EVIDENCE AND IMPLICATIONS FOR KARNAL CITY OF URBAN EXPANSION AND THE LOSS OF AGRICULTURAL LAND

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Accepted: 05.04.2022 **Published**: 01.05.2022

Keywords: Land-use Change, Loss of Agricultural Land, Urban Sprawl, Urban Agriculture.

Abstract

The land surface is always of interest to geographers engaged in spatial analysis. The land's surface has shifted over time, but the most recent shift corresponded with the fast expansion of the metropolitan population. It's more common in urban areas. It is imperative that this shift be mapped and measured on a frequent basis so that we can acquire real-time information about it. Landsat satellite pictures taken from www.glovis.usgs.gav/ were used. Other than satellite imagery, Toposheet No. 53C/14 and the Karnal city map were used. The researcher also looked at changes that occurred in Haryana's urban area between 2001 and 2017. The study's goal is to determine how Karnal and the surrounding agricultural area have changed throughout time. For land use classifications, Landsat data is used to perform a supervised classification. Categories include built-up, water bodies, farmland (crop), fallow and open terrain. Improvements in these areas from 2001, 2011 and 2017 were also estimated and mapped. Software like ERDAS IMAGINE 9.0 can be run on ARC GIS 9.3 and Microsoft Office. The city's spread is divided into two distinct zones. First, between Delhi-Ambala railway line and National Highway No. 1; second, on National Highway No. 1 in the east of the city. According to the findings, urban land use and agricultural land use have undergone significant transformations. Agricultural land and some vacant land have been used for construction.

Paper Identification

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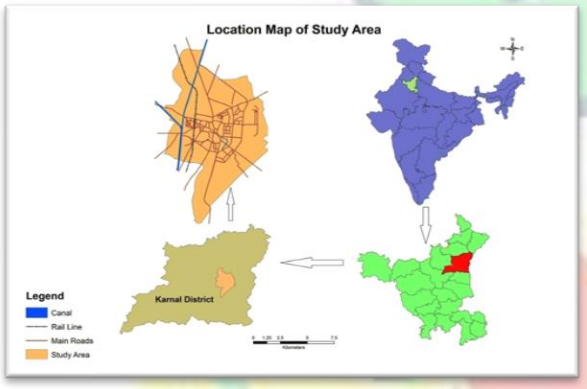
Introduction

Geographical phenomena have long been studied by geologists using the earth's surface as a laboratory. This growth is fueled by the city's attractions, which attract people. As the city's population grows, so do the demands on the city's natural resources. Unchecked development is taking place, especially in the suburbs, far from the centre of major cities. The urban and rural edge are the most rapidly changing features in respect to the urban landscape map.. As a result, rural urban fridge land use is becoming increasingly important for urban plans. Sustainable land use planning relies heavily on data on land change at the national and regional levels.

The management and planning of natural resources rely heavily on land use identification, mapping, and

delimitation. The activities that take place on a piece of land are based on its current use. Data can be collected and analysed in a variety of ways. The researcher now uses remote sensing photographs of land cover as a source of data from space satellites. Land use changes, such as the loss of agricultural land, can be detected using traditional field surveys and aerial picture interpretation. Changes in land usage in the same area can be studied in time intervals using satellite pictures.

Figure No. 1: Location Map of Study Area



Source: M.C. Office, Karnal City

Methodology

Study Area: Karnal is a city in Haryana, India, located at 29037'50"-29044'40"N and 76056'20"-77002'50"E. There are twenty-two districts in the state of Karnal. The district's administrative centre is located in the city of Karnal. After the formation of the Municipal Corporation in 2011, Karnal had a population of 3,57,284 people. The Kauravas built Karnal's kingdom during the Mahabharata period in honour of a mythological hero named Karnal, who played a significant role in the epic saga. It's 123 kilometres north of Delhi on the national highway No. 1, also known as the "GT road," which connects the cities of Chandigarh and Delhi. Karnal is known for its lush meadows, Liberty shoes, high-quality Basmati rice cultivation, and numerous agricultural and dairy research organisations.

