



Dynamics of Urban Growth in Hisar City of Western Haryana, India

Manju Sharma¹ and Sandeep Kumar²

¹*Department of Geography, Dayanand College, Hisar, Affiliated to Guru Jambheshwar
University of Science and Technology, Hisar 125 001, Haryana, India*

E-mail: manju.haritash@gmail.com

²*AMSSS, Bhiwani Rohilla, Hisar, under Department of School Education, Haryana, India*

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ABSTRACT Since the inception of towns and cities, the available employment opportunities in industrial sectors and better living conditions work as a magnet for the population which results in overcrowding, slum origin in urban and deglutition of periphery areas. The present study tries to monitor the growth pattern of the western city of Haryana, Hisar, based on spatial and non-spatial information which has been derived from different sources and agencies from 1972 to 2017. The land consumption rate has been calculated to measure the progressive spatial expansion of the city with its population. It has been revealed that rapid population growth and liberal industrial policy of the government have augmented the urban expansion that covered mainly the area of southeastern direction along with Delhi road. Apart from this, willingly or unwillingly the agricultural land of the fringe area and major transport routes have also facilitated this growth. Another finding reports that urban expansion for the creation of residents, entertainment spaces and other urban uses has resulted in a decrease of farming ground and alteration in bio-diversity of related area and perimeter also.

INTRODUCTION

From ancient time, as their living place, people have always preferred the location where they can avail better education, health care, employment facilities and security. This search for superior situation results in the origin of cities and their expansion around the municipal boundaries and in adjoining areas. The lust of land for a city to expand comes to an end only after achieving the title of ghost city passing through the various statuses like a town, city, metropolitan and megacity through the continuous intrusion in the periphery. There are two main aspects and possibility of urbanism: one is the fast expansion of urban areas toward the periphery in search of land while another is that fringe area also tiptoes in the direction of the city in the temptation of betterment and sound economic base. On one side, the growing towns and cities in a nation are symbols of develop-

ment and prosperity while on another side, these are drivers of socio-cultural problems and environmental degradation.

Generally, urban growth refers to the spreading of an area in its surroundings as the consequences of development and increasing concentration of population within a town or city. The process starts in a small way but expands very fast in different directions depending on the number of socio-cultural-economic and political factors (Silva and Clarke 2002; Sharma and Kumar 2017). In other words, it offers the tiled way to growth phenomena with a connotation of geographical and human aspects of any region (Ramachandra et al. 2014). The pattern and growth of cities in the world vary from one urban position to another and its study is essential for appropriate urban planning. This extension is the result of the movement of inhabitants from villages to towns, smaller towns to bigger towns or cities, and peripheral villages to towns due to pull and push factors of the next and the existing sites in that order (Ahmad and Ali 2006). In other words, many assorted facets like basic infrastructure, fundamental needs, socio-economic progression and administrative course of action help an area for expanding and it is very intricate to clear that which determinant gives

Address for correspondence:

Manju Sharma
Department of Geography,
Dayanand College,
Hisar 125 001, Haryana, India
E-mail: manju.haritash@gmail.com
ORCID: <https://orcid.org/0000-0001-6014-7424>

more than others (Kumar and Sharma 2017). In practice of unidirectional urban expansion, the cities and urban arrangements are deemed as the core of populace accumulation due to some precise pull factors and this amass plays a significant role in the development of social order (Dadras et al. 2015). Generally, the expanding roads of the urban areas traverse the productive agricultural land in its proximity. It has a pessimistic impact on peripheral fertile farming land and this scene of loss of agricultural land for other urban uses and waning food production increase the prospect of food scarcity more (Allen 2003; Seto et al. 2011; Kumar 2014; Gibson et al. 2015). The adaptation of new means and methods of farmland by farmers to cope with the system of urbanism present severe damage to environmental sustainability and non-natural progression of cities plus fringe. As geographical or geological phenomena gives both award and penalty and the disturbed elements of these put the shocking and beyond the eco-political boundaries impressions to a region, state or nation.

There are evidences that in recent decades at world level, the cities have expanded rapidly rather than uniformly caused by various social (socio-cultural values and attachments), geographical (physical arrangements of water bodies and landforms, relief structure) and economic-political dynamics (land value, land utilization, government policy, connectivity status) of itself as well as periphery (Aguilar 2008). This speedy growth in urban life causes to excessive exploitation of natural possessions which leaves giant prints of environmental degradation, not only in the concerned area but in surroundings also (Ramachandra et al. 2012; Lakshmana 2014). On one side, it works as an engine of economic growth and assures better way of life while on another side, it is blamed for fading the natural panorama (Costanza et al. 1997; Van-Ginkel 2008; Czamanski et al. 2008; Mitsova et al. 2011). The haphazard urban growth invites some common problems like traffic overloading, failing of social fraternity, cost-intensive infrastructure and cultural isolation which further poses a threat to all urban existence (Deal and Schunk 2004; Morris 2005). In reality, urbanization is a two-edged sword which attracts people and compels them to live in a balanced pose otherwise it may present reverse conditions. Even after having

the repulsive side, urban centres provide an optimistic path for going ahead by offering the facilities of education to novices, jobs to jobless, economic strengthening to rundowns, medical facilities to poor health, a standard way of life to seekers, wider platform to businessmen and choice-based consumerism to the residents. To fulfil the above-said promise of services, the city starts to expand with absorption of the peripheral geography which later endangers the unseen, unexpected and unenviable complications and stress for its own self as well as nearby areas. This type of sprawling due to express population growth not only generates heaviness on the existing urban services and resources but also a threat to city sustainability.

