Spatial Analysis of Settlements of Bharatpur Metropolitan City

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Abstract

The slum and the related squatter settlement problem accumulated overtime and created a daunting task of urban renewal. The current environmental quality, especially inside the any slum, is degraded as it is difficult even to provide basic water supply and sanitary services. Lack of basic infrastructure and services in the slums and squatter settlements has led the deplorable living conditions in the slums and squatter settlement in cities of developing Countries. It is therefore necessary to investigate the growing slum and squatter settlements in Bharatpur Metropolitan City and based on its finding proposes recommendation on appropriate planning interventions that would facilitate integrated infrastructure provision that would enable. This study is fully based on quantitative analysis from GIS tool. Rectification of the geo-referenced image was done. There were 76 squatter settlements as identified in during the study. All the settlements were connected with at least the earthen road and mostly with graveled road. Rapid increase in population growth in Bharatpur puts pressure on the household level in rural areas. Social discrimination and disparities between people, communities, increasing rate of unemployment, and disparities in ownership over land, conflict and difficult living conditions in rural areas are major stimulating factors for increasing rural urban migration in Bharatpur. Therefore, the only option is to live in open places available in public lands, forests, bare lands nearby canals open spaces is seen in Bharatpur.

Keywords: Slum, squatter settlement, spatial, metropolitan city, GIS

Background

In the general terms, slum means the landless and homeless people who are suffering from the problem of resettlement. But in wider sense, slum means a densely populated urban area which is characterized by a generally low standard of living. Slums may also be known as shanty towns, barrios, ghettos, although some of these terms have specific cultural meanings. In the later part of

the 20th century, slums exploded worldwide, becoming a cause for serious concern among humanitarian organizations, as an alarmingly high number of people live in various parts of public places of the south Asian country such as Nepal, India and Bangladesh etc.

Slum and squatter settlements along with planning and management deficiencies severely affect the city's liability and environmental quality. The slum and the related squatter settlement problem accumulated overtime and created a daunting task of urban renewal. It made development works next to impossible by posing complex environmental, social, economic and spatial challenges. The current environmental quality, especially inside the any slum, is degraded as it is difficult even to provide basic water supply and sanitary services. The UN Habitat Program of 1995 defines informal settlements as Residential areas where a group of housing units has been constructed on land to which the occupant has no legal claim, or which they occupy illegally. Unplanned settlements and areas where housing is not in compliance with current planning and building regulations (unauthorized housing). Based on this definition the informal settlements of Nepal can be categorized into four groups they are slums, informal settlements, landless settlement and bonded labour (Shrestha, 2011).

The squatter settlements, which was only 17 in number in Kathmandu Valley in 1985 with the population of about 2130, has boost up to 64 with an estimated inhabitants' population of 14500 in 2003. About 2.9 % of the total population of Kathmandu lives in informal squatter settlements (Lumanti, 2003)

Lack of basic infrastructure and services in the slums and squatter settlements has led the deplorable living conditions in the slums and squatter settlement in cities of developing Countries. It is therefore necessary to investigate the growing slum and squatter settlements in Bharatpur Metropolitan City and based on its finding proposes recommendation on appropriate planning interventions that would facilitate integrated infrastructure provision that would enable, sustain and enhance better living conditions and environmental quality for the slum dwellers.

There is a dominant theoretical perception that squatter settlements in cities of most developing countries result from the mass migration of the poor, rural population to urban areas where they mostly end up squatting. Many observers believe most squatters to be new, rural to urban migrants who fail to earn enough to support themselves - especially within urban legal or formal housing markets. Such a belief also often prompts government authorities to take firm action against squatter settlers. The action is often forceful and cruel, like squatter demolition and eviction, and can even extend to governments restricting movement from rural to urban areas through their migration policies (Khemro, 2000).