Data sources: Following data sources have been used for 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). Landsat-7 satellite image dated 31.08.2001 and Landsat-5 satellite image dated 20.09.2011 and Landsat-8 satellite image dated 24.02.2017 having with 0% cloud covers are downloaded from www.glovis.usgs.gov/. All these data are open source satellite images and Census data published by Census of India 2011. Primary data will be collected through field survey. Study focus on urban expansion and its impact on land use/land cover pattern.

Software Used: The following software's were used for this study. Erdas Imagine 9.0: This software was used for the preprocessing, import image, geo-referencing of satellite data. Arc/Map (9.3): 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 power point presentations. Excel was used in computation of various statistics, preparation of the graphs and excels sheets.

Methodology: A study's technique is critical to its ability to explain reality and provide scientific description. A team of tools, technicians, and a method are used to carry out the process quickly and physically. A tool is a piece of equipment that is necessary for doing a specific task. Rather of detailing the primary processes, a method simply outlines the specific steps that must be taken. A shared framework is formed by the primary procedure. You can break it down and combine it into sub-processes as well as vary the sequence of the steps. Any type of work activity necessitates the completion of these steps. The steps adopted in the methodology are as follows: Acquisition of data, Geocoding Toposheet No. 53C/14 on scale 1:50000 of Karnal city, Georeferencing & Rectification, Subset of study area, Supervised Classification, Accuracy assessment, Map Construction, Results and Discussions, Conclusions.

Process of Urbanization

The growth of cities and metropolitan areas is a critical component of urbanisation. The metropolis provides rural folks with a glimmer of optimism. Because the city has a higher level of living than rural places, and it isn't widely available there. People in rural areas have access to economic prospects in cities. Rural-to-city migration increases as a result of this. By 2030, India's urban population is predicted to reach 575 million, which is more than 40% of the world's population. As a result, practically every city's physical environment is deteriorating. As a result, we should see the response to urban development as a good. It is also important to mention that urbanisation should be more balanced and responsible to national development goals in general.

Urbanization in Karnal: In 1951, the urban population was 68422, and it grew to 82929 in 1961, an increase of 14787 people. From 82929 in 1961 to 105829 in 1971, the urban population expanded by 22900 people in the following decade (1961-1971). The district's urban area had a population of 183755 residents in 1981. Over the course of twenty years (1981-2001), the urban population grew from 183755 to 337842.

There were an additional 337842 people added to the population of urban areas in 2011 compared to census 2001. According to Karnal City's population figures, the city's population did not grow significantly between 1901 and 1931, fluctuating between 23559 and 26610 people. Onward and upward we go. In 1951 there were 59790 individuals in the city. In 1981, there were 132107 people. In 2011, the population was 286827. In terms of urban population decadal growth, a highly uneven pattern of expansion has been seen in both the city and the district. As a result of the outbreaks of malaria and plague in 1901-1911, enormous migrations of people following the partition in 1941-1951, and government health measures adopted during this period of rapid population increase. Many immigrants came to Karnal since it was near Delhi and had a high chance of finding a job. In addition, the population of the country is on the rise. Between 1921 and 1941, the populations of both cities grew by a negligible percentage.

As a result of the country's post-independence period (1951-1981), the population soared and the urban population boomed, both in the district and city (Table 1). The Government's health policies may be at blame for this. In rural areas, many people are unable to access these kinds of amenities. Many people from the neighbouring villages are moving to the towns in search of better education and a better life.

Table 1: 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.