Urbanization: Problems and Prospects

Irrefutably, the precious resource of land has always attracted scholars in the exploration of spatial phenomenon. Though nature has defined the limit for human in its way yet it follows not only to the determinism but also possibilism and neo-determinism. Throughout the globe, it is impossible to stretch land reserve but it offers a wide platform to mankind for experiments and to search the hidden potential by changing the land use patterns. This alternation in a land organization is a natural occurring episode with the time but when it joins the infinitive desire of purported human progression, it gives the irremediable damage to nature first and then to the human race. Then it acts as a non-point pollution which is generated by a human being without knowing the long-lasting appalling impacts on own self. It is just like to strip the green cover by frantically destroying nearby vegetation for top gallant urban structures, permanent cleanliness and then use an artificial air purifier and decorate the houses with miniature plants which are generally looked 'powdery, sun-baked and murky'.

The prolonged and commendable organization of terra firma is the key constraint of the development. In one way, planned urbanization provides the comfort to its residents while in another way ad hoc urban expansion creates the panic for nature as well as human beings through pollution, congestion, and unhealthy living settings (Kumar and Sharma 2016). An assessment refers that transformation of agricul-

tural land in urban uses, dense agricultural propensity due to direct loss of crop growing land and low nutritional density in cities are major consequences of rapid urban growth (Jiang et al. 2012; Jiang et al. 2013; Seto et al. 2000; Kumar 2016; Chadchan and Shankar 2012; Fazal 2001; Rahman et al. 2011; Mishra 2002). The UN report also says that urban India is witnessing more and unpredictable adjustments in land utilization because it is going to have half Indians in cities by 2050 according to World Urbanization Prospects (United Nations 2012). The future figures are pleasing but the nation can't ignore the present statistics of international agencies that expose to 15 out of 20 most polluted cities of the world as Indian cities. It is a very disgusting fact that a big proportion of people in the top megacities of the country are constrained to live in atrocious conditions. Apart from this even in planned cities, the bulk of the populations live in illegal colonies and slums (Gupta 2019). In many Indian cities, starting from historic urban nucleus the growth is nonstop spreading towards the periphery and forwarding in a jumbled way. It creates extra pressure on essential services and infrastructure of the country and it is a prime responsibility of urban planners and admin to manage and monitor the muddled urban growth to the conservation of fringe diversity and achieve the sustainable development (Farooq and Ahmad 2008). In the last decades, due to industrialization, commercialization and growing population, as well as an expectation of better services and opportunities in cities, the rapid, uneven and chaotic urbanization, has become an ordinary phenomenon in India. It is a great apprehension for the regional administration to tackle the increasing pressure on natural resources and ecological harms due to the rising urban population. As the chorological and chronological detection of land transformations is a prime call for urban studies which helps in designing of a new pathway of development and base level planning which not only pass up the related impediments but also determine the direction of amplification (Ewing et al. 2002; Kumar and Sharma 2017; Kumar 2014). The temporal monitoring and spatial information about urban land use and changes are also necessary to trace the advancement of different areas (Ramesh et. al. 1989). It is determined by both economic

and non-economic factors (Njungbwen and Njungbwen 2011). The spatial and the latest information from the satellite images give a more valuable elucidation for sustainable growth of cities and space technology within GIS offers for comparative analysis of urban expansion and land-use changes of a locale. Such type of information makes the planners more efficient for optimum utilization of land resource through well-defined planning. It also provides sufficient space for modifications in land categorization on the demand of dwellers. Obviously, GIS is many more than a tool or technology and it not only assists urban planners in the monitoring of different natural and human operations over the earth but also offers the editing possibilities within same geographical boundaries.

Study Area

Hisar is one of the important cities of western Haryana located in the northern plain of India and also known as 'Steel City' of the state. During the last some decades, the city has attained an excellent prominence in the field of education, research and industrial fields. According to the existing prose, Feroze Shah Tuglak had established the city with a name Hisar-E-Feroza means 'fort'. Having the geographical location of 29° 10' Northern latitudes and 75° 45' Eastern longitudes, the city is managerial head-quarter of the district with the same caption (Fig.1). Being a prime urban and having historical importance, the city is well connected with its bordering districts through rail and road network.

Objectives

The study aims to find out the following objectives:

1. To pore over the temporal pattern and direction of physical growth of Hisar city with the exploration of causes and consequences.
2. To identify the status of illegal settings and slums population in the study area.

MATERIAL AND METHODS

The study is based on secondary sources related to multi-temporal cloud-free satellite data