A squatter settlement can be defined as a residential area which has developed without legal claims to the land and permission from the concerned authorities to build; as a result of their illegal or semi-legal status, infrastructure and services are usually inadequate. It is considered as a

residential area in an urban locality inhabited by the very poor who have no access to tenured land of their own, and hence "squat" on vacant land, either private or public. Rapid growth of urban areas in most developing countries in the last few decades has led to shortfall in many sectors, primarily housing. The problem has been two-fold: on one hand, the majority of the people moving to the urban areas have lacked the necessary asset and financial holdings in order to acquire a "decent" house. On the other hand, the designated government agencies and bodies have not provided sufficient housing units which are affordable for the poor majority in urban areas. The proliferation of slums and squatter settlements has been a result of this scenario (Srinivas, 2003). Shakya Sumeda (2005). On her thesis entitled-"An Extensive Study of the Urban Poverty Situation and its Environmental Implications in the Squatter Settlements of Kathmandu and Dharan has focused on the three squatter settlements of Kathmandu (Jagritinagar, Shantinagar and Pathivara) and one squatter settlement of Dharan (Amar Basti). Here, she concluded more than half of the households in Jagritinagar, Shantinagar and Amar Basti were found living below poverty line, considering Rs.9000 per capita annual income as the poverty line as defined by Lalitpur Sub-Metropolitan City in baseline survey of Lalitpur, 1999. Lack of education, unemployment, inability to earn money due to lack of skill and opportunity, and ignorance were found as the main causes of the poverty of squatters. Dongal (1998) has carried out a Ph.D. thesis on Policy measures for upgrading squatter settlements in Kathmandu, Nepal. The study aims to develop a set of squatter settlement upgrading policies for improving the quality of their housing and living condition. It states shelter as the most valuable asset and its acquisition as a basic necessity for all in order to achieve good health, welfare and quality of life. It concludes that lack of shelter and adequate infrastructure rank as one of the greatest urban problems leading to other urban problems resulting in slum and squatter settlements, congestion and so on.

The spatial pattern of poverty does not correspond to that of informal settlements, a couple of huge agglomerations of informal settlements are observed in the poverty area in the Bharatpur. Transportation and social services are mostly available anywhere in the center of Metro Manila; their service areas do not cover the poverty area (Shohei, 2009). Prakash Mihir (2011) in his dissertation "Spatial Growth of Informal Settlements in Delhi" focuses on validating the relationships between the location choice and spatial growth of slums, and quantifiable and observable factors such as water availability, accessibility to public transit and jobs, identified as relevant in earlier studies on the subject of squatter settlements in New Delhi. He concluded that Ground water is relatively significant in determining the spatial growth of settlements and extremely significant in determining the intensity of development within settlements. Further, he concluded proximity to bus stops is of much higher significance as compared to the availability of jobs nearby and close developmental investments. Mbathi (2012). on his paper " Technology and Governance: Enhancing Participation Using Geographical Information Tools (GIS) in Low Income Settlements" explores how the integration of technology based tools (Geographic Information Systems and Remote Sensing) in settlement mapping and subsequent upgrading using has impacted on planning processes particularly with regards to community participation in Kenyan context. GIS tools offer a platform for integration of spatial and non-spatial data as well

as visualization of the settlements. The capabilities offered by these tools have enabled communities to participate especially in the planning and management of new infrastructure as well as settlement upgrading. As development-related decision-making invariably has an explicit spatial context or component, a part of the information processing and exchange will be spatial or geographic information. Participation in development issues therefore involves at least a component of spatial information.

Government of Nepal has made a committee to identify the real landless people and provide them the land. Within informal land tenure, there have been activities of selling and renting houses and lands in these illegal occupations. At present many unplanned squatter settlements should be removed by giving inhabitants temporary occupation certificate whereas genuine settlements should be relocated on safer sites. It relates to the urban development and housing of the poor in Kathmandu and Pokhara and provides usable suggestions and policy recommendations for urban development and housing for the poor in Kathmandu and Pokhara cities in particular. It deals with some of the basic issues arising from and contributing to the success of urban development and housing and tries to make critical assessment of growing squatter settlements and the inevitable consequence in the absence of plans and policies for slums and squatter settlements (Kanskakar, 1998). The scientific study is not found in the study of Kanskar in 1998 because of poor condition of urban development was mentioned but scientific remedial process is not mentioned (Shrestha, 2003).

Objectives of the Study

The basic objective of this paper is to locate Slum and squatter settlement of Bharatpur Metropolitan City and to find out the causes and consequences due to slum and squatter settlement.