After the creation of the Municipal Corporation in 2011, the population of Karnal, the city I'm studying, was 357284. 189239 men and 168045 women are the total. There are 267963 people in total that are literate. There are 3945 people per square kilometre in the 90.57-square-mile area. Karnal's 20th most populous ward. Karnal City's average sex-to-child ratio is 888, while the corresponding figure for children in Karnal City is 809. Education-wise, the district is ranked 14th highest in the state. District 236 has the highest proficiency rate in the United States. In Karnal, the city's overall proficiency rate is 84.60 (84.60 for males, and 79.88 for females). 32468 people, or 11.31 percent of Karnal City's total population, are in the 0-6-year-old age bracket. There are 17945 male and 14523 female children between the ages of 0 and 6 years old in the United Kingdom. Karnal has a Child Sex Ratio of 809, according to the 2011 Census.

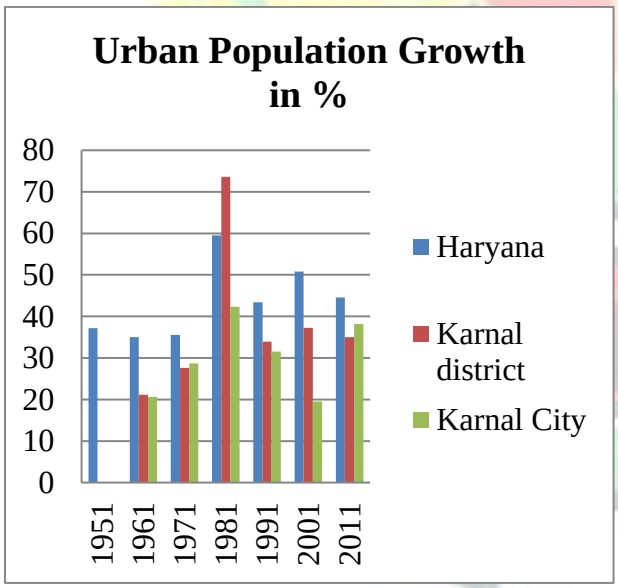


Fig. 2: Urban Population Growth in Percentage

Urban Agriculture

Urban agriculture can be defined as the development propagation and preparation of vegetables and animal husbandry with flowers. This is an important valuable activity for markets and urban environments, which is mainly on the outskirts of the city. Urban agriculture has been tested worldwide for many years and it is a mixed urban structure in many places. Urban agriculture is part of the integrated ecological plan in many circumstances. The importance of which is important for the greenery of the region, expansion of tourism and its environment. The increase or decrease of organic perception is of a natural concrete area, if the plan is very well organized and harmonized in the urban boundary area, then this agricultural area can improve the physical environment of the city. Flowering plants and elaborate food growers can control air disintegration and its aroma. Urban agriculture will also enthusiastically increase biodiversity with the use of humans and similar structures.

Agriculture and the urban expansion in Karnal: Due to the increasing development of urban slum areas in the city of Karnal, the population is increasing. This includes adequate unemployment, lack of food and lack of facilities, lack of food in high urban social and welfare environments calls for altered processes to guarantee adequate access to food for everyone. This change in where they are is driven by factors such as particular users and preferences, because now land is needed for urban applications rather than agriculture. It has promoted maturity and land acquisition to consider capacity. For this, the land of rural urban limits is considered the most suitable. With the expansion of urbanization in the city of Karnal, the city has developed to a large extent in the form of roads, multinational companies etc. There has been a shortage of 9.23 sq. km. of agricultural land from 2001 to 2011 and from 2011 to 2017 there has been a shortage of 4.30 sq. km. of agricultural land, which has become a built up area of slums mostly due to population pressure. This will be explained with the help of maps and tables in the further topic of results and discussion.

Results and Discussion

Looking at the map and the table shows that there have been significant changes in the city of Karnal in the years 2001 to 2011 and 2017. From the statistical images it was seen that the built up area was very low in the year 2001, the built up area in increased 2011 which is shown in red colour in the map and then in the year 2017 the built up land increased more which you see in the map. Due to which the agricultural land has decreased 13 sq. km in 2001 to 2017, 40.25 sq. km. in 2001, 30.02 sq. km. in 2011 and 26.72 sq. km. in 2017, which has reduced the agricultural land due to which production of agricultural products has decreased significantly.