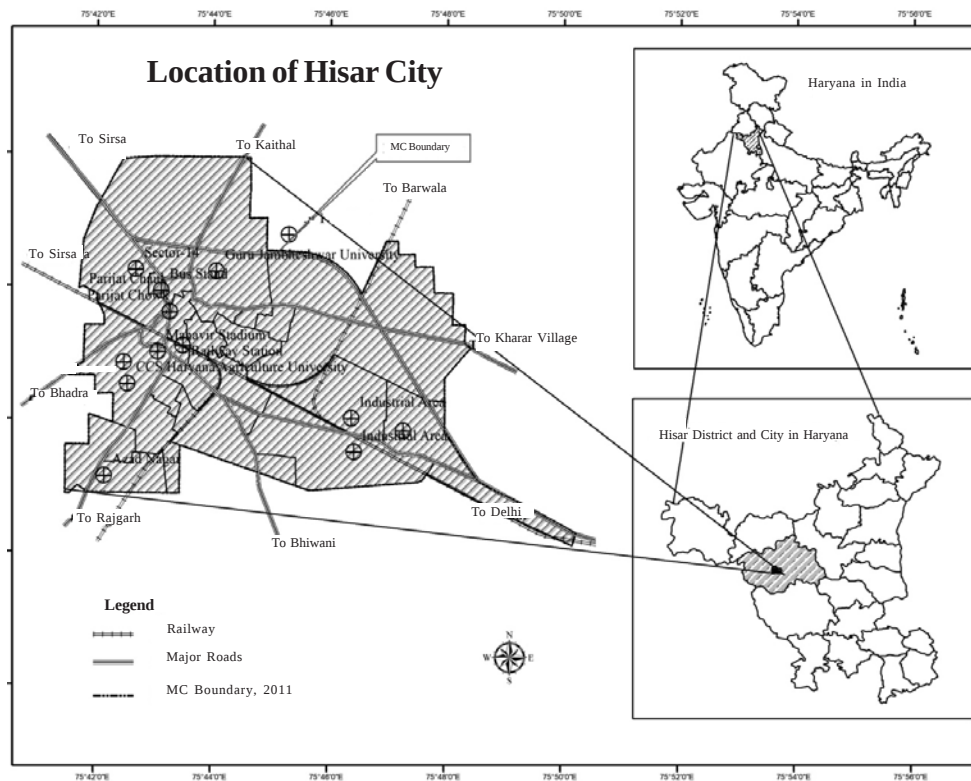


Fig. 1. Location map of study area

for the years *Landsat MSS (1-5) on 04/09/1972, Landsat MSS (1-5) C-1 on 12/09/1981, Landsat TM (4-5) C-1 on 05/03-1991, Landsat 7 ETM+ C-1 on 08/03/2001, Landsat 5 TM on 29/04/2011 and Landsat -7 ETM+ C-1 on 04/03/2017* downloaded without charges from the United States Geological Survey (USGS) by way of <http://earthexplorer.usgs.gov/> website.

The data related to population has been collected from, General Population Tables and Primary Census Abstract 1981, 2001 and 2011 (Census of India, 1981a, 2001a, 2011a) whereas the information regarding slums has been composed Town Directory (Census of India 1981b), Director of Census Operations, Haryana, 1981, Slum Primary Census Abstract (Census of India 2001b, 2011b). The information regarding unauthorized colonies is derived from MC, office, Hisar. The software ERDAS 10.0 and ArcGIS 10.0 are used for image processing, classification and map-

making in that order. The obtained information related to city expansion, nature of growth and historical shreds of evidence have been strengthened by ground-truthing of the study area. The land consumption rate has been calculated by using Sharma et al. (2012) method to measure the progressive spatial expansion of the city concerning its population:

$$\text{Land Consumption Rate (LCR)} = \frac{A}{P}$$

Where,

A = Built-up area of the city in hectares

P = Population

$$P_t = P_0 + \frac{n}{N} (P_1 - P_0)$$

The estimated population of the study area has been designed following procedure:

Where:

P_t = Estimated Population at some censal year t.

P_0 = Population in the previous census.

P_1 = Population in the succeeding census.

N = Number of the years between the census.

n = Number of years between the given year and the previous census year.

The growth rate of population and expansion of the built-up area has been calculated from the following method:

$$\text{Growth Rate} = \frac{\text{Latest year value} - \text{Base Year value}}{\text{base Year value}} \times 100$$

RESULTS AND DISCUSSION

Population Growth and Physical Expansion

During some preceding years, the cities have not only experienced the significant growth in its population but also felt the requirement of space to expand and fulfil the basic needs of people (Sharifi and Hosseingholizadeh 2019). This demand of land has always justified the infiltration of cities in peripheral areas and most of the cases the productive cultivable land of fringe has been encroached by the advancing boundaries of an urban area.

Table 1 reveals the trends of growth in population and area of Hisar city from 1901 to 2011. It has been reflected that from 1901 to 1951, there is an absolute increase of 17650 persons in city population and this growth is 23.34 percent. It is

a representation of data that in 1961 the area of municipality was only 17.53 square km. with a population of 60222 which has increased up to 37.48 square km inhabited by 131309 persons. The various censuses have reported the positive growth of the city population. In forty years, the area increased about two and half times and calculated as 45.43 square kms in 2001 whereas the addition in population was 196467 persons for the same period. Amazingly in 2011, there is an increase of 44694 persons as compared to the previous enumeration but the city limits remained similar. It shows the increasing pressure of users on the available resources and this fact augment the city to trespass the nearby territory. Firstly, the administration of Hisar city was constituted in 1867. The numeral reveals that the city had gained the status of Municipality and Civil Lines in 1901. During the phase of 1901 to 1941, the municipality worked as city's administration in Hisar town and then it was changed as Municipal Committee during the segment of 1951 to 1991. In 2001, the municipal council worked as city's administration in Hisar and the city achieved the status of Municipal Corporation on 17 March 2010 vide notification no. 18/5/2010-3C1 by Urban Local Bodies Department under Government of Haryana (Haryana Government 2010). On one hand, the setup of various renowned educational institutions like Dayanand College, Fathe Chand Mahila Mahavidhyala,

Table 1: Trend of population growth and area of Hisar: 1901-2011

Census year	Urban status	MC area in a square kilometre	Persons	Variation since the preceding Census	
				Absolute	Percentage
1901	M. and C.L.	-	17647	-	-
1911	M.	-	17162	-485	-2.75
1921	M.	-	21415	4253	24.78
1931	M.	-	25179	3764	17.58
1941	M.	-	28618	3439	13.66
1951	M.C.	-	35297	6679	23.34
1961	M.C.	17.53	60222	24925	70.62
1971	M.C.	31.34	89437	29215	48.51
1981	M.C.	37.38	131309	41872	46.82
1991	M.C.	45.43	172677	41368	31.50
2001	M.Cl.	45.43	256689	84012	48.65
2011	M. Corp.	45.43	301383	44694	17.41
2017	M. Corp.	76.52	332669*	31286	10.38

Source: Census of India, 1981a, 2001a and 2011a and MC Office, Hisar.

