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ASSESSMENT OF URBAN LANDUSE PATTERN OF BIRGUNJ CITY: A GEOGRAPHICAL APPROACH

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Abstract

Birgunj has experienced rapid growth due to migration from peripheral districts and villages for security and other reasons. Most of the fertile agricultural fields are rapidly converting into residential and commercial areas. The changes in land use from 1998 to 2005 and further to 2016 were computed using toposheet maps and satellite images adopting qual-quant method. It has been observed that about 598 hectare of agricultural land converted to built-up area from 1998 to 2005 with the annual increment rate of 20.9 percent. However, the increment rate decreased to 8.1 percent during 2005 to 2016 resulting the conversion of 897 hectare agriculture land into built-up area. In terms of change in percent, the built up area increased by 146 percent from 1998 to 2005. It is interesting to note that despite the gap of 11 years between 2005 and 2016, the percent of increment has slowed down to 89 percent only in later period. On the other hand, the agricultural area decreased by 9 percent and 14 percent between 1998 and 2005 and 2005 and 2016 respectively. Thus, there is urgent need to implement effective policy by concerned authorities to reduce the negative consequences of haphazard urbanization.

Key words

Peripheral; rapid growth; conversion; agricultural land; migration

Introduction

According to census 2011, only 17.1 percent of the total population of Nepal was in the so-called urban areas or 58 municipalities of Nepal (CBS, 2011). However, with the declaration of 133 new municipalities in 2014, the proportion of the urban population increased to 38.26 percent. The proportion of the urban population has been showing a

continuous increasing trend with the addition of further new municipalities from 191 in 2014 to 217 later (Pradhan, 2015).

Earlier, Nepal had 217 cities and 3157 famous villages with fame and specialties because they all have different culture, natural resources and other special identities. Later on, the data was changed as the Commission of Restructuring in Federalism has decided 774 local bodies in Falgun of 2073 BS which constitute 7 provinces, 77 districts, 6 metropolises, 11 sub metropolis, 276 municipalities and 481 rural municipalities. The recommended local bodies are listed in the red book of the government and it is implemented practically (Pradhan, 2012 & Acharya, 2018).

Nepal is recorded as one of the top ten fastest urbanizing countries in the world. The population growth in newly developed peri-urban areas is significantly higher. According to Muzzini & Aparicio (2011) annual population growth was high in the peripheral municipalities of Kirtipur (5 percent) and Madhyapur Thimi (5.7 percent). The growth of population and the rapid expansion of built-up area in recent decades have caused a substantial Land Use & Land Cover change (LULC) in Kathmandu Valley. With 3.94 percent urban growth rate between 2010 and 2014, the Kathmandu Valley is going through significant transformation of its landscapes in recent years making it important to understand the dynamics of LULC change processes, including their interaction with local and regional environmental change (Ishtiaque, et al., 2017).

Land use involves the manner in which land is being utilized for various activities such as residential, commercial, industrial, institutional, etc. The land use pattern is the resultant of various activities associated with physical, socio-economic and environmental aspects. Urbanization causes change in the land use pattern like converting agricultural area into residential area or non-built up area to built-up area and hence changes in catchment hydrology turning pervious area into impervious area (CUDP, 2018).

Naturally, the proportion of the urban population has also exceeded more than 50 percent and this is the highest among the SAARC countries. The increase in the number of municipalities has not been matched by affiliated increase in the provision of basic infrastructure services and facilities thereby resulting into excessive pressure of population in the limited infrastructure provision in most of the municipalities in Nepal. The growth rate of urban population in the entire census was higher than the national growth rate of population and this was true in the census of 2011. Furthermore, there is imbalance in the distribution of urban population with the dominance of Kathmandu Valley and few other major cities of Nepal despite the fact that there has significant increase in the number of

municipalities across the whole country in recent years (CUDP, 2018).

Methodology

Study Area

The study area is confined to Birgunj Sub-Metropolitan City, which naturally covers the recently added VDCs. Thus, the total study area now is 75.2 sq. km. with total population of 204,816. Dense settlement with high density is clearly visible in the southern part near Indian border whereas newly added areas particularly in the North-West side have scattered settlements with low density. Birgunj Sub- Metropolitan City (BSMC) is located in Parsa district of Narayani zone in the Central Development Region of Nepal (Fig. 1).

