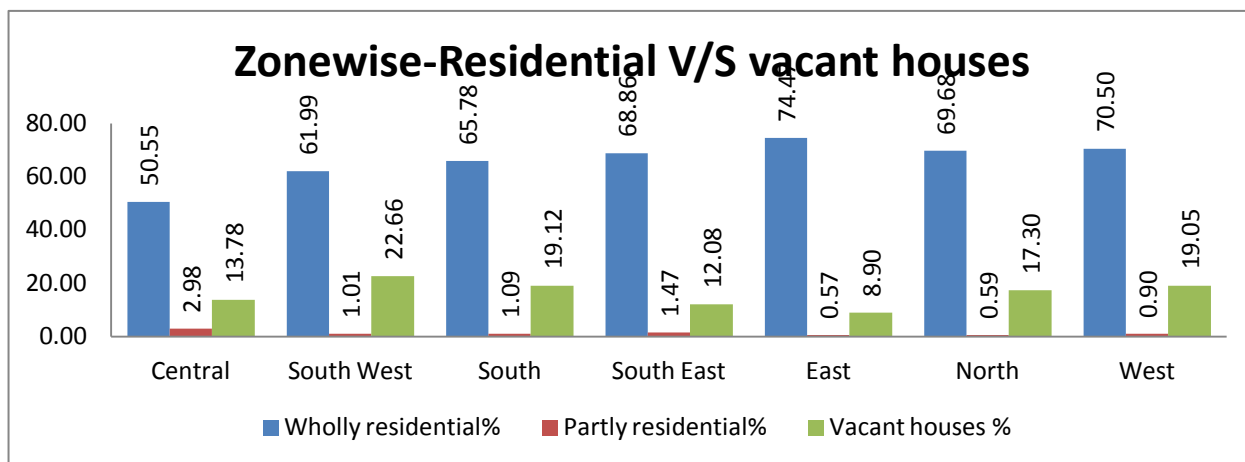


Figure 13: Zone-wise housing

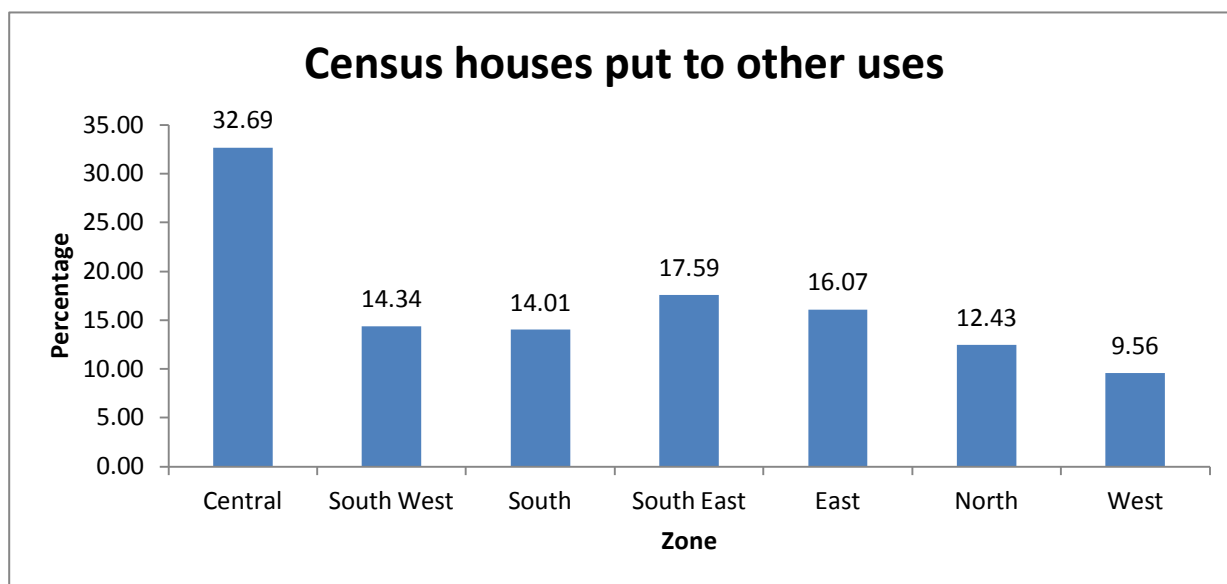


Figure 14: Zone-wise Use of houses for other purpose

Zone wise sex ratio

Sex ratio denotes social characteristics and an important indicator for gender equality in the society. Zone wise sex ratio shows that the ratio has declined in central zone, South East Zone, South Zone in the last decade. This indicator is also highlights the vulnerability in terms of gender.