Note: M. and C.L. =Municipality and Civil Lines, M. Municipality, M.C. = Municipal Committee, M. Cl. = Municipal Council and M. Corp. = Municipal Corporation and * means Estimated Population.

Government Post Graduate (co-aid) and Women College gave the abundant possibility of expansion to the city while on another side, various central and state research organizations (Stud Farm, Fish Farm, Goat Breeding Centre, Buffalo Research Centre, Livestock and Seed Production Farms, Sheep and Piggery and Hatchery Centre), instruction centers (Farmers Training Center for traditional and modern farming skills and handling the agricultural equipment) and district executive and legal complexes, electricity board and residential and industrial set of connections as a result of lenient government attitude have also provided the positive and rational way to the city to spread out its boundaries.

Hisar City: Walled City to Afar Boundaries

Hisar was an important part of Delhi in the 14th century. In one way, the four gates namely Delhi, Nagori, Mori and Talaqi in north, south,

east and west of the city in that order proves its historical meaning of 'fort' while on another side, the bulwark encircle of the city as a result of prescient philosophy of providing security and comfort to its residents. All these things facilitated to the erection work in the city around 1354 A.D. and in this way under the personal supervision of Mughal Empire Firoz Shah Tuglak and constant efforts of two and half years a 'walled town' with stones of Narsai Hills (located in Narnaul) came into existence. A big and yawning reservoir was built indoor of the castle to replenish the water in the drain encircling the pebble boundaries of the outer surface. The approved and legitimized construction of houses with caustic lime and burnt bricks was a far-sighted view towards the development of a planned city. No doubt, these means and methods had added to the security of the residents along with eternal subsistence of the city.

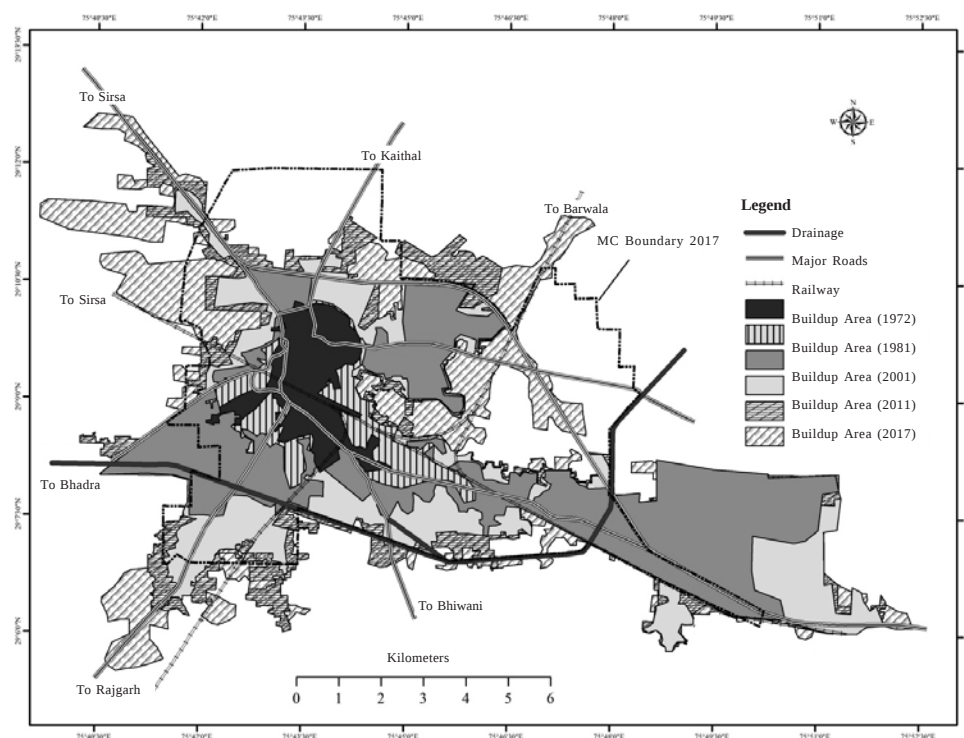


Fig. 2. Expansion of Hisar City

Source: Based on Landsat MSS (1972), Landsat MSS (1981), Landsat TM (1991), Landsat 7 ETM (2001), Landsat 5 TM (2011) and Landsat 7 ETM+ (2017) satellite images.

