

Dynamics of Urban Growth in the Karnal City Area 2001 - 2011 from Landsat Observations

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Abstract: Land utilization and land cover generally involve certain development with effects but land losses, open spaces, and environmentally sensitive habitats. The current paper is called "The usage of a remote sensing and GIS to identify and monitor the use of land and land cover of the region and its time shifts." The Land use and Land coverage report sheet offers ample evidence of the effectiveness of GIS and remote sensing. For the different seasons from 2001, 2011, the latest satellite details images of Google earth and Land sat have been used. Apart from satellite, Toposheet No. 53C/14 and the map of the city of Karnal has been used for purposes. ARC GIS 10.0 and MS OFFICE use for software similar to ERDAS IMAGINE 9.0. The researcher also searched for the modifications which have taken place in the urban side in Haryana from 2001-2011. The aim of the study is to discover the sprawl pattern of the city of Karnal and surrounding agricultural land changes. In addition, improvements in these categories were calculated and mapped between 2001 and 2011. Two main areas are the sprawl of the city. The first is between the main railway route Delhi-Ambala and the national highway number 44; the second is on National Highway No. 44 in the east of the city. The study found that major changes have occurred in land use in urban areas and cultivation land. Construction has mainly been expanding on cultivated land and in part on vacant land.

Keywords: Land-use Change, Remote sensing, GIS, Land use/land cover, Urban Sprawl.

I. INTRODUCTION

The fast urbanization of the world in the coming decades will be one of the best difficulties in ensuring human well-being and a crucial worldwide condition. According to current estimates, urban populations own 4% or less of the earthbound surface of the planet, but they are home to almost 50% of the world's population, invest almost 75% of the world's popular assets, and generate 75% of its waste and squanders. In addition, the UN predicts that nearly all net global population and economic development will occur in the cities over the next 30 years, leading to a doubling of existing populations and city area expansion ("UN, 2002").

Human is a unique organic animal; his advancement is a remarkable marvel of nature. It is additionally obvious that human is a social operator of a considerable number of societies and social locales over the earth. The populace is the essential component of the state ("Tiwari, 2004, 751"). Francis Bacon (1612) utilized the word 'populace' ("Tiwari, 2004, 751"). When all is said in done, Population is a gathering of people of similar species inside a network' ("Mayhew, 2009, 394") or frequently characterized by demographers as indicated by the

particular needs of the examination and specialist ("Ali, 2011"). In particular, the populace is a gathering of people of a solitary animal group having a similar living space and they can interbreed ("en.wikipedia.org, 2017").

In mapping and quantification for changes in land cover and land use of the study area, satellite data are shown to be useful. The research into these questions can help to inform decision-makers, urban designers, and policymakers and action on natural resource restorations before they are forever lost. In the end, it depends on local knowledge, regulation, administration, management challenges, and organizational problems to support urban environments. This Urban Systems report seeks to support experts, politicians, architects, community designers, and, in the end, the average citizen to see how towns and communities evolve over time based on work in locations around the city and regions. This paper is an overview of the improvements that took place between 2001 and 2011 in the land-use trend of the city of Karnal.