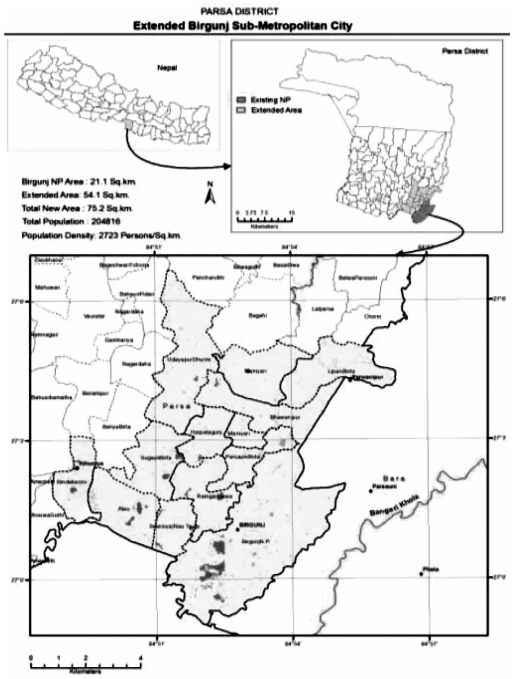


Fig. 1 Location of BSMC in Parsa district

It is surrounded by the Singha River in the East, Tilawe River in the West, Gandak Nahar in the North and Indian state of Bihar in the South. It lies at 27°02'30" to 26° 57' 45" North and 84°55'00" to 84°52'15" East longitude. The altitude ranges from 78m above sea level in the South near the border area to 87 m above sea level in the North with gradual slope of about 1:900 from north to south (Profile, 2017).

Data collection, survey and consultation

As per understanding from the earlier stage, detailed data and information from key stakeholders through various means: site visit and measurements, questionnaire survey and interview, consultation and focus group discussion were conducted. In this context, the focus group discussion at community level and meeting with officials working at policy making and implementing agencies was crucial. Views from the professional bodies and other key stakeholders were also noted down.

The data related to land use pattern, extent and status of physical and social infrastructures, their standards and quality, land values and environmental problems were collected from primary sources such as physical mapping, available GIS data and maps of Birgunj Sub- Metropolitan City, satellite images available online, on the site observation and interview. Similarly, secondary

sources data were collected and analysis was done as much as needed. Based on the available and collected data from different sources, the spatial analysis using GIS and interpretation of satellite image were carried out.

Remote Sensing and GIS technologies were extensively used to assess and analyze the current situation of BSMC and prepare various GIS-based land use data and maps to present the situation in the easily understandable format. Various GIS data and maps were produced as output that would help policy makers, planners, decision makers, implementers, politicians, civil society and citizens to visualize the BSMC's plan for Municipality's development. BSMC's existing GIS data and maps were used for previous municipal areas and high resolution satellite images and maps were used to create data base and maps for BSMC's recently extended areas.

Results and discussions

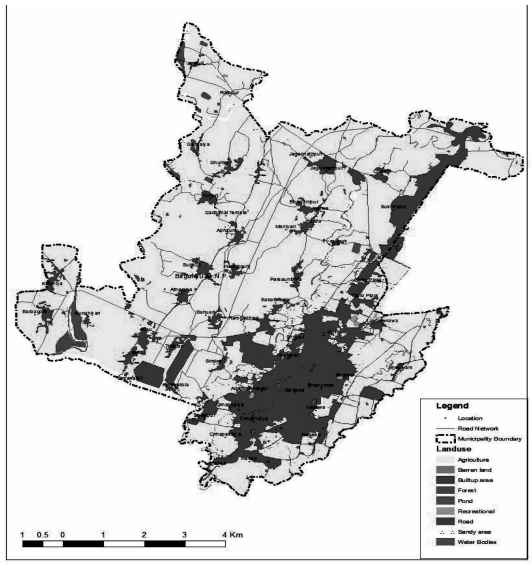
The spatial analysis has clearly revealed the demand and supply situation of vacant land based on Land Use & Land Cover (LULC) technique including land develop-ability analysis. The analysis, therefore, has clearly showed the location where the future growth can be channelized.