The city has remained the eyewitness of various episodes of prosperity and majesty as well as annihilation during the phase of various Mughal and British dynasty and through this long spans travelling from historical to the modern era, the city has not only maintained its continuation but also attained a marvellous repute in all. Concerning physical expansion, in 1972 with a population size of 94624 persons, the city was extended in 6.37 sq. km. area flanked by bus stand, Parijat Chowk, railway station and Mahavir Stadium (Fig.2). During the phase of 1972 to 1981, the city started to develop rapidly with an establishment of Agriculture University in south-west and west of the railway station as an extension of Punjab Agriculture University, Ludhiana. The outer fringe of the city gave the opportunities to the foundation of a variety of manufacturing for G.I. and M.S. pipes, strips, angles/channels and guarders of different segments and several cotton ginning industrial units, yarn makes units and flour mills as being the major producer of cotton. More of these industries were set up at a distance of 5 to 10 km. from the city and but with the growth, they have become a part of the city. Furthermore, the excess numbers of people by natural growth as well as migration from closest rural communities and states like Punjab and Rajasthan with a hope of better employment, education and medical facilities have created the pressure on a non-elastic land resource of the city. This congestion motivated the city limits to expand toward central-eastern part and nearby the bus stand and in this way, the unplanned setups in Mahavir colony, 12 quarter, Mohalla Dogran and Rishi Nagar came on the floor. The area around HTM

mill has emerged as unplanned built-up area for residential purposes while the transport routes gave the opportunities to city administration for designed development of Marketplace (Cloth Market close to bus stand, Rajguru Market reverse to historical love symbol Gujri Mahal, Vidyut Nager on Delhi road and New Grain Market between Sirsa Road and Guru Jambheshwar University of Science and Technology) and other settings. In southern side amid Delhi Road and bypass, the Housing Board Colony, Green Park area, Defense Colony and Sector-15A and on Delhi Road which joins Sirsa Road in north passing through east to west of the city M.C. Colony, D.C. Colony, Model Town and Jawahar Nagar, raised as deliberated housing areas (Fig.2).

The arrangements of Auto Market through the period of 1981 to 1991, South Western Indian Army Control Center in 1982 later converted as completely Armored Division as Cantonment Town in December 1993 and Guru Jambheshwar University of Science and Technology in 1995 had also assisted the city expansion.

From 2001 to 2011, the eastern Delhi transport way provided the space to city growth while in the west the intensification was constrained by Chaudhary Charan Singh Agricultural University (CCS, HAU). With the presence of wasteland along Sirsa and Kaithal roads, there is a large planned segment in form of Sector-14 whereas Quarter Colony, Azad Nagar, Navdeep Colony, Saket Extension, Aadarsh Colony and Sastri Colony came on the floor along with Rajgarh Road and Railways. In 2011, the built-up area of the city reached 72.76 square km. which started spreading in conjunction with focal transportation road of NH-10 and a hysterical ribbon

Table 2: Population growth, physical expansion and land consumption rate of Hisar City

Year	Built-up area (in sq. km)	Growth rate in percent	Population	Growth rate in percent (population)	Land consumption rate (hectares per person)
1972	6.37	-	93624*	-	0.007
1981	11.59	81.95	131309	40.25	0.009
1991	40.95	253.32	172677	31.50	0.023
2001	60.49	47.72	256689	48.65	0.024
2011	72.76	20.28	301383	17.41	0.024
2017	94.68	30.13	332669*	10.38	0.028

Source: Based on Landsat MSS (1972), Landsat MSS (1981), Landsat TM (1991), Landsat 7 ETM (2001), Landsat 5 TM (2011) and Landsat -7 ETM+ (2017) satellite images.

Note: *Estimated Population

type construction has also appeared on the route of villages of Badi Satrod and Satrod Khas (Fig. 2 and Table 2). Forwarding its step, the city amalgamated with Military Town which was far away about 10 kms from the core of the city in its initial stage. The recent expansion has been observed in the form of Airport in outskirts of the city after the approval of state government in August 2012 for operating the domestic aviation service. In urban areas, the growing concrete jungle or forest of buildings is an outcome of basically two phenomena. First is pulling aspect like education and health institutions, industries and comfy transportation which tempts the people to become an urban and secondly to solve the scarcity of horizontal space, the city grows vertically. In this sequence, initially to cope with the increasing demand of residences for natural and migration induced population demand, the city meets with the appearance of illegal colonies and slum areas and in the second stage, the urban area starts wriggling en route for its boundaries to escape the overcrowding and contaminated environ. As a measure of compactness and spatial growth, the four times increase in (0.007 in 1972 to 0.028 in 2017) land consumption rate (LCR) reveals that the city is continuously going to be congested (Table 2).

It can be attributed to the ever-increasing demand of more urban land for natural and migrated population of the concerned area. The assimilation or encroachment towards the fringe area for mitigation of urban demands of housing and commercial structure has also augmented the municipal limits mainly at the cost of agricultural land and vegetation cover-up. This fact is also supported by the study of Nagpur (Kumar and Tripathi 2014) and Guhawati (Pawe and Saikia 2018) cities which explains that in both cases, natural and semi-natural vegetation area, as well as water bodies, have lost their actual area to fulfil the desire of land of growing cities.

Appraisal of Illegal Occupancy and Slums

The positive and negative aspect of growth phenomenon is general apprehension in urban studies. Owing to both side, with advancement or increasing urbanism, an urban area meets with unlawful possession and construction also in and around its edges. The availability of better

goods and services in the city attracts to the population of nearby and in most of the cases, these migrated deprived people fail to afford the urban facility and start temporarily settling in cheap areas and open spaces where it is available. In its initial step, this unauthorized and fleeting housing is ignored by authorities and officials whenever they have no plan for that particular site. With time, not only the residents' annex that space permanently but also demands the basic facilities like to any other intended urban area and create stumbling blocks in the development of a planned city. According to Hisar city administration, there are eighteen identified colonies mainly along with the transportation network whose possessions are against the law (Table 3).