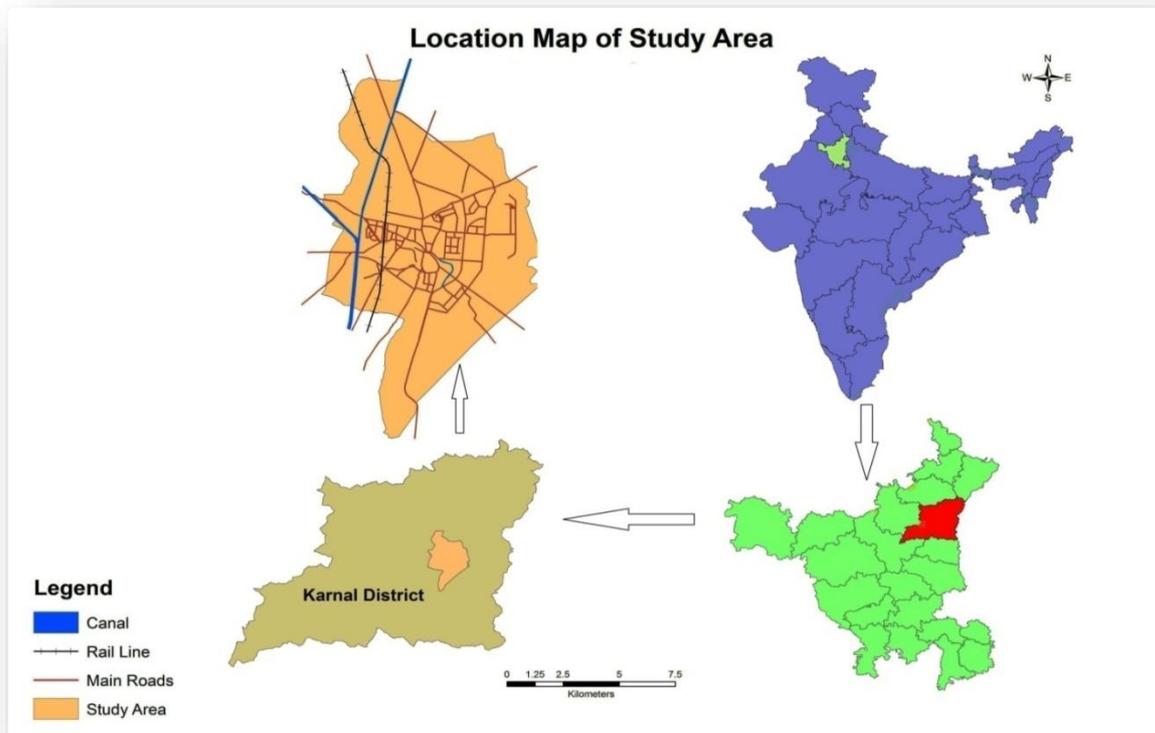
II. STUDY AREA

The city of Karnal is located at 29^o37'50"- 29^o44'40"N and 76^o56'20"-77^o02'50"E in Haryana in the province

of India. Karnal is one of the twenty-two state districts. The city of Karnal is also the headquarters of the district of Karnal. Karnal's population is 3,57,284 in 2011 after the formation of the Municipal Corporation. Karnal is believed to be a mythological hero and a key figure in the epic story, founded by the Kauravas during the Mahabharata era for king Karnal.

It is located on the national highway No.44 (popularly called GT road) between Delhi and Chandigarh, 123 km north of Delhi, and midway between Delhi and Chandigarh. Karnal is renowned for its luxurious grasslands, Liberty shoes, quality Basmati rice production, and its many institutes for agricultural and dairy research.

Figure No. 1: Location Map of Study Area



Source: M.C. Office, Karnal City

III. DATA SOURCES

Following data sources have been used for the present work. Topsheet No 53C/14 on scale 1:50000 (Survey of India, Dehradun). Guide Map of Karnal City. M.C. boundary Map of Karnal city (2011). For the different seasons from 2001 and 2011, the latest satellite details images of Google earth and Landsat has been used with 0% cloud covers are downloaded from Google earth and www.glovis.usgs.gov/. All these data are open-source satellite images and Census data published by Census of India 2011. Study focus on urban expansion and its impact on land use/land cover pattern.

IV. SOFTWARE USED

The following software was used for this study. Erdas Imagine 9.0: This software was used for the preprocessing, import image, geo-referencing of satellite data. Arc/Map (10.0): Arc Map is the premier application for desktop Geographic Information System (GIS) and mapping. MS Office: Microsoft Word was used basically for the presentation of the research work i.e. for preparing the manuscript and

PowerPoint presentations. Excel was used in the computation of various statistics, preparation of the graphs, and excels sheets.

V. METHODOLOGY

The methodology is at the heart of any research which helps to describe and explain the reality in scientific terms. A variety of processes, methods, and techniques are instantiated and materialized for a technique. A tool is a system or software required for certain tasks to be done. A procedure is not specific, but some protocols must be followed. A technique defines other methods; these processes are a general framework. We can be broken down, mixed, or changing series in sub processes. All tasks must, however, be carried out in one form or another. The methodology is the core aspect of every research project that helps to interpret and explain the facts in scientific terms. Methodological steps are as follows: Acquisition of data, Geocoding Toposheet No. 53C/14 on scale 1:50000 of Karnal city, Subset of the study area, Map Construction, Results and Discussions, Conclusions.

Following are the dynamics of urban expansion of Karnal city:

VI. LAND USE

Changes in land use/land distribution (LU / LC) are affected by human interaction and natural wonders, e.g., agribusiness, population growth, usage, designs, urbanization, monetary progress, etc. As an outcome, convenient and precise data on (LU / LC) intrigue area change position is critical to having relations and cooperation between human and regular assets for better simple leadership. Land use/land spread is never steady and it continues changing similar to some regular and anthropogenic variables are consistently there. Subsequently, it needs cautious investigation and checking to have superior making arrangements for the future economical utilization of land for farming, urban or different employments. Land use is surmised from land covers and can legitimately be utilized for strategy and arranging purposes, not at all like the land spread which by one way or another is gross in data it gives.

In 2010-2011, 2520.00 sq. km. in the area protected by the income an authority is 2392.95 sq. Kms rural only (including 127.05 sq. km of urban area); According to the records of the village. This suggests that the various measurement methods applied by two separate entities were different in two sets of areas. But, as per village documents, we will discuss land use here. Out of the 239295 hectares in total, 312 hectares are covered with woodland: 207817 hectares of the net planted area; 1275 hectares of waste are cultural waste (including Gaucher and groves) and 314 hectares of land for which we can define as uncultivable. The net area planted in the district is 86.85% of the total area. Karnal Tehsil is 898.88 sq. Km; the area is 555.44 square kilometers, 388.39 sq. km, 341.48, and 275.78 square km respectively, compared to Assad, Nilokheri, Indri, and Gharaunda tehsils. The geographical way of my study area is 90.57 square kilometers (including the municipal area of Karnal City 2001 with 23.07 square kilometers).

