

Growth of an Urban Centre and Its Ecological Implications A Case Study of Rupnagar City: 1971-2011

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Abstract

In the 21st century, urbanization is considered to be the most important process, due to which the developing countries have faced rapid growth of population and industrialization. The rapid growth of cities led to the problem of lack of housing, slum development and ecological degradation. The present study attempts to understand the ecological implications in relation to the urbanization in the Rupnagar city, using demographic data of different decades especially from 1971 to 2011 to show the different ecological problems in the city. The growth rate of the population in Rupnagar city is a very significant aspect of demographic changes and industrialisation is the main factor which becomes a source of the slum are in around in the city. The Pollution caused by the industrial unit by draining toxic pollutants in the Satluj river has been endangering vegetation, besides posing a threat to human life and livestock's. Data has been collected in respect of population growth, Areal growth of the city, density, occupational structure, slum and analysis of satluj river water. Overall, Rupnagar city has faced a sharp change in its demography and there are many ecological consequences which have emerged out of these developments.

KEYWORD: Ecological Implications, Demography, Pollution, Slum, Urbanization, Industrialization.

Introduction:

Urbanization is a process growth of population in number as well as growth of city outwards from its centre and population begin living and working in there central areas. The environmental setting plays a key role in the desirability of an urban place as a residential area and to a larger extent conditions its future growth. Cities as a products of man and environment interacting in a heuristic process of adaptations and response. The proportion of a country's total population living in urban area and generally been considered as a measure of level of urbanization. An increase in the level of urbanization, that is, an increase in the proportion of population living in urban areas (R.Ramachandran. 1989). It is a characteristic of economically advancing nation, where it is occurring at a much faster rate than it historically occurred in the past in the developed world. The urbanization process of the world growing faster than the total population of the world this because, the population of the world is expected to increase by 6.9

billion passing from 7.3 to 9.2 billion 2011 and 2015. While it's urban population is expected to increase from 3.6 billion in 2011 to 6.4 billion in 2050.(World Urbanization Prospects: The 2011 Revision, pp. 4)

Punjab is in the midst of urban transition. At the dawn of the twentieth century, only 12.46 % of the total population of the then pre-partition united Punjab was urban. At the beginning of the twenty-first century, the urban population of Punjab has increased to 33.95 %, against 27.78% for the country as a whole. The percentage of urban population to total population in Punjab was 20.13 % in 1961, 23.7% in 1971, 27.7% in 1981, 29.5% in 1991, 33.95% in 2001, and 37.5% in 2011 (Census of India, 2011).

The rapid increase in population and the sprawling an growth have reaching social, economic, demography, ecological and political implications in developing countries, as its bring in the strenuous burden on the weary shoulders of the developing nations to create and provides urban infrastructure facilities, and services for the surging population. Urbanization has the potential to usher in a new era of well-being, resource efficiency and economic growth. But cities are also home to high concentrations of poverty. Nowhere is the rise of inequality clearer than in urban areas, where wealthy communities coexist alongside, and separate from, slums and informal settlement (United Nation Population Fund, 2016).

This study examines of the concept of ecological implications in the relation to the urbanization tendencies in the developing urban centres using Rupnagar city as a case. In further inter-related urbanisation to the development of the city are increasing number of environment problems like, air pollution, water pollution, congestion, traffic James etc.But Rupnagar is still one of the peaceful and authentic city of Punjab and people of Rupnagar have a very improved approach to the environment too.

Statement of the problem:

This paper aims to study as how Rupnagar has emerged as a big urban centre of Punjab. The study deals with analyse patterns of urbanization in the city from 1971 to 2011. The positive impacts of the development of the city are increasing employment opportunities, rise in the living standards of the people, development of roads, and expansion of market and industry. Some of the negative impacts of this development are depletion of water resources, breaking up of the social ties and the ecological degradation, etc.

Now, in these days the city of Rupnagar is expanding at a very fast rate, due to immigration from other parts of state and country also. Due to this expansion, the built up area of the city is encroaching upon the fertile agricultural and forest land. This rapid expansion of the city Rupnagar city creates many environmental problems and disturbs the ecological balance of that area.

Objectives of the study:

1. To study the changes in demographic profile of Rupnagar city.
2. To study how the city of Rupnagar expanded during the last few decades.

3. To study the number of industries in Rupnagar city.
4. To study the slum area of Rupnagar city.
5. To study the water pollution in Satluj river of Rupnagar city.

Methodology and Data Base:

The study is based mainly on description and interpretation of maps, graphs, tables which have been used as an essential tool for analysing and illustrating each and every element in this work. The present investigation is mainly based on secondary data. This data is collected from various district head office, state government and central government institutions. Detailed information regarding population data, land-use data, demographic data of slum, and surface water monitoring table of Sutluj River in different decades has been collected from Punjab Pollution Control Board, Patiala, Census of India, Chandigarh, Department of Town and Country planning, Chandigarh, Punjab, Municipal council, Rupnagar, and District Industrial Center, Mohali.