Table 3: Unauthorized colonies in Hisar City

S. No.	Name of colony
1	Rajender Enclave Colony
2	Vidya Nagar
3	Satya Nagar
4	Baba Harsukhpuri Colony
5	Shaheed Bhagat Singh Colony
6	Master Colony
7	Tower Colony
8	Hanuman Colony
9	University Vihar Colony
10	Devilal Colony
11	Choudhary Colony
12	Model Town Extension-II
13	Mahabir Colony Extension-I
14	Mahabir Colony Extension-II
15	Dev Vatika
16	Kaushik Nagar
17	Krishna Nagar Extension Colony
18	Aggarwal Colony Extension

Source: Municipal Office, Hisar, 2016

Generally, slums are dwelling sites of unlawful ownership and characterized by the polluted environment, absence of basic minimum needs of food, water and shelter, poor health status and hazardous and susceptible settings with earth sliding, overflow and others adversity which always threats for desolation to the deprived occupiers. It is a bitter truth of life with hand to mouth, detrimental and bothering living conditions (Government of India 2011; Sharma and Kaushik 2013; Ragheb et al. 2016). The redundancy, under-employment and hidden un-

employment are key factors in the emergence of slums and force the people to live in such untidy, precarious and malodorous locations which increase the incidences and frequency of crimes, decadence and social anarchy.

It is estimated that with a large proportion of low economies slum population, about one-third urban residents constitute a significant part of total one billion slum inhabitants worldwide which are projected to be 2 and 3 billion by 2030 and 2050 in that order (United Nations 2015; UN-Habitat 2010). No doubt, the absence of basic needs like erudition and health care with the presence of unhygienic conditions and illegal activities in slighted sites not only affect the presently living community but also leave a bad impression for coming generations for a long time (UN-Habitat 2003). While studying the slums of Indian cities, Desai and Pillai (1970) found that in the lack of attentive and effective approach of planning authorities, there is left no another way for urban sites to close eyes towards the settling process of poor or work foragers in Augean stables. Unquestionably, in developing countries like India, rapid and pell-mell urbanization ignoring far-future expectations is responsible for slums existence. No doubt that political and other urban standards also contribute to this and the open area close to a planned site also assists the origin of slums by offering the unskilled or low-skilled work like cleaning, washing and kid's handling in households. With time, the residents of both areas become complementary to each other in terms of service providers and receivers and management have to face the sotto voce or sometimes open objection of well-planned societies during the confiscation of such settings (Table 4).

The statistics reveals that in 1981, only 10.20 percent (13400 persons) of the total population of the city (131309 persons) was living in slum areas which have become as one-third (33.83%) proportion of the whole in census 2011 passing through the ratio of 22.53 and 30.31 percent in 1991 and 2001 respectively. Generally, these slums have been observed near the railway station and along with railway line because of the concentration of people from various communities. As there is a demand for the working population in the city every day for different types of activi-

Table 4: Status of slum population of Hisar City, 1981-2011

<i>Census years</i>	<i>Total population</i>	<i>Slum population</i>	<i>Percentage of slum population of total population</i>
1981	131309	13400	10.20
1991	172677	38897*	22.53
2001	256689	77793	30.31
2011	301383	101962	33.83

Source: Census of India 1981b, 2001b and 2011b

Note: *Estimated Population

ties, these slum dwellers get employment temporarily in such activities easily. During the ground verification, a wide tract of illegal constructions or slums in the form of polygon or line has been also seen along with high class planned residential area of the city. Apart from working in households, the dwellers of such areas are also found engaged in garbage collection, selling of cheaper things of daily uses, begging in the food market, commuter zones and traffic signals either with their infants or various symbols of Gods or other religious items.

CONCLUSION

The overall analysis reveals that the establishment of residential and recreational sites, medical and service spots and commercial sites for urban uses also coerce the city to break its natural limits. Observation of population and land growth clears that from the tiny size of 6.37 sq. km of 1972 occupied by 93624 persons, the city has emerged as a big city with spatial expansion of 94.68 square kms with an estimated population size 332669 in 2017. This rapid increase in population either by natural growth or immigration from contiguous areas has put extra pressure on land and other services of the city and it has resulted as a high value of land consumption rate. In this sequence, experiencing express growth, the study area looks like a final destination of opportunities not only by its neighbouring population but also the bordering states of Rajasthan and Punjab. The incessant increase in built-up area disclose that shrubbery cover-up and farming land of the periphery have been compromised more to provide the space for city

growth. The political approach has also helped in the economic development of the city and emergence as a core of people's attention. This aspect is continuously modifying the margin areas into designed and unintentional residential arrangements, business and entertaining portions and other uses to facilitate the urban quality of life and confiscate the negative features of urbanization. But as another side of the same coin, the study area is witnessing the slums, inhabited by deprived supposed 'urban segments'. To sum up, the population and physical growth of the city is admirable unquestionably and it is the prime responsibility of urban planners and managers to maintain its advancement with a sustainable negotiation with biodiversity otherwise we will neither be in a position of enjoying real urbanism nor peasantry and it will be like to go in non-natural oxygen chambers after scandalizing the natural purity.