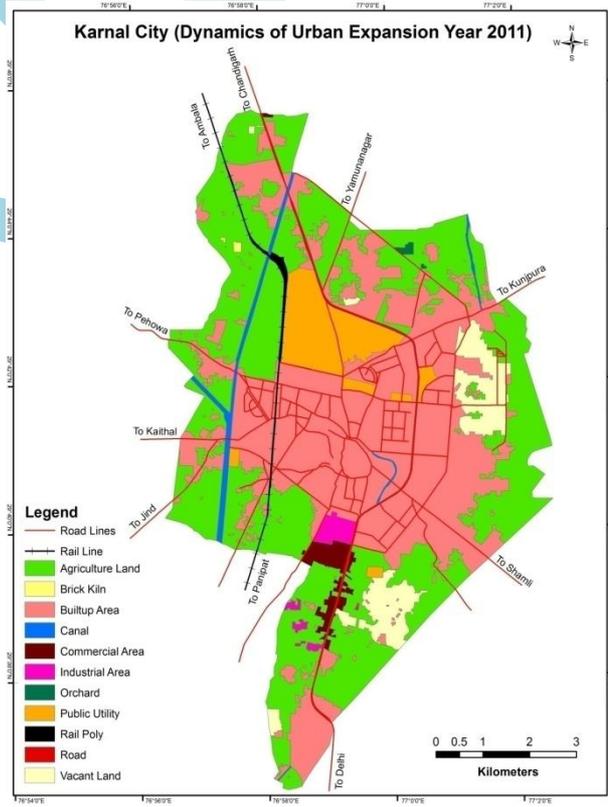
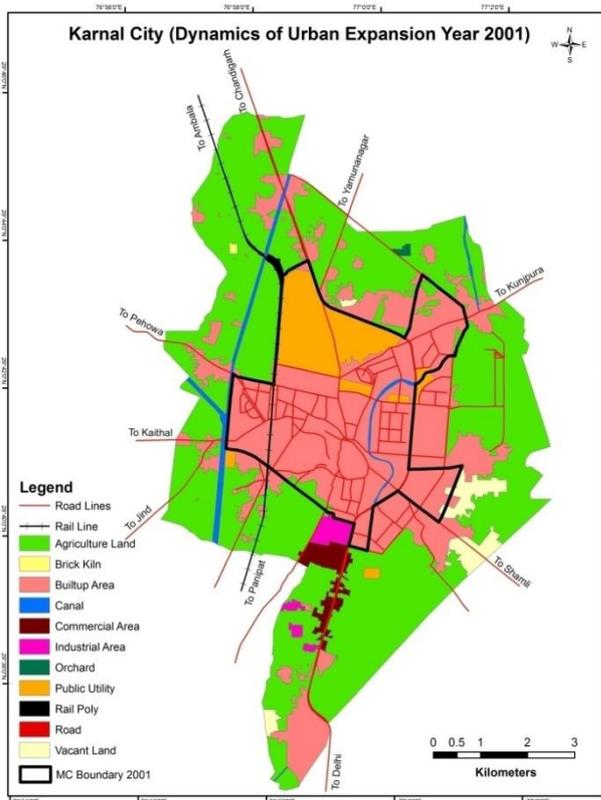


Fig. 2 Land Use Map in Karnal city (2001)

Fig. 3 Land Use Map in Karnal city (2011)

Source: Karnal City Map in M.C. Office, Google Earth & Landsat Image (2001 & 2011)

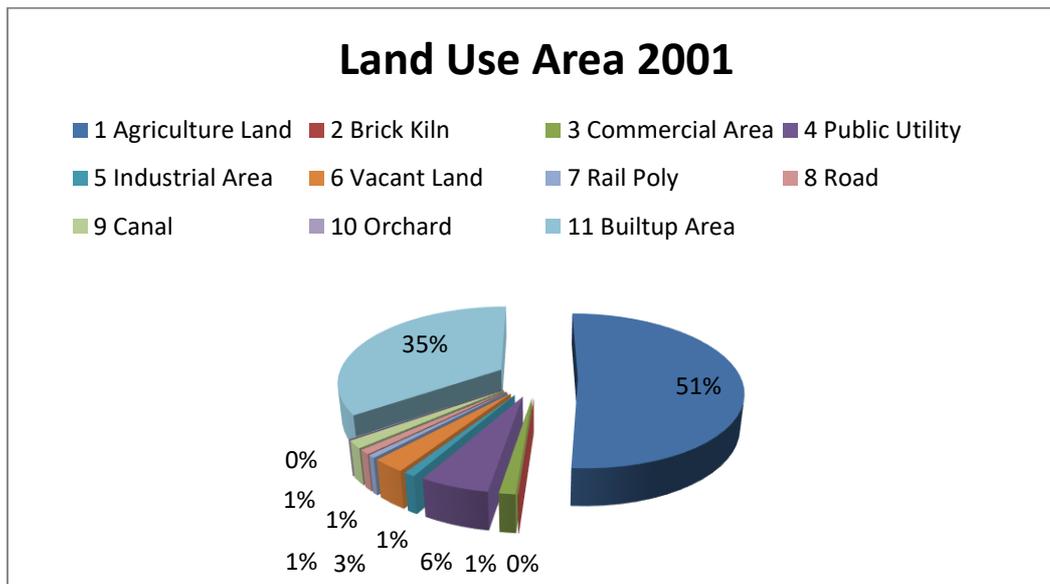


Fig. 4 Land Use in Karnal city (2001)