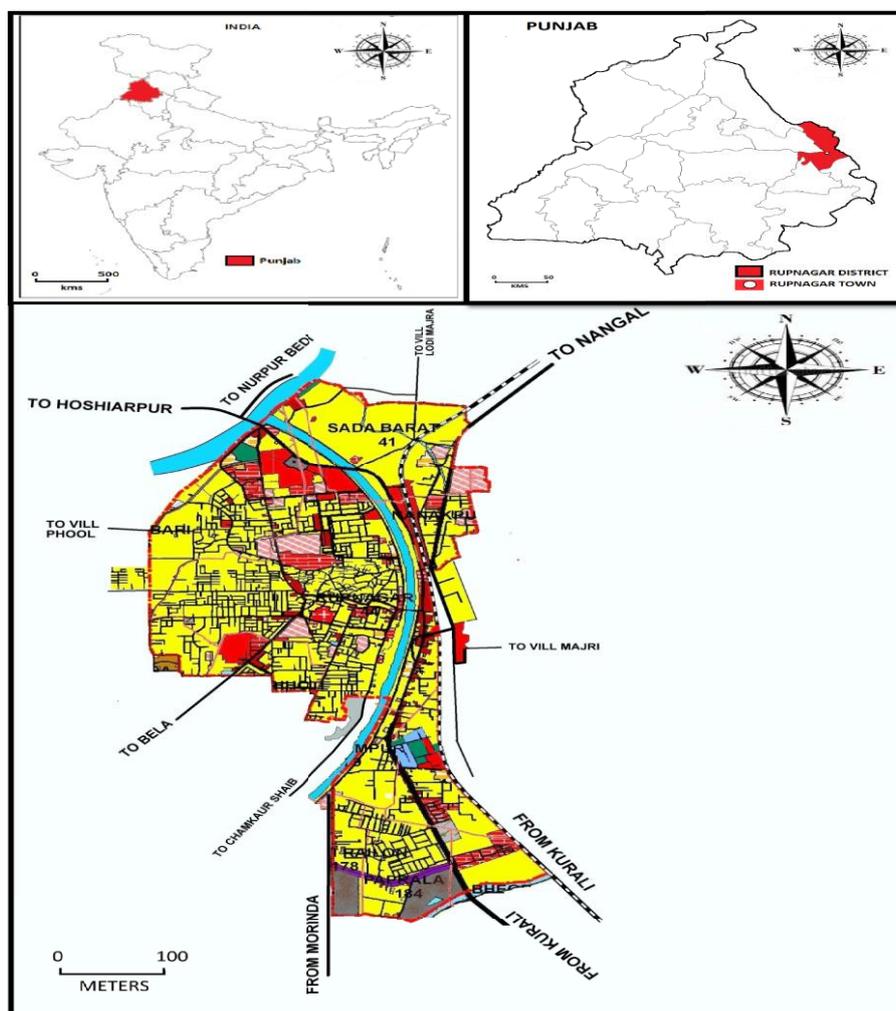
Study area:

The town of Rupnagar is of considerable antiquity. The town is said to have been founded by a Raja Rakeshwar who ruled in the 11th century and named Rupnagar after his son Rup Sen. The recent excavations carried out at Rupnagar have proved that this town was the seat of well-developed Indus Valley Civilization. In proto - historic Punjab, perhaps Rupnagar is the only known excavation site which can claim the status of a small town or city. The found in recent excavations consists of earthenware, statues, coins, etc. That proves that the city dates back to Harrappa - Mohenjo-Daro civilization which crossed Satluj River. Many of them settled at this place. In the excavations many things found belongs to Chandra Gupta, Kushan, Hoon and Mughal period. One of rare finds is a seal of Marble on which there are three letters engraved in Sindhi script. One of the finds is the statue of a woman dressing her hair. All these prove that even the people living in this town 4000 years back, were fully civilized and well cultured (Primary Census Abstract Rupnagar, 2011).

The city of Rupnagar with the population of more than fifty six thousand is also the district headquarter of Rupnagar. It is bordered by Himachal Pradesh to the North and S.B.S Nagar to its west. It is situated on Chandigarh-Manali road (National Highway No. 21) .It is at a distance of 275 km from Delhi and 183 km from Amritsar. The distance from the state capital of Punjab, that is Chandigarh, is around 42km. The city adjoins S.B.S Nagar, S.A.S Nagar and Fatehgarh Sahib district of Punjab. The town of Mohali was once part of Rupnagar District before it became a separate district in 2006 (www.rupnagar.nic.in).

Rupnagar city is situated on bank of Satluj River. Rupnagar is located at 30° 58'N to 30° 97'N latitude and 76° 32'E to 76° 56'E longitude and covers a total area of 9.50 square kilometres. The average elevation of the city above sea level is 262 metres (860ft) (www.rupnagar.nic.in).

Map 1
Location of the study area



The city is the part of the widespread Indo-Gangetic alluvial plain. The city is entirely covered by alluvial deposits which consist of clay and sand with kankar. The beds of gravel and cemented sands are occasionally present with the unconsolidated sands. The soils of the district vary in texture generally from loam to silty clay loam except along areas of the Satluj River (Rupnagar Masterplan, 2012).

Changes in demographic profile of Rupnagar city:

Rupnagar is a municipal council city in district of Rupnagar. It enjoys the status of district headquarters with the creation of Rupnagar district on 1st Nov, 1966. It was formerly known as Ropar and later re-named as Rupnagar by the State Government vide notification dated 16th November, 1976. The Rupnagar city is divided into 17 wards for which elections are held after every 5 years. The Rupnagar municipal council has population of 56,038 of which 29,359 are males while 26,679 are females as per report released by Census of India 2011.

Rupnagar was a very small town with very slow growth rate of population. In 1901 A.D. its population was only 8,888 persons which again declined in 1911 A.D., that is only 6,935 persons. It had a lower growth rate of 9.68% during 1911-1921 and had a population of 7606 persons in the year 1921. But after 1951, the population started growing as the formation of Punjab 1st Nov, 1966 gave Rupnagar city the status of district headquarters with the creation of Rupnagar District. During the period of 1971-2011, the total population was 16,454 persons in 1971 which increased to 25,165 persons in 1981, further increased to 37,966 persons in 1991, 49,159 persons in 2001 and 56038 persons in 2011. the city registered high growth rates of 52.94% and 50.98% during the decades of 1971-1981 and 1981-1991 respectively (census of India).