Study Area

Bharatpur metropolitan city is in the central-southern part of Nepal. Located in Chitwan District, Bharatpur is the district headquarter of the Chitwan District, as well as a separate Metropolitan authority, and is the fifth largest city of Nepal with the population of 280,502 and the density of population is 650 persons Km^2 (Metropolitan Office, 2019). Bharatpur is one of the fast growing cities of Nepal. It lies on the left bank of Narayani River and serves as a commercial centre of Chitwan district and central region of Nepal. It is located at the centre of Mahendra Highway and Kathmandu - Birganj (North-South) road corridor. The proximity of this city from Kathmandu (146 km), Pokhara (126 km), Butwal (114 km), Ghorahi (275 km), Birganj (128 km), Hetauda (78 km) and PrithiviNarayan (Gorkha) (67 km) has augmented the importance of its advantageous geographical location. In addition to good road access, Bharatpur has regular daily air services to Kathmandu and Pokhara.
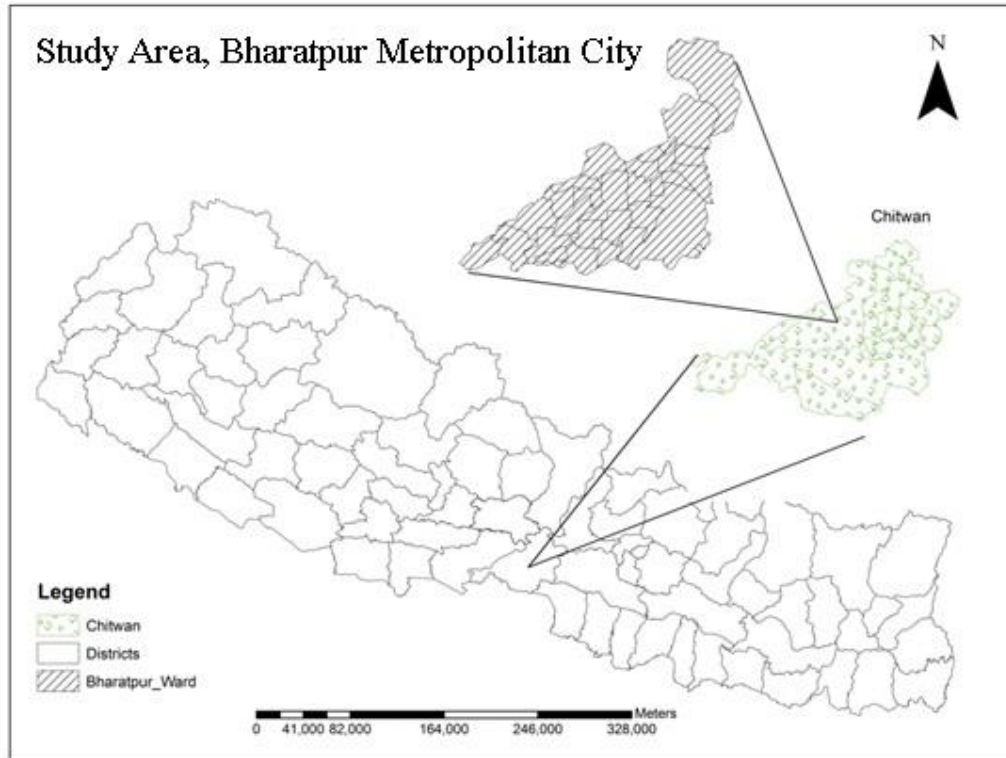
Figure 1.

Methods and Materials

This study is fully based on quantitative analysis from GIS tool. This is done by various methods according to the tools in GIS. One of the most popular and accurate methods used in this study is coordinate method, which is internationally recognized. In this study. Easting and Northing values provided in the topo-sheet were used to geo-reference the map. Four corner values were used during the geo-referencing process. Link table in the toolbar provided the root mean square errors (RMS error) that specify the accuracy of the work. The value of RMS error in the table was minimized by repeating the work many times. Rectification of the geo-referenced image was done, when the error became below the permissible value. Bharatpur Metropolitan City covered portion of many topo-sheets. Single topo-sheet of the city was not available, so the geo-referenced images were clipped. Clipping of the raster dataset was performed with help of the clip tool in raster processing of data management toolbox in Arcmap9.3.