Existing land use

The existing land use map (Map 1) shows the built-up area of Birgunj and distribution of different land uses. The total area of Birgunj Sub-metropolitan city is 2,337.02 hac. In addition to residential and residential commercial areas there are many isolated villages within the municipality. Birgunj contains a large amount of institutional and industrial institutions. The agricultural areas still dominate the total area of municipality.

Parks, open space and recreation areas

If one considers only earlier 19 wards of BSMC, then the open space available, is just 0.33 percent of total municipal areas. Compared to other sub-metropolitan cities of Nepal, these figures are quite less. Kathmandu metropolitan city comprises of 0.48 percent whereas Lalitpur sub-metropolitan city has 0.60 percent of total municipal areas. Biratnagar sub-metropolitan city comprises of 1.49 percent of municipal areas.



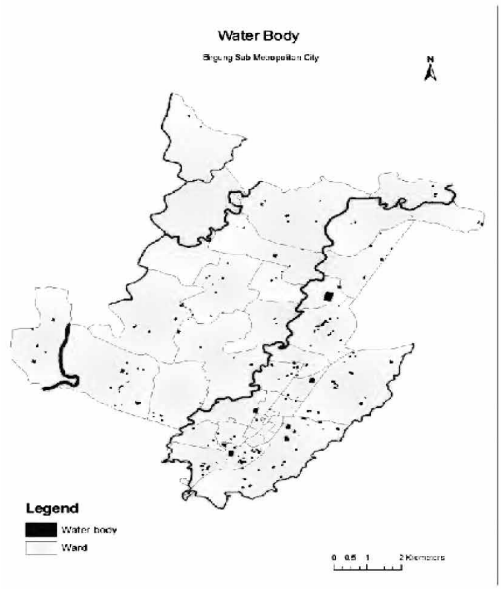
Map 1 Existing land use map of BSMC, 2016

Ailaani and parti land

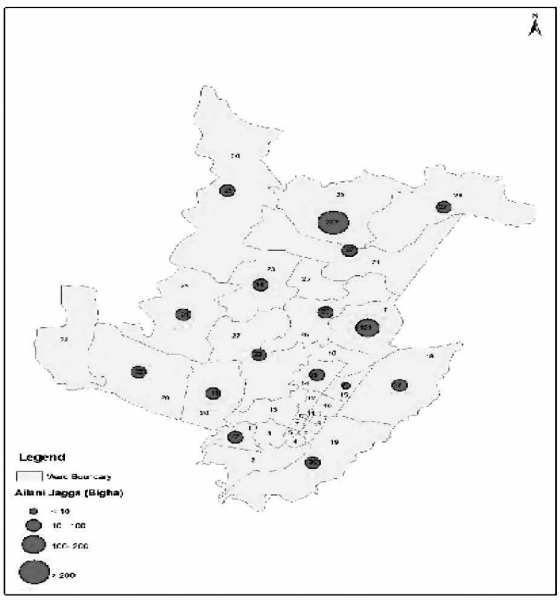
In BSMC, the ailaani and parti land covers about 644 bigha. The spatial distribution of these land parcels is shown in map 3.

Water bodies

Within the BSMC there exist more than 10 water bodies in the form of ponds and lake. Among them, Chapkaiya pond, Ghadiarwa pond, Murli pond, Chini mill pond, Baudhimai pond, Nagawa pond and Maidiya pond are the major ones. The location of these water bodies are shown in map 2.