RECOMMENDATIONS

The population growth and physical expansion of the city have assisted the overall development of the study area. But during the field observation it has been inspected that in peak hours of the day, the city has to face jams and congestion, generally induced by the encroachment of roads by the shopkeepers, movable *rehries* or carts of fruits, vegetables and fast food items. The resilience of the system towards illegal parking not only makes the problem more serious but also incites the people to make a mockery of urban arrangements plus traffic rules and regulations. The construction of flyovers on railway crossings and strict parking policy for traders, wandering sellers and public also, can be helpful to solve this dilemma. In this regard, it has been recommended that up to date remote sensing data and GIS tools can be effective in well-organized settings of transportation to crack the blocking or overcrowding in the city. It will also explore the space for future development plan through the identification of the unplanned and illegal residential sites. Because such type of advanced inspection and monitoring of infringement in open land and government initiative of housing for the deprived section will be cooperative not only in the elimina-

tion of slums and illegal settlements but also in the smart and sustainable development of the city. There should also be a plan to develop the urban conveniences like employment and education opportunities, good transport accessibility, connectivity and basic facilities in the fringe area to manage the pressure of the migrated population and their requirements.

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REFERENCES

- Aguilar AG 2008. Peri-urbanization, illegal settlements and environmental impact in Mexico City. *Cities*, 25(3): 133-145.
- Ahmad A, Ali MJ 2006. Levels of urbanization in West Bengal: A quantitative approach. *Geographical Review of India*, 68(4): 407-416.
- Allen A 2003. Environmental planning and management of the peri-urban interface: Perspectives on an emerging field. *Environment and Urbanization*, 15(1): 135-148.
- Census of India 1981a. General Population Tables and Primary Census Abstract Series-6 (Part II- A and B, Director of Census Operations, Haryana.
- Census of India 1981b. Town Directory, Part X -A, Haryana, Series-6, Director of Census Operations, Haryana.
- Census of India 2001a. Primary Census Abstract. Director of Census Operations, Haryana.
- Census of India 2001b. Slum: Primary Census Abstract. Office of the Registrar General, New Delhi, India.
- Census of India 2011a. Primary Census Abstract. Director of Census Operations, Haryana.
- Census of India 2011b. Slum: Primary Census Abstract. Office of the Registrar General, New Delhi, India.
- Chadchan J, Shankar R 2012. An analysis of urban growth trends in the post-economic reforms period in India. *International Journal of Sustainable Built Environment*, 1(1): 36-49. Doi:10.1016/j.ijbsbe.2012. 05.001.
- Costanza R, d'Arge R, De-Groot R, Farber S, Grasso M, Hannon B, Raskin RG 1997. The value of the world's ecosystem services and natural capital. *Nature*, 387 (6630): 253-260.
- Czamanski D, Benenson I, Malkinson D, Marinov M, Roth R, Wittenberg L 2008. Urban sprawl and ecosystems-Can nature survive? *International Review of Environmental and Resource Economics*, 2(4): 321-366.