Inter census comparison of ward wise population growth is however not possible as ward boundaries and number of wards have been changing over the years. In 1971 the city was divided in 14 wards, but in 2011 the numbers of wards have increased up to 18 in the city. The population growth gradient as per 2011 census shows that ward no. 6, 7, 9 and 15 are having a population of more than 40 per centage with the distinction of highest population growth of 73.63 per centage in ward no.6 and the lowest population growth -30.48 in ward no.3. Decadal change and population growth of Rupnagar city from 1971 to 2011 is given in figure 1 & 2:-

Fig 1: Decadal change in population of Rupnagar city: 1981 to 2011

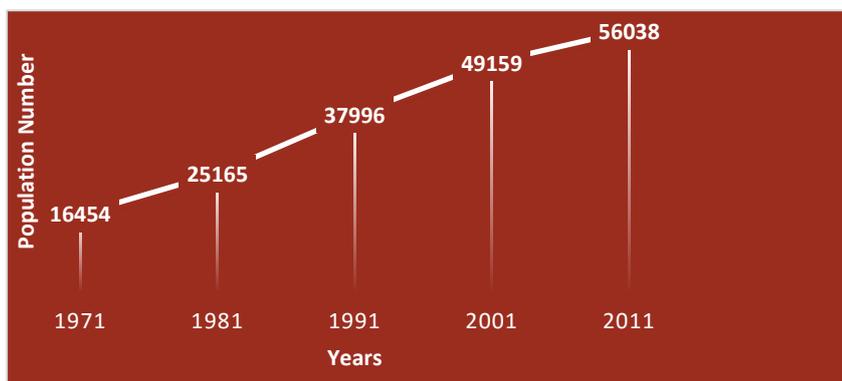
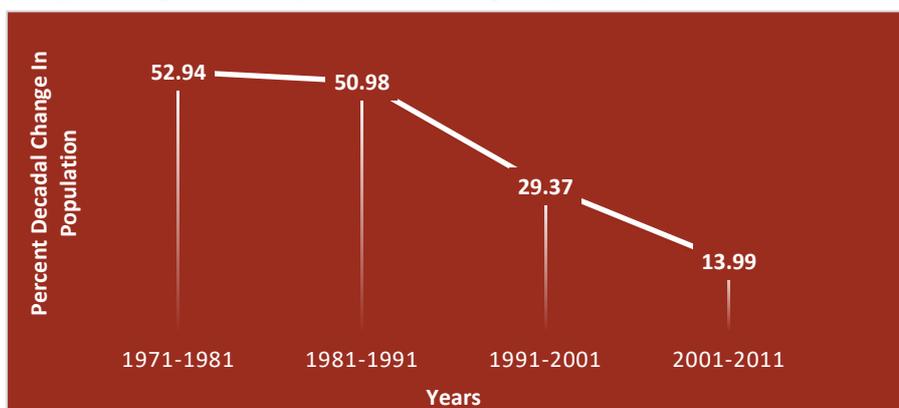


Fig 2: Population growth of Rupnagar city: 1971 to 2011



Areal growth of the city: Rupnagar city grew during this passage of time in a number of ways and various forces which contribute to the overall growth of the city are transport facilities, installation of the industries, expansion of residential area and increase in number of migrants. In 1925 Old Mandi site (near sub jail Ropar) was also established. Both these event boosted the economic and physical development of the town.

Table 1: Areal growth of the Rupnagar city 1971 to 2011

Year	Population (persons)	City area (in square kilometers)	Population density (persons/sq km)
1971	16454	4.43	3,714
1981	25165	4.97	5,063
1991	37996	5.67	6,701
2001	49159	6.72	7,315
2011	56038	7.47	7,501

Source: Census of India, Punjab, 1971,81,91, 2001,11 & Municipal Council, Rupnagar

The table 1 shows that the area covered by the city has increased manifolds during the last few decades. It was mere 4.43 square kilometers in 1971 and which increased to 4.97 square kilometers in 1981. The dramatic expansion had taken place in the history of the city from 1981 to 1991 in which the area coverage under Rupnagar city had increased to 5.67 square kilometers in 1991 from 4.97square kilometers in 1981. The area covered under the Rupnagar city was 6.72 square kilometers in 2001. There was expansion of the area due to the positive growth rate of the area. If we see the figure of 2011 and compare it with 1971 then we come to know that the area coverage had increased by 3.4square kilometers from 1971 to 2011 and the area of the city expanded at fast rate and it grabbed the nearby agricultural villages.

Population Density:

The gross population density of Rupnagar city has constantly increased during the period of 1971-2011, from 3,714 persons per square kilometers in 1971 to 5,063 persons per square kilometers in 1981, 6,701 persons per square kilometers in 1991, 7,315 persons per in 2001, and 7,501 persons per square kilometers in 2011. The Rupnagar city population is around 56,038 in 2011 and total area (including land and water) is 7.47 square kilometers .Therefore, the population density is around $56,038 \div 7.47 = 7501$ per square kilometers. The density pattern is likely to undergo considerable change in the years to come with the city recording higher growth and development. The density of the city doubled during 2001-11, when it increased from 3714 persons per square kilometers to 7501 persons per square kilometers.

Inter census comparison of ward wise density is however not possible as ward boundaries and number of wards have been changed over the years. The density

gradient as per 2011 census shows that ward no. 4,5,6, and 10 are having a gross density of more than 40 persons per acre with the distinction of highest density of 85 persons per acre in ward no.4 and the lowest only 16 persons per acre in ward no. 16.

Occupational structure:

The Indian census divides the entire population into two categories of workers and non-workers. The concept of workers was introduced, for the first time, in India, in 1961. According to Census of India, any person whose main activity was participation in any economically productive worker was either by his physical or by his mental activity was classified as workers. Thus, work involved not only actual work, but also effective supervision and direction. The definition of a worker in India has been changing from census to census. In 1971, if a person worked on any one of the days during the reference period of one week prior to the date of enumeration, was considered as workers provided his/her main activity was economically productive work. Thus person engaged primarily in household duties, those getting education, those receiving income without participating in any productive activity were classified as non workers (Census of India, 1971).