Map 2 Map of BSMC showing water bodies



Map 3 Map of BSMC showing ailani and parti jagga (open land)

Changes in land use

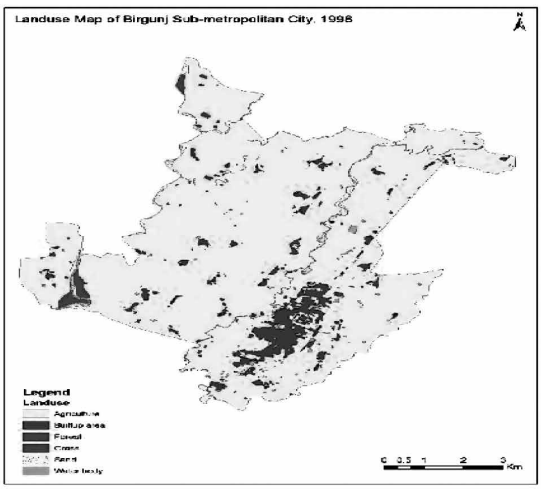
Birgunj Sub-Metropolitan City is Nepal's principal trade centre. The city has experienced rapid growth especially in the past decade, due to migration to the city from peripheral districts and villages for security reasons, or other reasons such as for a better livelihood. Most of the fertile agricultural fields are rapidly converting into residential, industrial and commercial areas.

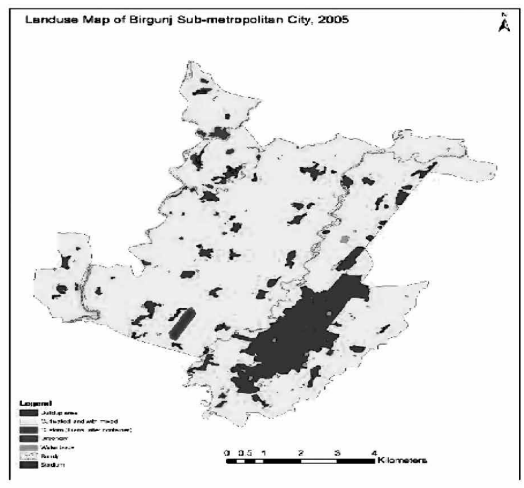
The changes in land use from 1998 to 2005 and further to 2016 AD were computed using satellite images. The agriculture land has been converted to built-up area in these periods. It has been observed that about 598 hectare of agriculture land converted to built-up area in 7 years from 1998 to 2005 with the annual increment rate of 20.9 percent. However, the increment rate decreases to 8.1 percent during 2005 to 2016 resulting the conversion of 897 hectare agriculture land into built-up area in 11 years (Map 4).

In terms of change in percent, the built up area increased by 146 percent from 1998 to 2005. It is interesting to note that despite the gap of 11 years between 2005 and 2016, longer than the previous 7 years from 1998 to 2005, the percent of increment has slowed down to 89 percent only in later period. On the other hand, the agricultural area decreased by 9 percent and 14 percent between 1998 to 2005 and 2005 to 2016 respectively.

It is very likely that the significant increase in built up areas between 1998 and 2005 (2055 BS and 2062 BS) was probably due to Maoist conflict which was started in 2050/51 BS and continued for ten years until people's movement II in 2062/63 and the Maoist conflict was in the peak between 2055 and 2062 BS. During this period, the people living in the hills and mountain areas across the country felt highly insecure of their lives and properties which resulted into a large number of families migrated to Terai region including Birgunj for the safety of their lives. And this has led to phenomenal growth of built up areas to the extent of 141.66 percent during this period in Birgunj. The growth of built up areas could not be sustained to the same level during the period between 2005 and 2016 compared to earlier period between 1998 and 2005 although there was growth in built up areas during this period also. The reason for this decreased rate of growth of built up areas may be due to Madeshi movement, which started after 2005 in the Terai region including Birgunj. Therefore, the growth in built up areas could not maintain the same level of growth as in the earlier period.

The following maps (Map 4, 5, & 6) show the changes in the built up area of BSMC from 1998 to 2005 and to 2016 AD.