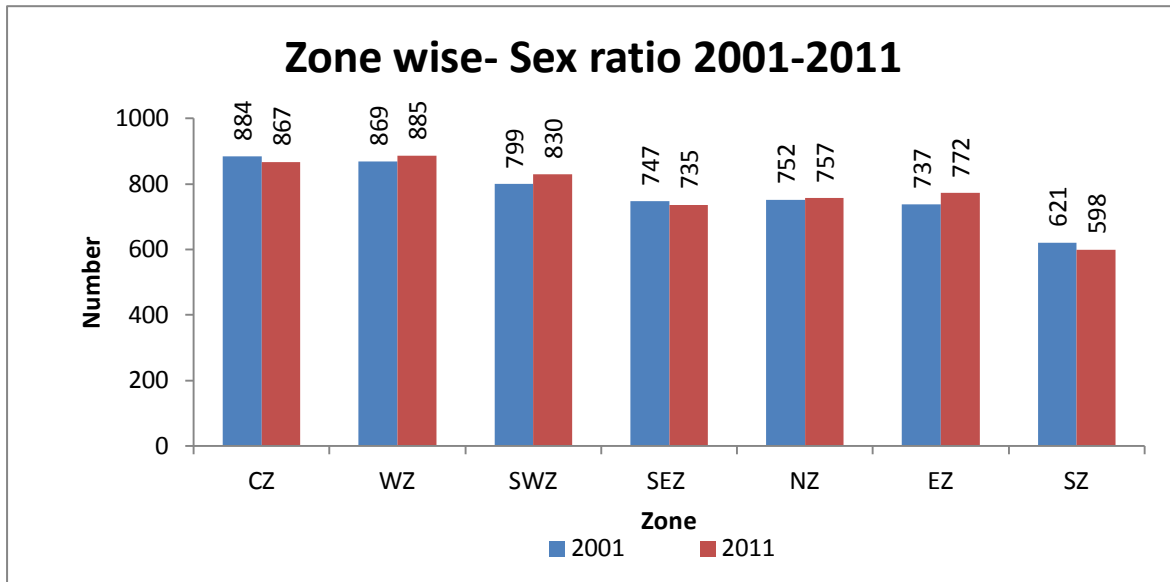


Figure 15: Zone-wise Sex ratio

Zone wise SC and ST population

Scheduled tribes and Scheduled Caste are one of the vulnerable populations both socially and economically. They are prone to macro economic shocks that undermine their earning capacity, with consequent impacts on access to food, housing, services and health.