Distribution of workers by occupation is given in **table 2** It is clear from table that in 1971 total 4657 workers were there in which 3.52per cent were cultivators, 3.28per cent were engaged in agricultural activities, 2.71per cent were in household industries, 1.63per cent were engaged in construction, 33.54per cent were in trade and commerce, 13.63 were in other than household industries and 42.30 per cent were in other services and about 11794 persons were non workers.

In 1981 out of 7610 workers 2.62 per cent were cultivators, 2.43 per cent were engaged in agricultural activities, 3.41 per cent were in household industries and 91.65 per cent were engaged in the other than household industries. In 1991 out of 11595 workers, 2.80 per cent were cultivators, 3.06 per cent were engaged in agricultural activities, 0.98 per cent was engaged in household industries, 13.34 per cent were in other than household industries, 0.50 per cent was in allied activities, 2.06 per cent were in construction and 93.16 per cent were in other services. In 2001 out of 15,350 workers 1.0 per cent were cultivators, 1.61 per cent were agricultural workers, 1.12 persons were engaged in household industries, 3.1 per cent were engaged in marginal workers, 96.27 per cent were in other services and 33804 persons were non workers. In 2011 out of 18529 workers 0.78 per cent are cultivators, 0.79 per cent are agricultural workers, 1.11 per cent are engaged in households industries, 12.01 per cent are in marginal workers, 85.00 per cent workers are other services and 37504 persons are non-workers.

In the Rupnagar the per centage of workers to the total population has marginally decreased from 30.64 per cent in 1981 to 30.52 per cent in 1991 and then again increased to 31.22 per cent in 2001, and further increased to 33.06 per cent in

2011. However, the workforce participation rate has increased from 30.64 per cent in 1981 to 31.22 per cent in 2001 in case of the city. The Rupnagar city, the workers engaged in primary activities i.e. cultivators decreased from 2.62 per cent to 0.78 per cent from 1981 to 2011 respectively. The household industry after showing a decreasing trend during 1981-1991 i.e. 3.41 per cent to 0.98 per cent, respectively, again recorded an increase from 0.98 per cent to 1.11 per cent during 1991-2011. Similarly, the share of workers engaged in other activities recorded an increase from 91.54 per cent to 93.66 per cent in 1981 and 1991 and then increased to 96.27 per cent in 2001, but further decreased to 85 per cent in 2011.

Table2 : Occupational Structure of Rupnagar city: 1971 To 2011

Year		Total Workers	Cultivators	Agricultural Laborers	Workers in household industries	Workers in other than household industries	Marginal workers	Non-workers	Live stock, forestry, fishing, hunting and plantation orchards and allied activities	Construction	Trade & commerce	Transport, storage and comm.	Others Services
1971	T	4657	164	153	126	635	-	11794	26	76	1562	351	1970
	M	4383	164	151	117	631	-	4494	24	76	1157	349	1714
	F	277	-	2	9	4	-	7300	2	-	5	2	253
1981	T	7627	202	187	263	6975	86	17455	-	-	-	-	-
	M	6882	200	182	242	6258	29	6548	-	-	-	-	-
	F	745	2	5	21	717	54	10907	-	-	-	-	-
1991	T	11595	325	355	113	1547	1	26400	59	240	2686	659	13301
	M	10480	325	347	109	1528	-	9732	49	221	2637	649	4615
	F	1115	-	8	4	19	1	16668	10	19	49	10	8686
2001	T	15350	139	217	167	-	481	33804	-	-	-	-	14346
	M	12811	129	196	137	-	215	13246	-	-	-	-	12134
	F	2539	10	21	30	-	266	20563	-	-	-	-	2212
2011	T	18529	146	148	207	-	2227	37504	-	-	-	-	15751
	M	15146	141	131	186	-	1798	14213	-	-	-	-	12840
	F	3383	5	17	21	-	479	23926	-	-	-	-	2861

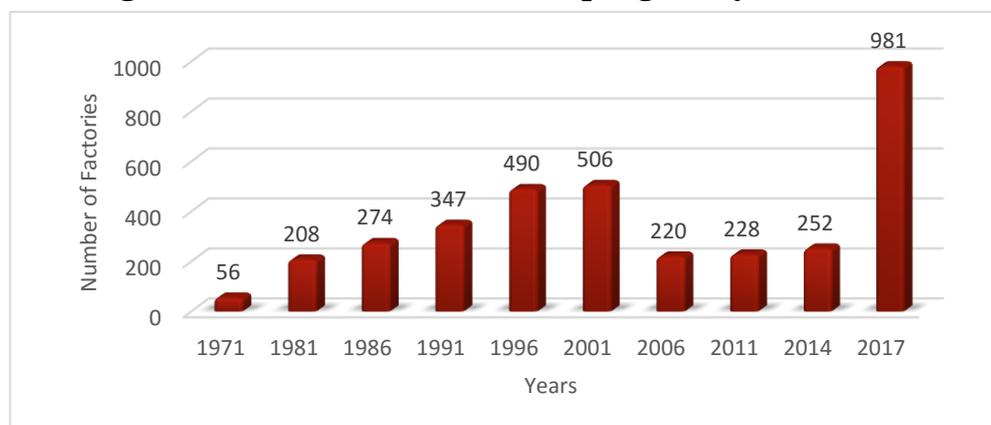
Source: Primary Census Abstract, Rupnagar, 1971, 1981, 1991, 2001, 2011

Industrial growth of the city:

Rupnagar is also important from industrial point of view its industries are confined to the village and cottage sectors. The traditional industry includes pottery work, leather tanning, handloom weaving, shoe-making and phulkari embroidering. Lock making at Rupnagar has also been important old time industry of the district. Locks made in Rupnagar were famous all over the country. After the migration of Muslim artisans to Pakistan in 1947, this industry also declined. Rupnagar city being a cotton market, a cotton ginning and oil-seed crushing unit was established there during 1912. Thereafter, four more cotton ginning factories were started at Rupnagar city, Rupnagar-Kurali road, Morinda road and Bela road. A woollen mill, set up at northern-eastern side, in 1944 by a partnership firm was later converted into a public limited company.