Table 2: Land use/cover in Karnal city (2001, 2011 & 2017)

Class	2001 (Area in sq km)	2011 (Area in sq km)	2017 (Area in sq km)
Agriculture	40.25	31.02	26.72
Built-up	33.02	46.65	56.02
Vacant	10.32	8.36	4.25
Water Body	2.03	1.56	0.86
Fallow Land	3.09	1.12	0.86
Road	1.86	1.86	1.86
Total	**90.57**	**90.57**	**90.57**

Source: Karnal City Map in M.C. Office, & Landsate Data (2001, 2011 & 2017)

In the table it is analyzed that the agricultural land in terms of area has declined due to the effect of urbanization. In the year 2001 it was 40.25 sq. km. in 2011 it was 31.02 sq. km. and in the year it decreased more i.e. 26.72 sq. km. The built up area shown in the table increased in from 2001 to 2017. In 2001 it was 33.02, in 2011 it was 46.65 and in 2017 the area increased more and it was 56.02. The vacant land that could have been used for agriculture also kept declining in all these years shown above. In 2001 it was 10.32, in 2011 it was 8.36 and in 2017 it was 4.25.

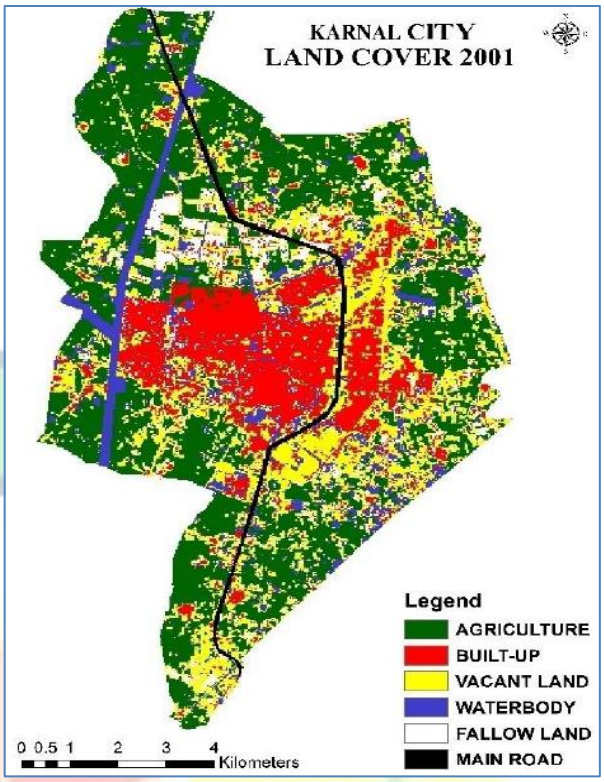


Fig. 3 The land use and land cover map (2001).

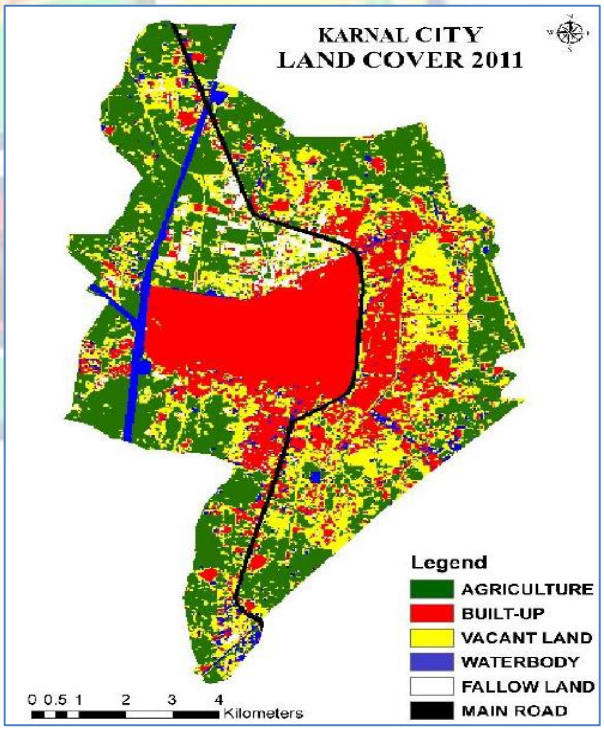


Fig. 4 The land use and land cover map (2011)