Discussion and Analysis

Bharatpur Metropolitan City is city of high immigrant people from different districts of Nepal. The fertile land of the city as well as developed infrastructure are playing role of pull factor for migration. This has been one of the most effective causes of growth of slum and squatter in the city. During the study location of the settlements were traced with help of hand held gps and plotted in arc GIS 9.3(Google Earth, 2015). The latest goggle earth images were used for the digitization of the slum and squatter area to make a polygon data set. The dataset contained fields like name, number of settlements; ward and the type of land used encroached by the resident people.
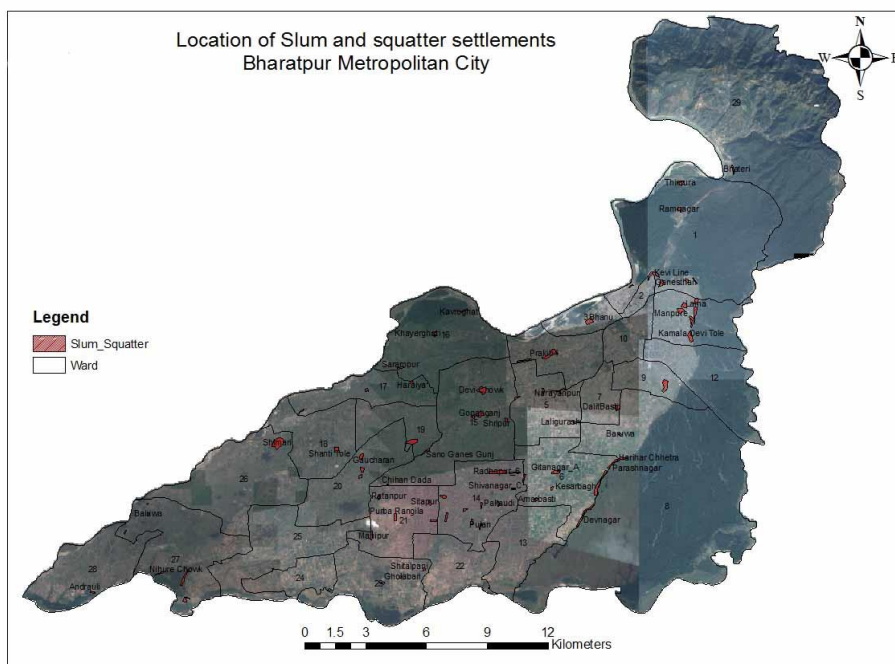

Figure 2.

Bharatratpur metropolitan city has many aspects for growth of settlement. In total 76 settlements were identified during the study in the Metropolitan City. The settlements contained from 10 to 190 households. There were two wards where there were no slum and squatter. Data of four wards was not available due to various reasons. Ward 14 contained the highest number of squatter settlement. It contained 10 settlements with 732 household. Among the settlement of ward 14 six settlements were residing in *parti* land (not registered), three in gaucharan and a settlement in canal side. Ward 14 was followed by ward 6 with 8 settlements having 613 households (figure 2). Out of seven settlements three were settled in forest area, two were in canal side, and one in gaucharan. The third largest ward in slum and squatter settlement was ward 1, with 7 settlements including 483 households. All of these residing in forest land but one on Narayani river bank. The number of settlements in the ward varied from 1 to 10. Two wards did not have any squatters; nine wards have one squatter settlement; two wards have two settlements; three wards have three settlements; three wards have four settlements; one ward have five settlements; two wards have six settlements; one ward has seven settlements; one ward have eight settlements and one ward has one settlement.

It can be seen that the density of the settlements being high in two area. Aptari area included nearly 12 settlements in the surrounding. And the area of award 14 and 6 included 18 settlements. Both areas are near the forest area, so it can be concluded that the forest area the forest area are commonly encroached by the squatter settlements. Dissimilar to the settlements of Kathmandu the settlements were not found to be near the bank of rivers. But some single households (not included in this study) were staying in the side of the canals. According to the local residents the growth of the settlements were discouraged by the probability of flood in the area near to water bodies. The gaucharan or parti (unregistered land) were also popular among the settlements. Some of the resettlement programs used these types of lands for the reestablishment of the displaced settlements due to natural hazards or land eviction.