The year 1971 to 2001, witnessed significant expansion in the industrial growth of the city. The number of industries in the city increased at a tremendous rate. The city had only 56 small scale industrial units and no large /medium scale industry till 1970-71. In 1980-81 were 208 small scale industrial units and no large /medium scale industry. The growth in the number of industrial unit has shown a rapid increase which is clear from Fig.3. The total industries in 1985-86 increased to 274 in which 272 were small scale industries and 2 were large/medium scale industries. Further in 1995-96, the number increased to 490 in which there were 487 small scale industries and 3 large/medium scale industrial units was there. In 2000-2001 increased to 506 in which 502 were small scale industries and 4 large /medium scale industrial units in the city. But in the 2005 year, there was a sudden set back to the small scale industrial growth in the city. It occurred may be due to shortage of electricity, deficiency of rainfall and frequent political agitations. It's clear from Fig.3. that the total industries in 2005-2006 decreased to 220 in which 216 were small scale industries and 4 were large /medium scale industrial unit. Further in 2010- 2011 the number slowly increased to 228, out of which 224 were small scale industries and 4 were large /medium scale industry.

Fig 3: Number of factories in Rupnagar city: 1971 to 2017



Source: Directorate of Industries, 1971-2017

In 2013-14 the total number of industries increased to 252, out of which 248 were small scale industries and 4 were large /medium scale industrial unit. After the crisis ridden year of 2005-2006, the industrial growth in the city showed signs of recovery, many new small scale industries and large /medium scale industrial unit started establishing and some old small scale industries restarted establishing there. Then from 2011 onwards the industrial growth picked up and as a result it attracted more migrants from other areas which contributed to population growth of the city. Now, in 2016-17, there is sudden increase in the total number of small scale industries unit and a small increase in large/medium scale industrial unit. The growth in the number of industrial unit has shown a rapid increase in the city which is clear from table 3.2. The total industries increased to 981, out of which 974 are small scale industries and 7 are large/medium scale industries.

Ecological implications of growth of city:

It is amazing to know that all big cities in India are surrounded by slums and some have slums even in the middle of the city, for example, Kolkata. It is further shocking to learn that only less than half of people are having access to toilets. There is a huge problem of garbage disposal and clearance and piles of rotting rubbish can be seen in posh localities. As we know that one of the consequences of slums is disturbing the ecology of an area. Due to slums, various kinds of pollutions are caused. What is pollution? Pollution is the presence in or introduction into the environment of a substance which has harmful or poisonous effects.

From the very dawn of human civilization, with the unplanned rapid urbanization and industrialization aquatic resources are being used as dumping grounds for sewage, industrial, and technological waste, with an idea that vast column of water through dilution and by the action of many detoxifying agents would make the toxic agents innoxious (Hynes, 1960). The deteriorating water quality affects man, animals, and plant life with far-reaching consequences. In India, due to tremendous urbanization and industrialization, the problem of water pollution has assumed an alarming situation; and about 70 per cent rivers in India are polluted. In the last few decades, there has been increasingly greater emphasis on the deterioration of water quality of Indian rivers (Singh and Nautiyal, 1990). Very little work has been done on the water quality of Satlujriver. Keeping this in view, present investigations have been undertaken to assess the pollution load in the river Satluj after it enters in the plains of Punjab at Rupnagar.

Discussion

Slum in Rupnagar city:

According to Mathur (1987), slum as a loosely applied term; very often to be synonymous to dilapidated houses and blighted areas of the city. The inhabitants of slum live in all sorts of makeshift arrangements using any kind of building material on which they can lay their hands upon. Their dwellings are made of

‘katchi’ bricks, mud, wood, straw, bamboo, and ‘pucca’ bricks. He further stated that, it denoted only those residential areas which are characterized by overcrowding and insanitary conditions having absence of civic amenities and facilities; and these substandard living conditions endanger the health, safety or moral values of the inhabitants of the community (Mathur, 1987).

The Rupnagar city is which faces problems of slum dwelling units. The city Rupnagar has clogged sewers and drains like Ludhiana, Patiala and Amritsar’s slum area. Yet people are actually living near them and make a living out of scavenging. Infact, there is a positive co-relation between urban sprawl and growth of slums in most of developing countries because the main aim people is to earn more money in the cities than the villages. It is factually correct that agriculture is no more a lucrative business to afford to make progress in life. If only agriculture was more productive it would have yielded more income to the rural population and the rural people would not have migrated to cities in such large numbers. No slum or pavement dwellers opt for city life voluntarily. It is because agriculture yields such meagre incomes that the youth who are without jobs have to leave home to make entry in the big cities for their progress. In Beijing, in China, no slums can be seen around and within the city but there are low income areas which have cheap but adequate housing to shelter the low income group of people. In the Rupnagar, the low cost housing projects seem grossly inadequate. Though government has increased the allocation of funds for slum development and glorifies big claim, yet the money is not being actually spent the way it is required for the improvement of amenities in slums. It is sad to know that implementation of such schemes is always lagging behind to help the slum people and to bring a marvellous achievement in the field of ecology by providing at least minimum sustenance of life and removing the piles of rubbish from the area to make the environment clean, healthy and liveable.