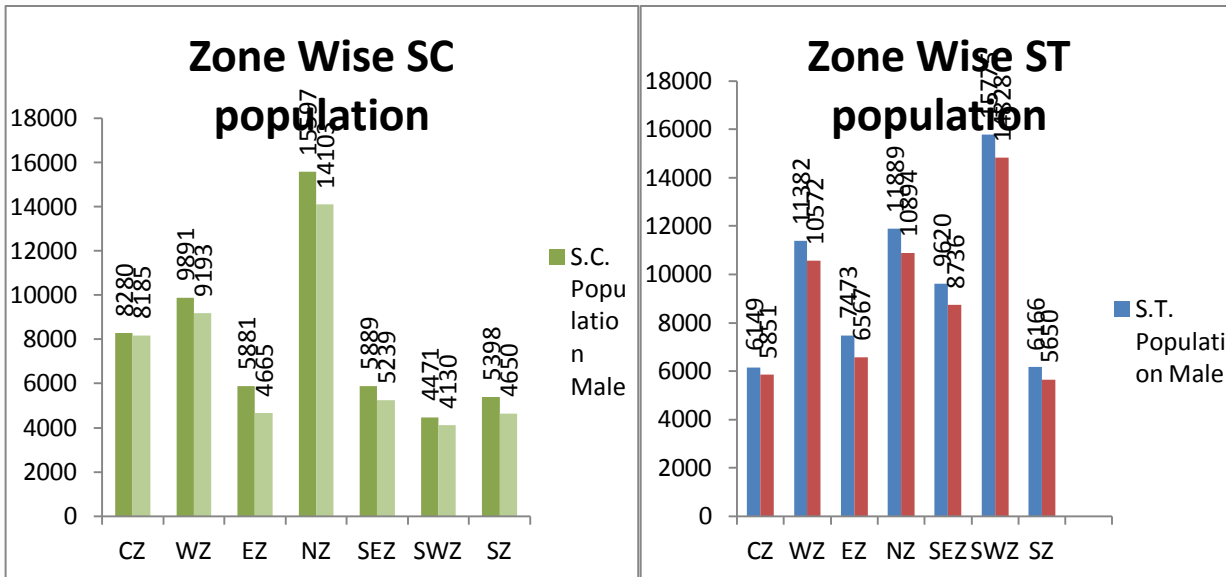


Figure 16: Zone-wise SC and ST population

The analysis shows that North Zone has highest Schedule Case population and South West zone has the highest Scheduled tribe population.

Zone wise Houseless population

Houseless population is another set of vulnerable group. They are particularly exposed to hazards, and lack hazard-reducing infrastructure such as drainage and sanitation. They may also lack well-constructed housing with security of tenure which ensures they can return to their homes after disaster events. West zone, South east zone and south west zone show higher population of such groups.

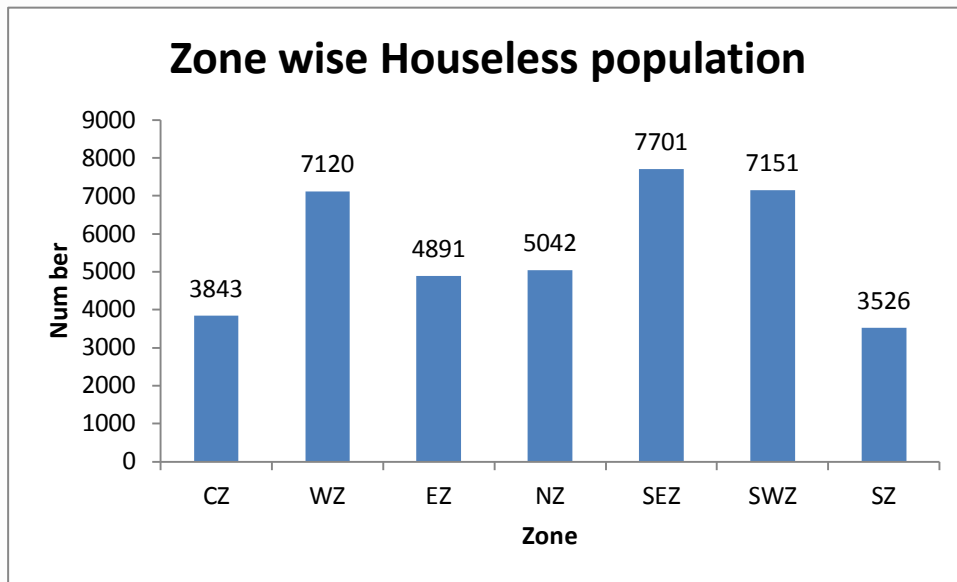


Figure 12: Zone-wise homeless population

Conclusion

Population census is one of the most reliable and easily accessible data source that is used for demographic estimates, projections of populations, assessment studies etc various planning purposes. Surat city has witnessed three major floods in the 20th century (1968, 1994 and 1998) and recently in the year 2006. 1994 was the turning point in terms of public health management due to the plague epidemics. The phenomenal growth in the last four decades has expanded the city to non-residential flood prone areas on both the banks of river Tapi. Moreover, the mounting pressure of land development did not permit planners to consider flood as a serious factor until 2006 disaster. The 2006 flood was the biggest in the last 34 years after the construction of the Ukai Dam. Since Surat is prone to such disasters it becomes a necessity to carry out city level assessment studies to identify the vulnerability parameters that affect the city to increase the effectiveness of emergency actions and response during such crisis. To carry out city level vulnerability assessment study it becomes essential to study all the aspects of vulnerability such as-physical, social and health. Urban vulnerability evident through census data indicators like sex ratio, literacy, age group data can be crucial in case of flood prone Surat city for further climate change related vulnerability assessment.

References

- 1) Census of India, (2011) :Population Enumernation Data (Final Population) retrieved from website –www.censusindia.gov.in Regsitrar General and Census Commissoner, India,
- 2) www.suratmunicipal.org-Demographics
- 3) WWF India- Vulnerability assessment of people, livelihoods, ecosystems in the Ganga Basin