Table 1: Ward wise household proportion

Ward	Slum and Squatter Settlements	Total Households	Percentage
1	483	2502	19.30
2	48	4164	1.15
3	40	3529	1.13
4	63	3634	1.73
5	113	1883	6.00
6	613	2609	23.50
7	0	2690	0.00
8	64	1566	4.09
9	44	2343	1.88
10	0	6477	0.00
11	374	5314	7.04
12	0	2837	0.00
13	0	1483	0.00
14	732	2094	34.96
15	90	2845	3.16
16	0	1894	0.00
17	95	1514	6.27
18	120	1675	7.16
19	120	1473	8.15
20	202	1576	12.82
21	230	1614	14.25
22	0	1294	0.00
23	84	1654	5.08

24	0	981	0.00
25	0	1863	0.00
26	36	1936	1.86
27	125	1763	7.09
28	20	1323	1.51
29	20	1164	1.72

Source: Metropolitan Office, 2016

The highest percentage in the number of such households was found in ward 7 with 732 households. Out of all 29 wards five settlements had more than 10% households in such settlements (Table 1, figure 3). The averages of 5.49% of total households of the study area were living in such settlements.

Most of the wards have households below hundred and four wards have households more than hundred and less than two hundred (Figure 3). It can be seen that most of the ward have less than hundreds of households. The reason behind might be the frequent distribution of lands to land less people by various Slum problem resolution commission. The settlements were found to be established in various types of lands. The categories of lands were found to be Forest land, Parti, Gaucharan, Public lands, and canals. Among these forest lands were encroached highest. Out of 76 settlements 22 were established in forest, 20 in *parti* land, 16 in Gaucharan, 13 in public land, and 5 along the canals. There are many methods are used to detect temporal and spatial variation, 1) Geometry based spatio-temporal matching method: by using algorithm that comparing the geometrical characteristics of two versions of data, it can judge whether the objects feature has changed or not. 2) Property based change detection method: by comparing the thematic information of different version of data, some rules are created for the comparing, then it can easier to get the information whether the objects changed or not. It can be seen that the growth of settlement in the Aptari area had been dramatic from year 2005 to 2010 (figure 4). In 2005 very sparse settlements were present and relatively smaller
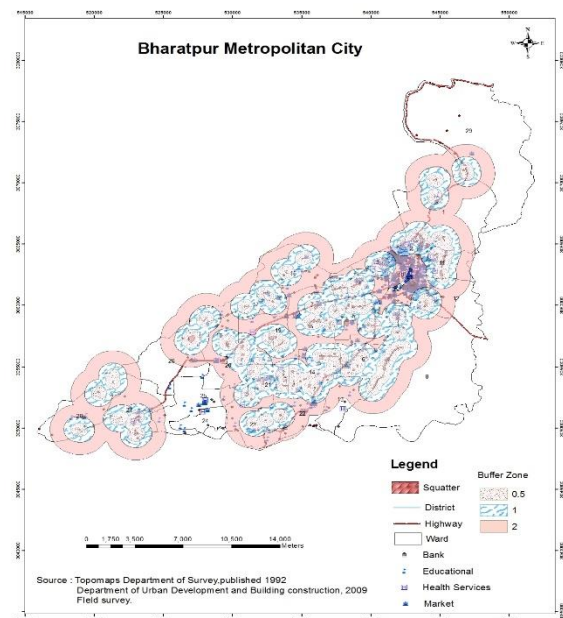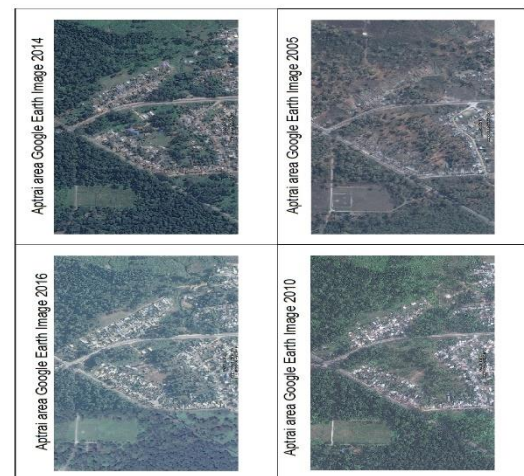

Figure 3.

Figure 4.

houses were built. But by year 2010 it showed up a great increment in the density of houses in the settlement area. The year 2014 and 2016 showed up with the development of houses rather than the increment in number of households (figure 5).

Similar pattern of growth of the settlements had taken place in the Radhapur settlement in ward 14. In year 2005 smaller houses were present; this continued up to year 2010 but by 2014 the settlements have developed in the size of houses.