Name of the slums:

According to census 2011, we have four slums in Rupnagar city. The names are listed below in table 3. Also, from map 2, we know the distribution of slums in the city during 2011.

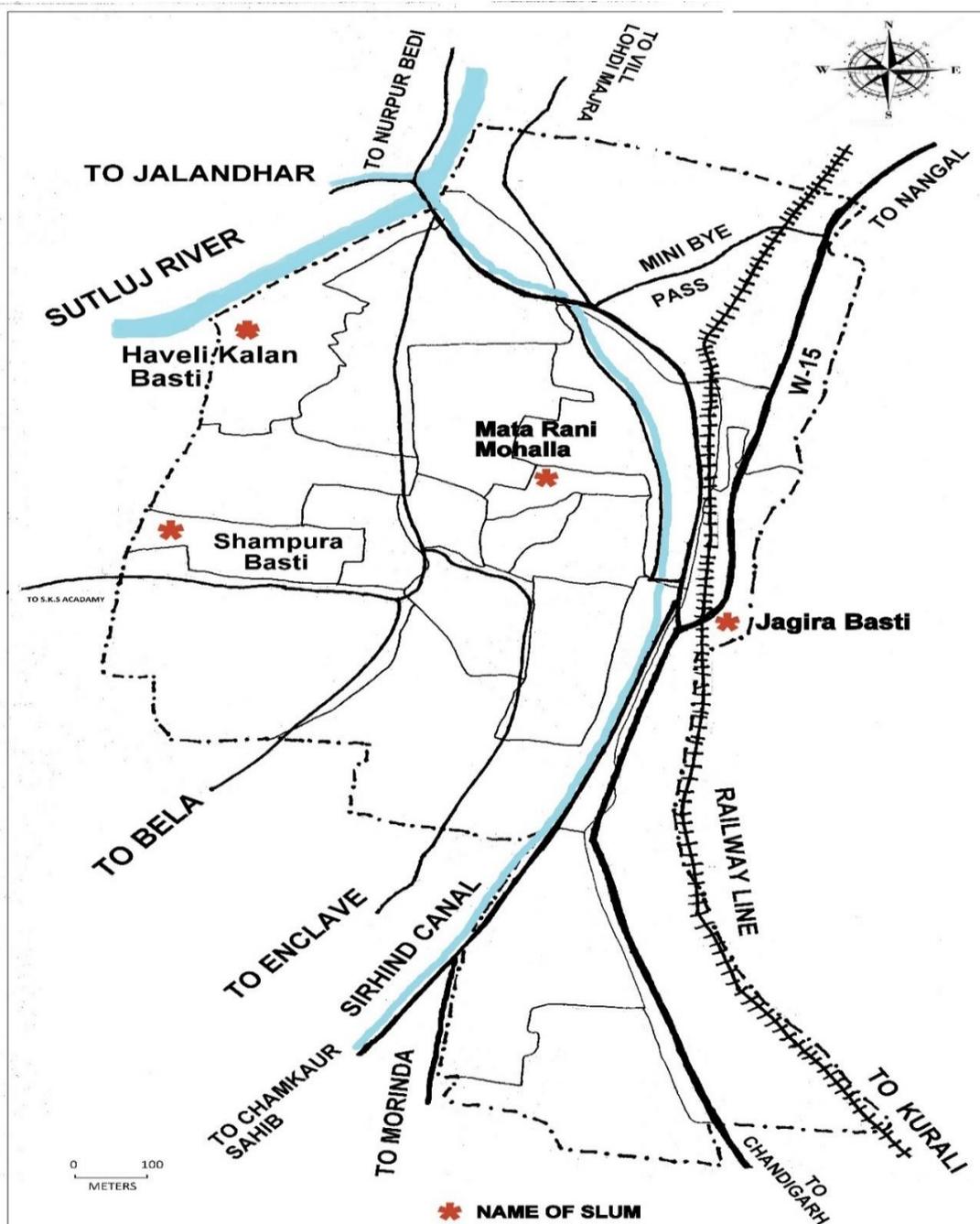
Table 3: slums in Rupnagar city during 2001 to 2011

Sr. No.	Name of the slum	If notified Yes/no
1	Haveli Kalan Basti	Yes
2	Shampura Basti	Yes
3	Jagirabasti	No
4	Mata Rani Mohalla	No

Source: Census of India, 2001, 2011

From the above table 3, we conclude that there are 2 notified slums and 2 non-notified slums. Almost, 50% are notified slums and 50% are non-notified.

Map 2: Slums in Rupnagar city, 2011



Distribution and Population of slum:

In most of the cities of Punjab slums have occurred but these are not identified by local governments or state governments as given by Census of India 1991 (Town directory). “No slum areas has been identified in Punjab state though certain pockets have separately been identified”. This comment is 100% true in case of Rupnagar city that there is slum population as well as number of slum colonies, but state government or local government did not made any separate identification. The data which is collected for this project report is collected from Municipal Council of the city and Census of India, 2001 and 2011. There are total

of four slums found in Rupnagar city. Almost 70% are located on the peripheral areas of the city, 1 along railway line and 1 in centre of city.

The total slum population in 2001 was 573 persons (1.16%) and total households were 120. The highest number of population was found to be in Haveli kalan as the land under this slum is encroached by people of different creed, cast and religion. Most of the people are refugees. But the most dense area was Mata Rani Mohalla followed by ShampuraBasti and JagiraBasti. The houses or dwellings in Haveli kalan and JagiraBasti are quite traditional.