The water body area like lakes, ponds and wells also decreased. As seen above in 2001 the water body area

was 2.03, in 2011 it was1.56 and in 2017 it was 0.86. The fallow land that can be used for grazing of animals and more cultivation also declined. From the table it can be seen that in 2001 it was 3.09, in 2011 it was 1.12 and in 2017 the fallow land that was remained was 1.86. So all this was due to effect of urbanization.

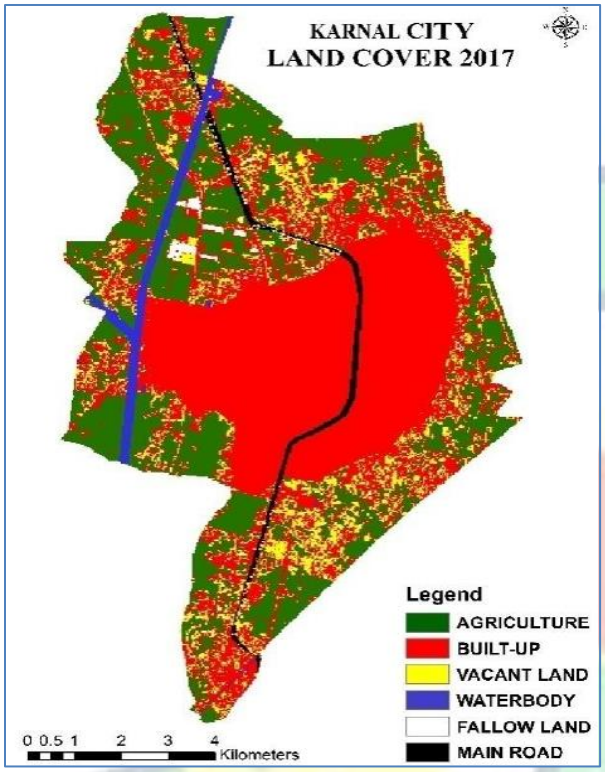


Fig. 5 The land use and land cover map (2017).

Table 3: Transformation of Agricultural Land

Categories Total (Area in sq km)		Agriculture 2001 to 2011	Agriculture 2011 to 2017	Agriculture 2001 to 2017
		40.25	31.02	40.25
Change Categories	Agriculture	25.01	24.36	24.36
	Built-up	4.32	5.17	13.75
	Vacant	9.17	1.18	1.67
	Water Body	0.80	0.05	0.12
	Fallow Land	0.87	0.19	0.23
	Road	0.08	0.07	0.12
	Total %	100	100	100

Source: Karnal City Map in M.C. Office, & Landsate Data (2001, 2011 & 2017)