- Dadras M, Shafri HZ, Ahmad N, Pradhan B, Safarpour S 2015. Spatio-temporal analysis of urban growth from remote sensing data in Bandar Abbas city, Iran. *The Egyptian Journal of Remote Sensing and Space Science*, 18(1): 35-52. Doi:10.1016/j.ejrs.2015.03.005
- Deal B, Schunk D 2004. Spatial dynamic modeling and urban land use transformation: A simulation approach to assessing the costs of urban sprawl. *Ecological Economics*, 51(1-2): 79-95. Doi:10.1016/j.ecolecon.2004.04.008
- Desai AR, Pillai SD (Eds.) 1970. *Slums and Urbanization*. Bombay: Popular Prakashan.
- Ewing RH, Pendall R, Chen DD 2002. *Measuring Sprawl and its Impact*. Washington, DC: Smart Growth America.
- Farooq S, Ahmad S 2008. Urban sprawl development around Aligarh city: A study aided by satellite remote sensing and GIS. *Journal of the Indian Society of Remote Sensing*, 36(1): 77-88. Doi:10.1007/s12524-008-0008-0
- Fazal S 2001. The need for preserving farmland: A case study from a predominantly agrarian economy (India). *Landscape and Urban Planning*, 55(1): 1-13. Doi:10.1016/S0169-2046(00)00134-1
- Gibson J, Boe-Gibson G, Stichbury G 2015. Urban land expansion in India 1992–2012. *Food Policy*, 56: 100-113. Doi:10.1016/j.foodpol.2015.08.002
- Government of India 2011. *Slums in India: A Statistical Compendium*. Ministry of Housing and Urban Poverty Alleviation National Buildings Organization, New Delhi.
- Gupta S 2019. Why Indian Cities will remain Pitiable? *Dainik Bhaskar* (Hindi version), Editorial Column, *Abhivayakti*. July 22, 2019, P. 4.
- Haryana Government 2010. Urban Local Bodies Department, *Notification No. 18/5/2010-3C1*.
- Jiang L, Deng X, Seto KC 2013. The impact of urban expansion on agricultural land use intensity in China. *Land Use Policy*, 35: 33-39.
- Jiang L, Deng X, Seto KC 2012. Multi-level modeling of urban expansion and cultivated land conversion for urban hotspot counties in China. *Landscape and Urban Planning*, 108(2-4): 131-139.
- Kumar M, Tripathi DK 2014. Spatial monitoring of urban growth of Nagpur City (India) using geospatial techniques. *Journal of Settlements and Spatial Planning*, 5(2): 91-98.
- Kumar S 2014. Land transformation and urban planning case of Sonapat city, Haryana, India. *Indian Journal of Spatial Science*, 5(2):1-11.
- Kumar S 2016. Analysis of land use changes in urban environment of Sonapat city: A study from Haryana state. *Indian Journal of Geomorphology*, 21(2): 125-136.
- Kumar S, Sharma M 2016. Assessment of land use/land cover and transport network: Case of Kanpur metropolitan, Uttar Pradesh, India. *Indian Journal of Geomorphology*, 21(2): 79-90.
- Kumar S, Sharma M 2017. A study of urban sprawl in Rohtak City, Haryana. *The Deccan Geographer*, 55(1 and 2): 17-24.
- Lakshmana CM 2014. Dynamics of urban growth, resource degradation and environmental pollution in million plus cities of India. *Environment and Urbanization Asia*, 5(1): 49–61. Doi:10.1177/0975425314521532
- Mishra V 2002. Population growth and intensification of land use in India. *International Journal of Population Geography*, 8(5): 365-383. Doi:10.1002/ijpg.266
- Mitsova D, Shuster W, Wang X 2011. A cellular automata model of land cover change to integrate urban growth with open space conservation. *Landscape and Urban Planning*, 99(2):141-153. Doi:10.1016/j.landurbplan.2010.10.001
- Morris D 2005. *It's a Sprawl World After All: The Human Cost of Unplanned Growth and Visions of a Better Future*. Canada: New Society Publishers.
- Municipal Office 2016. *Data Related To Unauthorized Colonies*. Municipal Office, Hisar, 11 September, 2016.
- Njungbwen E, Njungbwen A 2011. Urban expansion and loss of agricultural land in Uyo urban area: Implications for agricultural business. *Ethiopian Journal of Environmental Studies and Management*, 4(4): 74–83. Doi:10.4314/ejesm.v4i4.9
- Pawe CK, Saikia A 2018. Unplanned urban growth: land use/land cover change in the Guwahati Metropolitan Area, India. *Geografisk Tidsskrift-Danish Journal of Geography*, 118(1): 88-100. Doi: 10.1080/00167223.2017.1405357
- Ragheb G, El-Shimy H, Ragheb A 2016. Land for poor: Towards sustainable master plan for sensitive redevelopment of slums. *Procedia-Social and Behavioral Sciences*, 216: 417-427.
- Rahman A, Aggarwal SP, Netband M, Fazal S 2011. Monitoring urban sprawl using remote sensing and GIS techniques of a fast growing urban centre, India. *IEEE Journal of Selected Topics in Applied Earth Observations and Remote Sensing*, 4(1): 56-64. Doi:10.1109/JSTARS.2010.2084072
- Ramachandra TV, Aithal BH, Sanna DD 2012. Insights to urban dynamics through landscape spatial pattern analysis. *International Journal of Applied Earth Observation and Geoinformation*, 18: 329-343. Doi: 10.1016/j.jag.2012.03.005
- Ramachandra TV, Bharath HA, Sowmyashree MV 2014. Urban footprint of Mumbai-the commercial capital of India. *Journal of Urban and Regional Analysis*, 6(1): 71-94.
- Ramesh B, Bueno EA, Vyas A, Mhando JA 1989. Air photo approach to inventory of urban land use in central area case study-Kanpur. *Journal of the Indian Society of Remote Sensing*, 17(3): 115-125.
- Seto KC, Fragkias M, Güneralp B, Reilly MK 2011. A meta-analysis of global urban land expansion. *PloS one*, 6(8), e23777. Doi: 10.1371/journal.pone.0023777.
- Seto KC, Kaufmann RK, Woodcock CE 2000. Landsat reveals China's farmland reserves, but they're vanishing fast. *Nature*, 406(6792): 121. Doi:10.1038/35018267
- Sharifi A, Hosseingholizadeh M 2019. The effect of rapid population growth on urban expansion and destruction of green space in Tehran from 1972 to 2017. *Journal of the Indian Society of Remote Sensing*, 1-9. Doi:10.1007/s12524-019-00966-y
- Sharma L, Pandey PC, Nathawat MS 2012. Assessment of land consumption rate with urban dynamics change using geospatial techniques. *Journal of Land Use Sci-*

- ence, 7(2): 135-148. Doi:10.1080/1747423 X.2010.537790
- Sharma M, Kaushik SP 2013. Socio-economic characteristics of slum dwellers of Kurukshetra City. *Eastern Geographer*, 19(1): 35-42.
- Sharma M, Kumar S 2017. Development and sprawling nature of Karnal City: A GIS perspective. *The Geographer*, 64(2): 50-59.
- Silva EA, Clarke KC 2002. Calibration of the SLEUTH urban growth model for Lisbon and Porto, Portugal. *Computers, Environment and Urban Systems*, 26(6): 525-552.
- United States Geological Survey (USGS) 2017. Landsat Satellite Data. From <<https://earthexplorer.usgs.gov/>> (Retrieved on 15 June 2018).
- UN-HABITAT 2003. *The Challenge of Slums: Global Report on Human Settlements*. London, UK: United Nations Human Settlements Programme.
- UN-HABITAT 2010. *State of the World's Cities 2010/11: Cities for All, Bridging the Urban Divide*. UN-Habitat.
- United Nations 2012. *World Urbanization Prospects the 2011 Revision*. New York: United Nations, Department of Economic and Social Affairs (DESA), Population Division, Population Estimates and Projections Section.
- United Nations 2015. *The Millennium Development Goals Report 2015*. New York, NY: United Nations.
- Van-Ginkel H 2008. Urban future: The cities of the developing world are spectacularly ill-prepared for the explosion in urban living. *Nature*, 456: 32-33.

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