According to Census of India 2001, the population of Rupnagar city was 49,159 persons. Out of this, 573 persons were from slum population which was about 1.16 per cent. Then, in 2011 the population recorded was 56,038 persons out of which the slum population counted was 1.28 per cent. The figure is 722 persons. There are following tables which show the slum population in an individual slum.

1) Slum population in 2001:

The table 4 shows slum population and number of slum households in 2001.

Table 4: Ward-wise distribution of slum population and Number of Households in Different Slums of Rupnagar City: 2001

Sr. No.	Municipal ward number	Name of slum	Population	Number of households
1	1	Haveli Kalan Basti	159	37
2	13	ShampuraBasti	155	33
3	6	JagiraBasti	122	21
4	17	Mata Rani Mohalla	137	29
		Total	573	120

Source: Census of India, 2001

2) Slum population in 2011:

The following table 5 depicts ward-wise distribution of slum, population and households in 2011.

Table 5: Ward-wise distribution of slum population and Number of Households in Different Slums of Rupnagar City: 2011

Sr. No.	Municipal ward number	Name of slum	Population	Number of households
1	1	Haveli Kalan Basti	229	69
2	13	ShampuraBasti	204	61
3	6	JagiraBasti	132	32
4	17	Mata Rani Mohalla	157	43
		Total	722	205

From the above both tables we see that there is increase in number of population as well as households in 2011, the total population is 722 (1.22%) i.e. increase of 149 persons in different slums. The most population slum is Haveli Kalan Basti followed by Shampura Basti and Mata Rani Mohalla. There is slight change in population number i.e. population increased in Jagira Basti by 10 persons. The population in Haveli Kalan Basti there is remarkable increase of 70 persons. Also, noticeable increase is seen in Shampura Basti and Mata Rani Mohalla.

Impact of water pollutants on water quality of river Satluj in Rupnagar city:

In the present era of modernization there is advancement in every phase of industrialization which leads to generate pollutants from alteration of aquatic ecosystem. The wide array of pollutants discharged into aquatic environment may have physico-chemical, biological, toxic and pathogenic effects (Goel, 2000). The life of aquatic ecosystem directly or indirectly depends on the water quality (Contreras et al., 2009). Satluj is one of the major rivers in the Northern region of India. It starts providing water to run industrial units in Punjab after Bhakhra dam and also receives large quantity of wastewater from these industries, as well as, domestic wastes and sewage of Nangal city while it is on its downstream course towards Rupnagar wetland. Satluj River is responsible for high degree of water pollution in Rupnagar as the industries contribute a lot to contaminate its water. Cotton and chemical industries, chrome chemicals and dyes use highly toxic cyanide for heat treatment and these toxic effluents are drained in Satluj River to make the water dirty, filthy and toxic. On the other hand, sewage water is also discharged in Satluj River without caring about water pollution and its effect to the health of people residing near. The

present study was undertaken to assess pollution load from point source near Rupnagar wetland in the laps of Shiwalik foot hills. Attempt was made to understand the rate of dumping of pollutants and its impact on water quality of river which ultimately affects humans, ecology and materials.

Discussion

Physico-chemical analysis of Satluj River:

Physico-chemical analysis of water samples were done by using standard methods given in American Public Health Association (APHA) as found by Trivedi and Goel (1986). Physical and chemical parameters viz water temperature, pH, turbidity, TSS, TDS, colour, DO, free CO₂, alkalinity, hardness, chlorides, BOD, free ammonia, nitrates, phosphates, sulphates were analysed and compared with drinking water standards for various uses as prescribed by Indian Standards Institute (ISI), Indian Council of Medical Research (ICMR), Central Pollution Control Board (CPCB) and World Health Organisation (WHO). Water samples were collected during the period of January, 2008 to October, 2016 by Punjab Pollution Control Board, Patiala.

Table 6: Analysis of Results of Samples Collected from Ropar Head-Works of Satluj River: 2008 To 2016

S.No	Year	Month	pH	DO mg/l	COD mg/l	BOD mg/l	T.Coli MPN/100ml	F.Coli MPN/100ml	NO ₂ -N mg/l	NO ₃ -N mg/l
1	2008	January	7.6	7.4	2.8	1	500	110	1	2.2
		October	7.8	8.6	2.8	1	230	ND	2.4	0.8
2	2009	January	7.1	8.6	2.4	1.0	500	110	0.8	2.2
		October	7.6	7.4	-	1.2	500	-	-	-
3	2010	January	7.5	7.6	10.8	3.4	900	500	1.4	2.8
		October	7.5	7.4	5.8	0.8	500	110	1.0	1.4
4	2011	January	7.5	10.8	4.0	4.0	500	110	1.6	2.6
		October	7.4	7.0	13.8	3.0	2500	1100	1.4	1.0
5	2012	January	7.5	8.0	7.8	2.0	500	130	1.6	2.6
		October	7.4	7.3	10	2	2100	700	0.8	1.2
6	2013	January	6.9	6.0	7.2	1.2	500	110	1.4	1.8
		October	7.8	7.2	8.0	2.0	500	40	ND	2.6
7	2014	January	7.1	8.4	3.6	1.2	500	50	ND	1.2
		October	7.7	8.6	2.4	0.3	700	460	ND	1.1
8	2015	January	7.3	7.6	4.0	1.2	500	390	ND	2.0
		October	7.8	7.6	6.4	2.6	400	110	ND	2.0
9	2016	January	7.3	7.8	4.0	1.4	370	180	2.0	1.6
		October	7.9	7.8	6	BDL	920	450	-	0.8

Source: Punjab Pollution Control Board, Patiala, 2008, 2009, 2010, 2011, 2012, 2013, 2014, 2015, 2016