Table: - 1. Land Use in Karnal city (2001& 2011)

	Description	Area Sq. Km (2001)	Area Sq. Km (2011)
1	Agriculture Land	46.33	38.65
2	Brick Kiln	0.05	0.06
3	Commercial Area	1.23	1.25
4	Public Utility	5.16	5.16
5	Industrial Area	0.85	0.83
6	Vacant Land	2.51	4.62
7	Rail Poly	0.56	0.56
8	Road	0.88	0.88
9	Canal	1.47	1.30
10	Orchard	0.09	0.11
11	Built-up Area	31.44	37.16
	Total Area	90.57	90.57
Total Area of Karnal MC Limit		23.07 Sq. Km	90.57 Sq. Km

Source: Karnal City Map in M.C. Office, & Google Earth Image (2001& 2011)

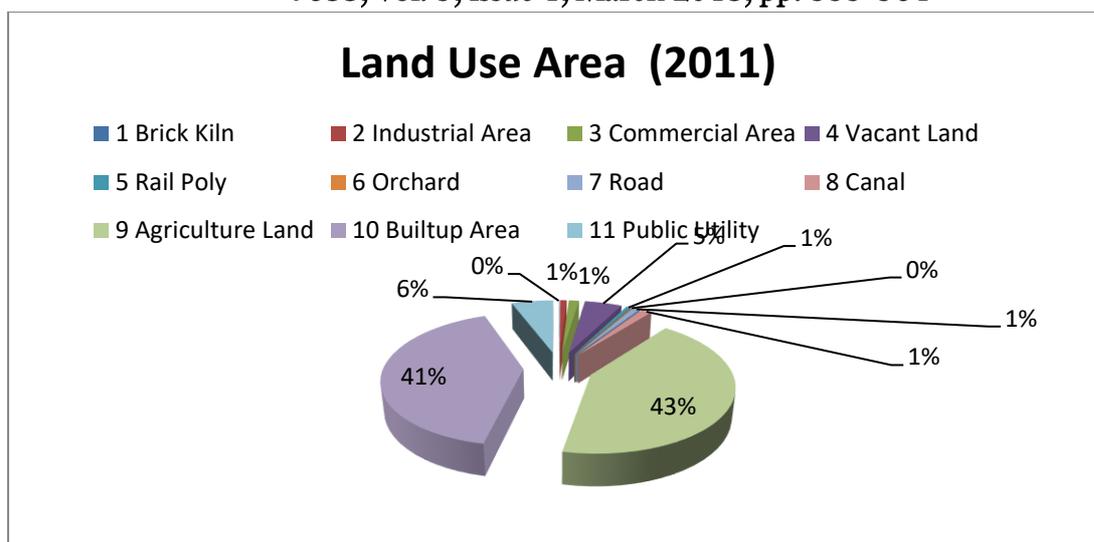


Fig. 5 Land Use in Karnal city(2011)

According to my manual land use classification under table number 1 and figure number 2, Karnal city has the highest agricultural land in 2001 with 46.36 square kilometers. Built-up area 31.44 square kilometers, public utility 5.16 square kilometers, vacant land 2.51 square kilometers, commercial area 1.23 square kilometers, canal 1.47 square kilometers, road 0.88 square kilometers, industries area 0.85 square kilometers, and rail poly area 0.56 square kilometers is available. Thus, according to Figure 4 agricultural land is at 51% and built-up area at 35% area and public utility at 6%. According to figure 3 and table 1, the agricultural land in Karnal MC Area in 2011 is 38.65 square kilometers, which has been reduced by 7.68 square kilometers in the last 10 years. But in contrast, the built-up area is 37.16 square kilometers which have increased by 5.72 square kilometers in the last decade. With this, the area of vacant land has also increased by about 2 square kilometers in the last decade. Thus, according to Figure 5 agricultural land is at 43% and built-up area at 41% area and public utility at 6%.

VII. CENSUS CONCEPTS

Process of Urbanization:

An important element of urbanization is the development of cities and metros. The city is a ray of hope for rural people. Because the city has a high standard of living and it is not available mainly in rural areas. Cities provide economic opportunities to the people of rural areas. This leads to large scale migration from rural to city. With this, India's urban population is expected to reach around 575 million by 2030, which will be more than 40% of the world. Due to this, the quality of the physical environment is gradually decreasing in almost all cities. Therefore, we should look positively at the response to urban development. It should also be noted that urbanization should be more balanced and accountable to national development goals in general.