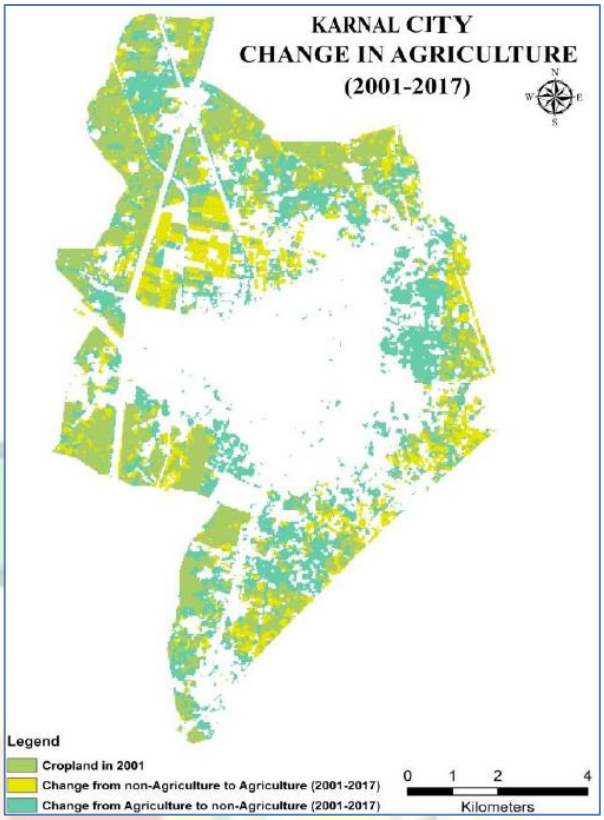


Fig. 6 Change in Agriculture Map 2001 & 2017

It is observed in the above statistical table that there has been a lot of change in the built up, vacant land, fallow land and water bodies of agricultural land. In the years 2001 to 2011 there has been a change of 4.32 sq. km. from the agricultural land to the built-up area and 9.17 sq. km. from the agricultural land to the vacant land. But 5.17 sq. km. from the agricultural land to the built-up area between 2011 and 2017, 1.18 sq. km. from the vacant land the key has changed. After seeing all this it is known that between 2001 and 2017 a large part of agricultural land has turned into built up land, vacant land fallow land and water bodies. Apart from this, one thing has also come to notice that between 2001 and 2011 the agricultural land has gone into a lot of vacant land which later changed to the land built up area between 2011 and 2017. This analysis shows that urbanization has been greatly affected agricultural land.

Loss in the Production of Food Grains: An estimated 193 million tones, which was barely achieved due to favorable monsoons, were in demand in the country in

1998. The demand will amount to some 350 million tons by 2015. Production needs to be increased by 3 percent a year in order to fulfill these food requirements; but in the past five years, food grain production has grown by just 1.6 percent. The attainment of these goals is more demanding and also an issue for agricultural scientists, as the reduction in agricultural land directly resulted in a decrease in the production of food grains, and this loss is very difficult to achieve.

Table 4: Loss of Food Grains Production 2001 to 2017

Years	**Loss of Agricultural Area (sq. km.)**	**Average Loss of Food Grain Production per Year (in quintals)**
2001 – 2011	9.23	80283
2011 – 2017	4.3	62336
2001 – 2017	13.53	73553

Source: Based on estimation by Researcher and Karnal City Map in M.C. Office, & Landsate Data (2001, 2011 & 2017)

The estimated total annual average loss of food grain production from 2001-2011 due to urban expansion in the area studied is about 80283 quintals per year in the area under study. The average annual food grain production in the study area between 2011 and 2017 is estimated to lose 374016 quintals of food crop production at 62336 per year. In this regard, new technologies should be pursued to improve productivity in agriculture as agriculture has lost land worldwide because of urbanization.

Conclusion

Additionally, urbanisation is considered as having a negative impact on agriculture, ranging from land losses to building and urban growth, and industrial propensity to government support for infrastructure and utilities, as well as subsidies. Even still, many people in the city suffer from extreme poverty, and rural revenue is crucial to the market for agricultural products in the city. Farmers and rural consumers also rely on urban businesses to deliver a wide range of goods and services, including access to the market. Therefore, the most pressing question is how a shrinking global supply of arable land and water will be met by an ever-rising urban population and economy's increasing demand for food (and other agricultural products). In addition, climate change's effects on agricultural and urban demand, as well as on city businesses that supply rural farmers and customers with services, must be taken into account. Agricultural production can be considered as the foundation of Indian industry. More than seventy percent of the country's workforce is employed in this sector. Providing food and raw materials, jobs for a huge number of people, resources for its own development and surpluses for natural economic development, it is the country's most important economic sector.

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