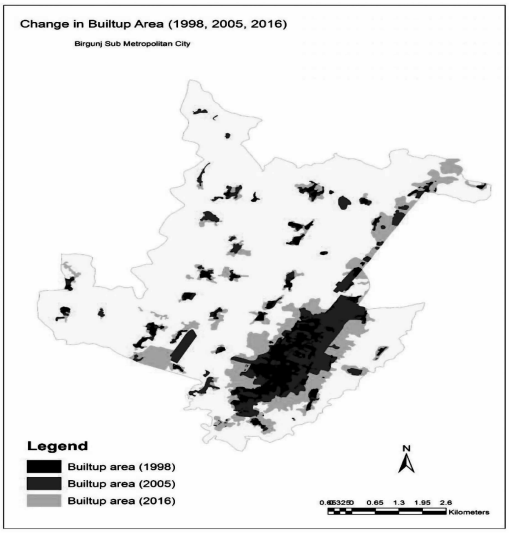




Map 4 Map of BSMC showing land use pattern in 1998

Map 5 Map of BSMC showing land use pattern in 2005

The built up area in 1998 AD is about 409 hectare which increased to 953 hectare in 2005 AD and further increased to 1761 hectare in 2016 AD.



Map 6 Map of BSMC showing changes in land use from 1998 to 2016

Proposed land use plan

The total land area covered by BSMC is 7,539 hectare, which has been classified into 16 types of land use such as industrial, commercial, residential, institutional, greenery, etc. as shown in Table 6.1. The total land area covered by each type has been calculated and proposed population density for the residential area has been also estimated. Further, the total population that can be accommodated in the residential area has been estimated in Table 1.

Table 1: Land use plan proposed for BSMC

SN	Land use type	Area in hectare	Proposed population density per hectare	Population accommodating capacity
1	Industrial	886	25	22,160
2	Commercial Corridor	90	50	4,506
3	Central Business District	34	50	1,684
4	Institutional	309	300	23,155
5	Transport Nagar	429	25	10,725
6	High Density Residential Area	168	300	50,359
7	High Density Residential Infill	705	300	211674
8	Low Density Residential Area	274	100	27,441
9	Residential Cum Commercial	115	100	11,539
10	Urban Expansion Area	577	150	86,556
11	Exhibition Area	7		
12	Greenery (Park)	30		
13	Recreational Sport	28		
14	River Front Development	90		
15	Sewage Treatment Plant	10		
16	Predominant Agriculture	3,787		
	Total	**7,539**		**449,801**

Source: Field Survey, 2018

Based on the proposed plan, about 4.5 lakhs people can be accommodated in the BSMC, which is 1.5 lakhs more than the projected population in 30 years i.e. 3 lakhs only in 2035 AD. The Map 7 shows the geographical distribution of the land use by its type.

The proposed land distribution pattern of BSMC shows that half of the total land is allocated to agriculture and about 16.7 percent land area is allocated to residential area with 7.7 percent land of urban expansion area for future. About 11.8 percent land is allocated for industrial area and other land use

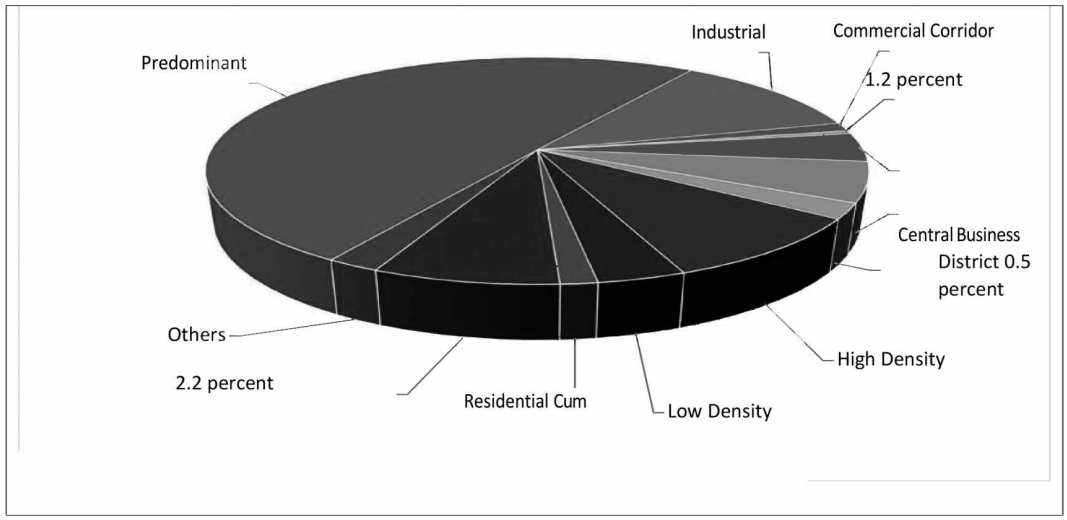


Fig. 2 Distribution of land by proposed land use plan

coverage are shown in Table 1 and Fig 2 in detail and the location of these land use types are clearly shown in Map 7. Beside land use types, this map also depicts the proposed priority road, proposed ring road, existing major and minor road and Gandak Canal.