Urbanization in Karnal:

The urban population in 1951 was 68422 persons which have reached 82929 persons in 1961 with an increase of 14787 persons. In the next decade (1961-1971) the urban population has increased by 22900 persons from 82929 in 1961 to 105829 in 1971. In 1981, 183755 persons were living in the urban area of the district. During the period of twenty years (1981-2001) the urban population rose enormously from 183755 persons to 337842 persons.

According to the census 2011, there are 456030 urban populations which is the addition of 337842 persons as compared to the census 2001. As we see the statistics of Karnal City, there is no significant increase in urban population up to 1931 and it remains varied 23559 in 1901 to 26610 in 1931. After that, there is a continuous increase in urbanization and the urban population increased from 59790 people in 1951 to 132107 persons in 1981 and 286827 persons in 2011. In regard to the decadal growth rate of the urban population, it has been observed a highly irregular trend of the growth in the city as well as the district also. The general factors which influence the trends of population growth are the severe attack of malaria and plague during 1901-1911, mass migration of people in the wake of partition during 1941-1951; and health measures adopted by the Government. Karnal city, because of its proximity to Delhi, had good scope for gainful employment, hence attracted a large number of refugees. Besides, there is a general trend of population rise in the country. An increase in the population of both the towns during two decades (1921-1941) was nominal. During the post-independence period (1951-1981), there was a steep rise in the population, and the urban population got a boom, in the district as well as in the city (Table 2). This may be attributed to the health measures adopted by the Government. Many people do not find such facilities in the villages. It has been observed that a large number of persons shift from surrounding villages to the towns for education and livelihood.

Table 2: Urban Population and its Growth Rate in Karnal district and Karnal City, 1951- 2011

Census Years	Karnal district			Karnal City		
	Total Urban Population	Variation in Population	Decadal Growth (Percent)	Total Urban Population	Variation in Population	Decadal Growth (Percent)
1951	68442	-----		59790	-----	
1961	82929	14487	21.16	72109	12319	20.60
1971	105829	22900	27.61	92784	20675	28.67
1981	183755	77926	73.63	132107	39323	42.3
1991	246121	62366	33.94	173751	41644	31.52
2001	337842	91721	37.26	207640	33889	19.50
2011	456030	118188	34.98	286827	79187	38.13

Sources: Census of India, District Gazetteer Karnal 1990, Chandigarh, Haryana, Census of India, Primary Census Abstract 1991, 2001, 2011 Chandigarh, Haryana.

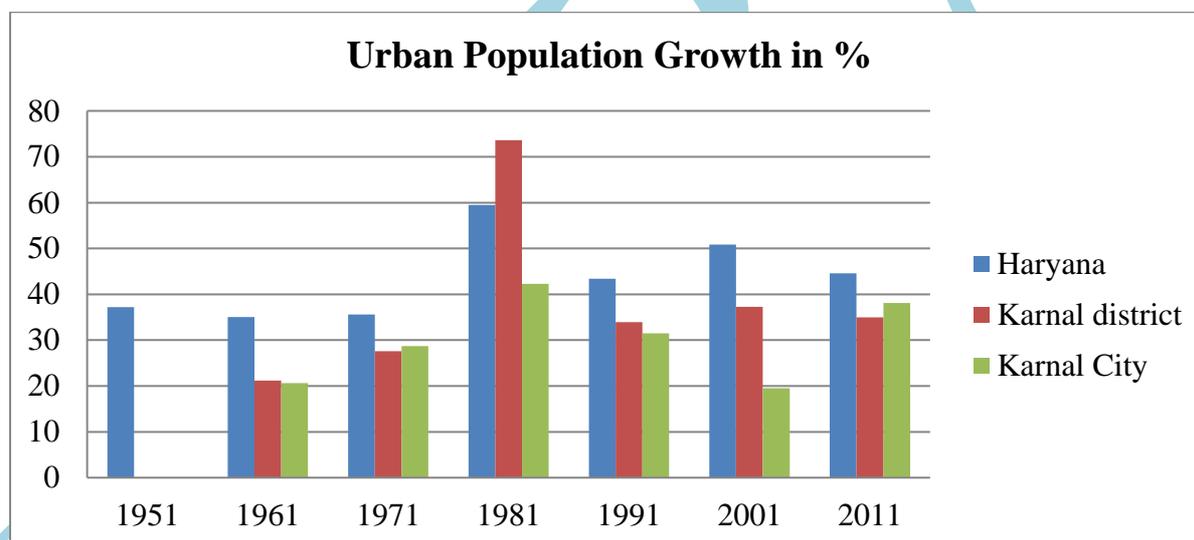


Fig. 6: Urban Population Growth in Percentage

According to the 2011 Census Karnal district of Haryana has a total population of 1,505,324. In which 797,712 are men while 707,612 are women. 292,084 utter families were residing in Karnal district in 2011. Karnal District Average Sex Ratio is 887. Karnal City Total population is 286827 as shown by 2011 statistics before Municipal Corporation was established. Males is 151287, Females is 135540. Between the aggregates are 215199 literate persons. It has an overall area of 77.27 sq. Km and population density: 3712 people per sq. Km. 31st ward in Karnal city of Population. Karnal City's Adult Sex Ratio is 896 and Kid Sex Ratio is 809. After the establishment of Municipal Corporation, Karnal City my study area has a population of 357284, as indicated by statistics 2011. Males are from 189239 and Females are from 168045. Among the aggregates are 267963 literate individuals. It occupies a total area of 90.57 sq. Km and population