Shanti tole of ward 18 was settled in gaucharan. The settlements contained smaller and fewer houses in year 2005 and by 2010 the density of the households increased. Increment in the number and density of the vegetation can be seen clearly from the time series images. By the year 2016 few houses have zinc roof. The house structure of this settlement is not seen to be developed (figure 6).

Figure 5.

Baghbazar of ward 20 reside in gaucharan. In similar pattern to other settlements the growth limited to increase in density of the slum households but the expansion in the area of the settlement was not found. Similar to that of shanti tole the settlement included higher density of the vegetation.

Gaucharan of ward 20 showed different pattern of growth of settlement. The year 2005 and 2010 have nearly similar pattern of households. But by the year 2014 the households' number increased and developed households were found. There was no significant difference in the household pattern and density between the year 2014 and 2016 (figure 7). Spatio-temporal analysis of the slum area predicts that all of the settlements have been settled before the year 2004. The expansion or the spreading of the settlements was not popular among the settlements. None of the settlement grew up in its aerial extend but tended to increase in the density of households.
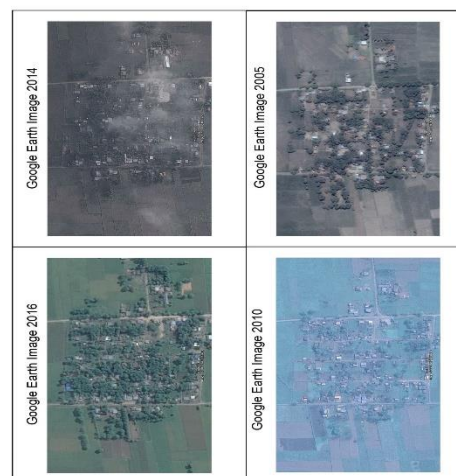

Figure 6

Accessibility to Commercial Services

The commercial service centers are those institutions that provide the financial services to the people. Commercial banks, development banks, finances, cooperatives, and money transfer were assumed to be the commercial service centers in this study. The presence of these sectors in the area was assumed to have more commercial activities than other areas.

Figure 7

During the study 133 commercial service centers were located in the study area. The density patterns of these centers were similar to that of health services but they also spread over the entire Metropolitan City. They were more centralized in the developed area. The core urban area after the Bharatpur and Narayanghat like Gitanagar, Shivanagr, Rampur, Jagatpur, Saradhanagar, Megauli, Parsadhap were the main area of establishment of these commercial centers. These areas are regarded as the centers for the other suburban area of the Metropolitan City. Out of the 76 identified settlements just 8 were in side 500 meters from the commercial centers. The number of squatter settlements gradual increased as the distance from the centers became 1 kilometer and reached 35. 56 settlements were within 2 km and 74 were within 5 km from the commercial centers. Two settlements as like to that of health centers were beyond 5 km distance from the centers.

Conclusion and Recommendation

Bharatpur Metropolitan City is among the fast developing city. The urbanization is in rapid phase. There were 76 squatter settlements as identified in during the study. All the settlements were connected with at least the earthen road and mostly with graveled road. The expansion, extension and the construction of the road were found to address the location of the slum and squatter. Transportation routes also nearly covered all the squatter settlements; some were around 1 km from the bus stand. Educational sector development had also not left such settlements behind. But the provisions of higher education were city center focused that made the people to travel long distance to obtain higher education. The provision of proper health facility lagged behind such settlements. Some of the settlements were even deprived of primary health services. Accessibility to the commercial services to improve the livelihood has been like primary essence. 74 settlements have at least such service center within 5 km distance, this indicate that the commercial sector development do not only focus the core area but also the squatter areas. From the study it can be concluded that the growth of markets are also near to the slum and squatter area.

Rapid increase in population growth in Bharatpur puts pressure on the household level in rural areas. Social discrimination and disparities between people, communities, increasing rate of unemployment, and disparities in ownership over land, conflict and difficult living conditions in rural areas are major stimulating factors for increasing rural urban migration in Bharatpur. Specially the poor move to the urban areas and face numerous problems relating to shelter, employment, food and other facilities. Their low level of education and skill do not meet the requirement for the locally available jobs. Poor migrants cannot afford the housing rent in the city. Therefore, the only option is to live in open places available in public lands, Forests, bare lands nearby canals open spaces is seen in Bharatpur.

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