- pH value :** The pH level of our drinking water reflects how acidic it is. pH stands for "Potential Hydrogen", referring to amount of hydrogenions found in the substance, and in this case water. Higher value of pH (7.9) was observed at Ropar head- works throughout investigations in October, 2016. This may be due to presence of large quantity of black ash slurry produced from nitrogenous pollutants. Relatively low value of pH (6.9) has been observed at Ropar head- works in January, 2013 due to inflow of freshwater but it becomes acidic in pre-monsoon period, the different time periods of pH values at Ropar Head-works
- Dissolved Oxygen (DO):** The effect of wastewater released in a water body largely determined by discharge of oxygen demanding waste and oxygen balance of the system. The DO range (6.0-10.8mg/L) during study period at Rupnagar is shown in Fig.4.3 The maximum values of DO was noted at Ropar Head-Works in the month of October, 2011 (10.8mg/L) as there is constant aeration of water due to water currents generated at undulating terrain, low temperature, better illumination, low turbidity and free from impact of human activities. In January, 2013 the low DO (6.0mg/L) at

effluent nallah of Guru Gobind Singh Thermal Plant was estimated due to high organic sludge and nitrification.

3. **Biochemical Oxygen Demand (BOD):** Biochemical Oxygen Demand (BOD) is an index of organic pollution to measure the amount of DO required by microbial community in decomposing the organic matter present in a water sample by aerobic biochemical action. In the present study, BOD was observed in between (0.3-3.4mg/L) at effluents from industries like DCM, Ranbaxy, Ambuja cement and nallah of NFL due to microbial activity of protozoan, rotifers, dipterans larvae and presence of algal blooms. High value of BOD between (3.0-4.0mg/L) in 2011 and low value of BOD (0.3mg/L) in October, 2014 was observed at Ropar head-works after mixing with wastewater from industries and dumping of domestic waste and sewage.
4. **Chemical Oxygen Demand (COD):** Chemical Oxygen Demand or COD is a measurement of the oxygen required to oxidize soluble and particulate organic matter in water. COD was observed in between (0.2.4-13.8mg/L) at effluent from industrial waste and sewage of the city. High value of COD (13.8mg/L) in October, 2011 and low value of COD (2.4mg/L) in October, 2014 was observed at Ropar head-works. In January, 2010 COD was observed in (10.8mg/L) and after this year again high value of COD (10mg/L) was observed in October, 2012.
5. **Nitrogen (Nitrite) (NO₂ -N):** Nitrite in water is either due to oxidation of ammonium compounds or due to reduction of nitrate. The maximum values of NO₂-N was noted at Ropar Head-Works in the month of October, 2008 (2.4mg/L) at effluent nallah of Guru Gobind Singh Thermal Plant and NFL in Nangal was estimated due to high industrial waste, nitrification and sewage. In October, 2012 the low value of NO₂-N (0.8mg/L) observed the resultant freshwater mixing high rainfall in the hilly areas. Average value of NO₂-N is 1.4 mg/L recorded in 2010, 2011 and 2013. The NO₂-N ranged (0.8-2.4.8mg/L) during the study period at Rupnagar city.
6. **Nitrogen (Nitrate) (NO₃ -N):** Nitrates are formed in water due to oxidation of ammonia by bacterial action and their presence indicates that nitrogenous organic matter is under nitrification. High value of NO₃-N between (2.6-2.8mg/L) in year January, 2010, January, 2011 and January, 2012 and low value of NO₃-N (0.8mg/L) in January, 2009 was observed at Ropar head-works. The average annual value NO₃-N (2.0 mg/L) are recorded in January, 2015 but it decreased to NO₃-N (0.8 mg/L) in October, 2016.
7. **Total Coliform and Fecal Coliform (T.coli and F.coli):** Total Coliforms include bacteria that are found in the soil, in water that has been influenced by surface water, and in human or animal waste. Fecal Coliforms are the group of the total Coliforms that are considered to be present specifically in the gut and faeces of warm blooded animals. T.coli and F.coli observed in Satlu river are 920 MNP/100ml and 450 MNP/100ml, respectively, in October, 2016. The high values ranged from T.coli (2500 MNP/100ml) and F.coli (1100 MNP/100ml) are recorded in October, 2011 and after this year in high value of T.coli (2100 MNP/ml) was observed in October, 2012. The

low values recorded of T.coli (230 MNP/ml) in October, 2008 and in October, 2013 is recorded value of F.coli (40 MNP/ml). The value Total coliforms and Fecal Coliform of in during the study period 2008 to 2016 at Ropar Head-works

Major findings and Conclusions:

This study examines the concept of ecological implications in relation to the urbanization tendencies in the developing urban centres using Rupnagar city as a case. The city experienced a remarkable growth in industries as well as in its population. The rising population of the urban centres leads to consumption of resources at a higher rate in Rupnagar city. Due to the availability of opportunities people are attracted to that city and migration of the population in Rupnagar city has increased significantly. This increase in population leads to overexploitation of the resources and this results in air pollution, water pollution, noise pollution, the problem of sewerage, congestion on roads, development of slums, etc. Due to these environmental problems, the people living in the Rupnagar city have to face a number of health related issues. Slums development in the city has noticed a rapid increase from 2001-2011. The main causes for this are the low standard of living, poverty, shortage of facilities, etc. Which forces people to live in these areas.

Pollution in Satlujr river is caused by main source i.e. industrial waste, sewage and garbage of Rupnagar city. Due to the pollution of the Satlujr river the quality of the groundwater has declined. Rupnagar has the problem of nitrate, T.coli, and F.Coli, contents in the groundwater which is quite dangerous for health.

As a matter of fact, the growth of Rupnagar city and growth of industries in the city has generated a source of employment to a variety of people and at the same time, it has endangered the human lives spreading pollution and creating a number of problems which ultimately disturb ecological balance of nature. It has become the need of the hour for the government to take some concrete steps rather than to provide only lip service to overcome this alarming danger.

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