density are 3945 people per square km. Twentieth ward in the town of Karnal. Karnal City's Adult Sex Ratio is 888 and Karnal city's child sex ratio is 809. 14th most highly educated district in the State. 236th most highly qualified district in the world. Total Karnal City competency Rate is 84.60, 88.99 male and 79.88 female. In Karnal district, the number of inhabitants in children 0-6 years of age is 32468, 11.31 percent of the entire population. There are 17945 male youths and 14523 female children aged 0-6. The Child Sex Ratio of Karnal is 809 according to the 2011 Census, which is not exactly the Average Sex Ratio(896). According to the 2011 Census, 30.2% of the population live in urban areas, while 69.8% live in rural areas. For urban areas, the regular level of skills is 82.3%, for rural areas, they are 71.4%. The sex ratio in urban areas is 890 in the Karnal district, while in provincial regions the sex ratio is 886.

Growth of population:

The populace of the City has expanded by 38.1% in the most recent 10 years. In 2001 enumeration overall populace here was about 79187. The female populace development pace of the City is 39.7% which is 2.9%

higher than the male populace development pace of 36.8%. General position populace has expanded by 15.8%; Schedule standing populace has expanded by 27% and youngster populace has expanded by 2% in the City since the last statistics.

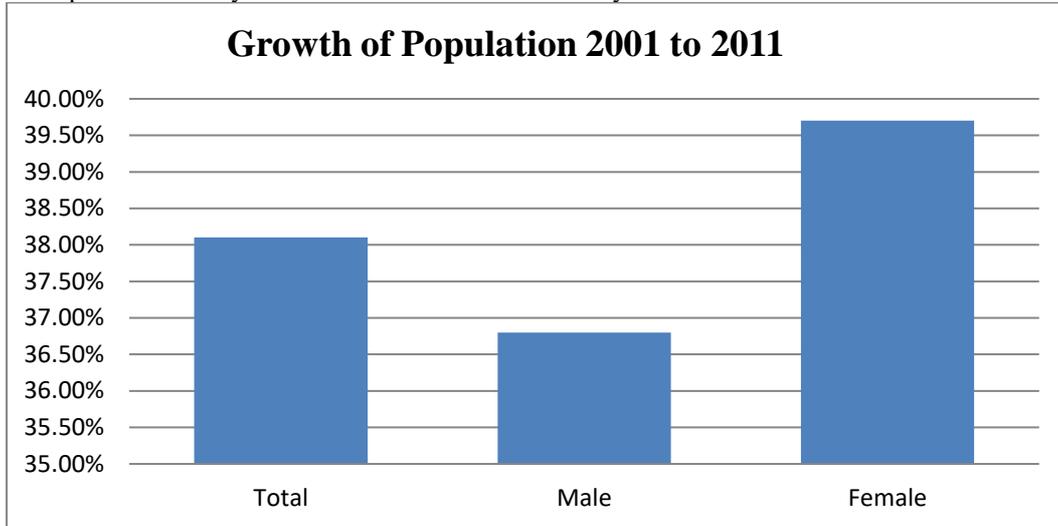


Fig. 7 Growth of population in Karnal city (2001-2011)

Caste-wise Population in Karnal city:

Scheduled castes (SC) constitute the socially and economically deprived caste groups of the society. They mainly consist of agricultural laborers, cultivators of small land holding, artisans, petty laborers, and industrial laborers ("Tiwari, 2007"). The distribution of caste groups varies from one ward to other in Karnal city, but the data on a caste basis has not been classified in defined methods, so the location quotient of the scheduled castes is calculated on a category basis. The location quotient is developed by P.F. Florence in 1948. It is used to measure the concentration of a characteristic. The position quotient that gives us the relative picture of those proportions as described is the proportion ratio of a particular

feature in an area to the same proportion in the region ("Mahmood, 1998").

Gen. Caste constitutes 55.63% Schedule Caste (SC) constitutes 18.54% while Other Backward Caste (OBC) was 25.83% of the total population in the Karnal City of Haryana. The City is home to about 2.86 lakh individuals, among them around 1.51 lakh (53%) are male and about 1.35 lakh (47%) are female. 77% of the entire populace are from general station, 23% are from timetable position. Kid (mature under 6 years) populace of Karnal City is 13%, among them 55% are young men and 45% are young ladies. There are about normal 5 people live in each family in the City.