Conclusion

Birgunj city, the entrance gate way and one of the important break of bulk points of this Himalayan country, has been experiencing rapid growth due to migratory trend of people from peripheral districts, villages for security purpose and from cross-border area for better livelihood and other reasons. Most of the fertile agricultural fields are rapidly converting into residential, industrial and commercial areas. The changes in land use from 1998 to 2016 AD were computed using toposheet maps and satellite images. It has been observed that about 598 hectare of agriculture land converted to built-up area in 7 years from 1998 to 2005 with the annual increment rate of 20.9 percent.

However, the increment rate decreases to 8.1 percent during 2005 to 2016 resulting the conversion of 897 hectare

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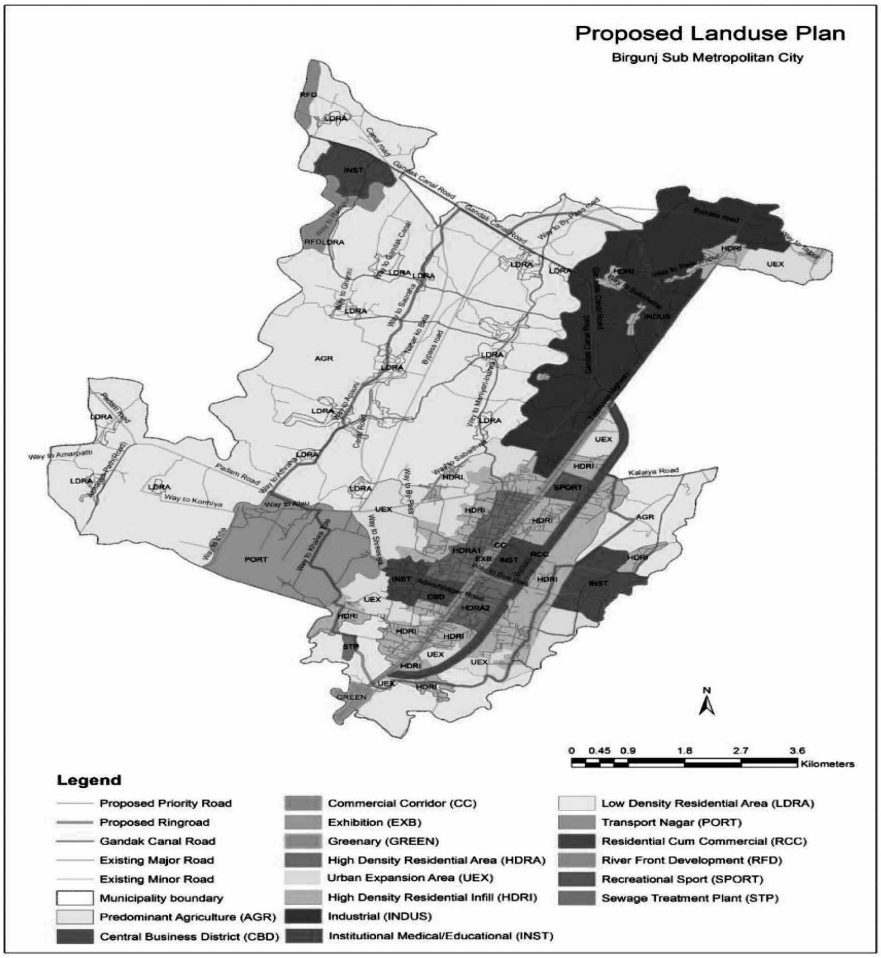

Map 7 Proposed land use plan

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