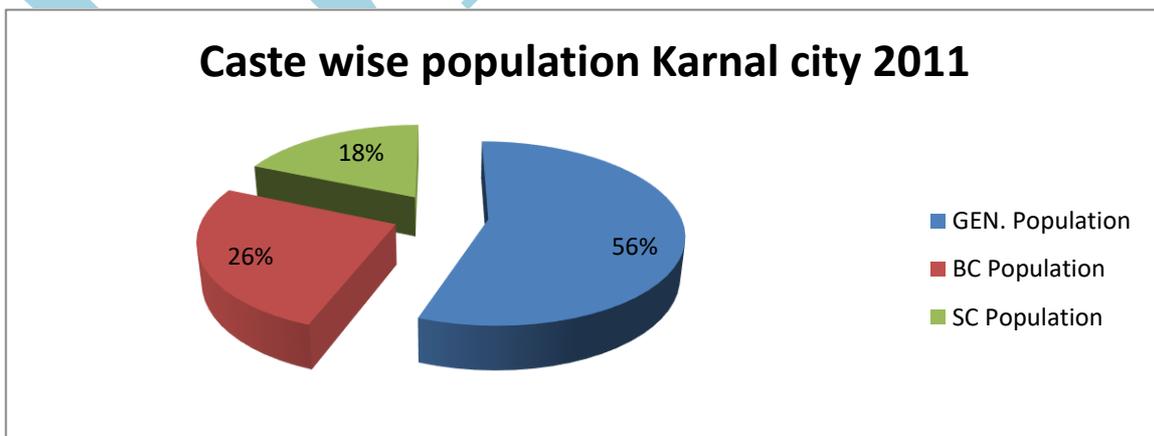


Fig. 8 Caste wise population in Karnal city (2011)

Religion-wise PopulationKarnal City:

The religious composition is an important aspect of the population. It is also one of the basic traits of society and a genuine element of human behavior. Indian society is divided into six major religions. The

majority of people follow one of these six major religious groups namely Hindu, Muslim, Christians, Jainism, Buddhists, and Sikhs. There is no doubt that Karnal city is a Hindu dominated city.

Table: 3 Religion wise population, Karnal city 2011

Religion	Total Population	% of Population
Hindu	274498	90.85
Sikh	21033	6.96
Muslim	3938	1.3
Christian	776	0.26
Buddhist	280	0.09
Jain	793	0.26
No Religion Specified	808	0.27
Other Religion	14	0

Source: Census of India, Primary Census Abstract, 2011, Chandigarh, Haryana

Hindus contribute 90.85% of the overall populace and are the biggest religious network in the City pursued by Sikhs which contribute 6.96% of the absolute populace and Muslims are the third biggest religious network here with 1.3% populace.

Literacy Rate - Karnal City:

Education is base on overall advancement in the general public ("Bangar, 2009"). Education is considered as a genuinely dependable file of socio-culture and financial progression in the general public ("Chandna, 2001"). It is a record of human improvement and the nature of human life. Poor education thwarts monetary improvement and if there should arise an occurrence of females even impedes the advancement of family arranging projects ("Tiwari, 2007"). The meaning of proficiency shifts from nation to nation and time to time. In India, from 1901 to 1931 the meaning of education was "the capacity to peruse and compose any language"

("Bhende, Asha and Kanithar 1988"). Education rates for 1951 identified with populace matured years or more. As indicated by 1971 registration, "An individual who can both read and compose with comprehension in any language has been considered as literates while kids matured 0-5 years were considered as ignorant. In any case, it has been changed in 1981 enumeration and offspring of 0-6 years matured were treated as illiterate.

Karnal City's absoluteness rate in 2011 was 84.60%, which is exactly the average rate of 75.55% of Haryana proficiency. Of the 215199 literacies, 118533 were guise of Populace astute, while 96666 were females. In addition, in Karnal City, the education rate of men was 88.89% and the skill rate of women was 79.88%.

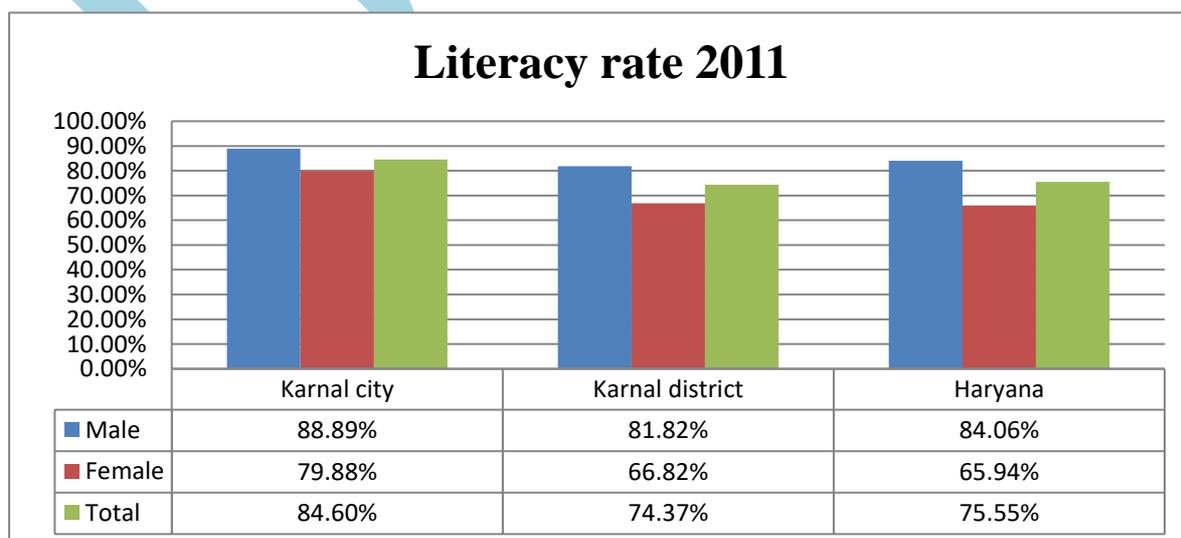


Fig. 9. Literacy rate in Karnal city (2011)

Source: Census of India, Primary Census Abstract, 2011, Chandigarh, Haryana

Sex Ratio - Karnal city:

Sex ratio is a very significant demographic measure for the study of population socio-economic features. This is the ratio of women to 1000 male population. Urban centers in less developed countries such as India are marked by high migration rates from rural surroundings in search of a better lifestyle, educational facilities, and work knowledge. This type of migration is highly male dominant as a result the sex ratio is low in the cities. On one side, Haryana is an economically developed state of the country, while on the other side;

it has the lowest sex ratio in the country which shows the social backwardness of the region. According to Census 2011, there are only 879 females per thousand males. The last few decades have witnessed a sharp decline in the sex ratio which is a very serious issue. This is a very critical situation for the city at the national and state level. In 2011, the total population of the city is 286827 which comprise 151287 males and 135540 females that resulting in a sex ratio of 896 females per thousand males.

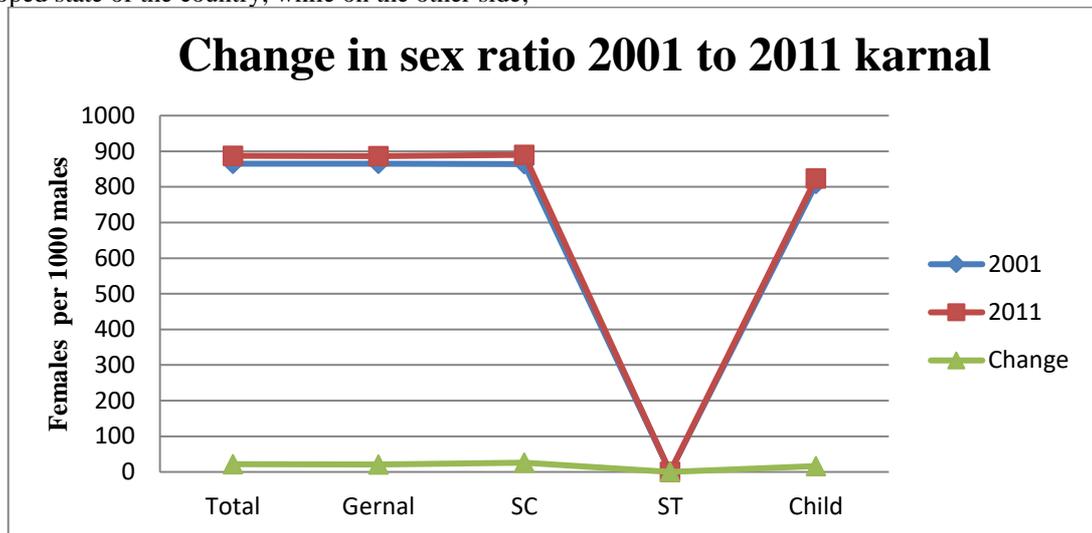


Fig.10 Change in Sex ratio in Karnal (2001 - 2011)

Source: Census of India, Primary Census Abstract, 2011, Chandigarh, Haryana

Starting at 2011 registration there are 887 females for every 1000 males in the district. Sex proportion as a rule standing is 886, in timetable station is 890. There are 824 young ladies under 6 years old for every 1000 young men of a similar age in the district. By and large sex proportion in the district has expanded by 22 females for every 1000 males during the years from 2001 to 2011. Kid sex proportion here has expanded by 15 young ladies for every 1000 young men during a similar time.

of climate change that could affect agriculture and urban demand, as well as to city companies supplying rural community farmers and customers with services. This is because farming can be seen as the foundation of the Indian economy's industrial structure. It offers livelihoods in the country of more than 70 percent. It is the largest sector of economic activity and plays a key role in the economic development of the country by providing food and raw materials, jobs for very high populations, captive for its own development, and surpluses for natural economic development.

VIII. Conclusion:

Urbanization is also viewed as having a detrimental effect on agriculture, ranging from land losses to construction and urban growth, and industrial predisposition to government support for infrastructure, utilities, and subsidies. Yet the scale of urban deprivation for many people reveals no urban prejudice and, naturally, rural income is of significant importance to the urban market for agricultural products. Farmers and rural consumers are also dependent on urban companies to supply a variety of goods and services including market access. The main issue is, therefore, how the growing and evolving demand for food (and other agricultural products) generated by an increasingly urban population and the economy will help sustain agricultural and rural resources in a global downturn in the amount of agricultural land per person and water constraints. In addition, it is now important to respond to the impacts

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