



A STUDY ON CHANGING LAND USE PATTERN OF CHANDRAGIRI MUNICIPALITY IN KATHMANDU VALLEY

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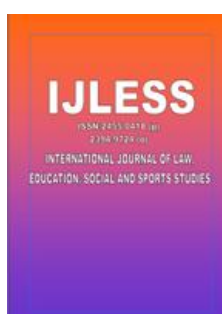
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ABSTRACT

Land use and land cover is a changing phenomenon of the earth's surface. Various reasons are responsible for dynamics of land use changes. Different categories of land use patterns are appeared over the space and time. Basically, from agricultural to non-agricultural based activities and phenomenon are vivid in urban surrounding due to population growth. This study is mainly based on both spatial as well as attributes data. For this purpose, data were calculated from Toposheet 1994, Google image 2004, and 2014. Intensive lab work was carried out for digitizing and geo-referencing. After that, field verification was carried out sincerely. Finding clearly indicates that rapid urbanization due to excessive population growth in the area has played significant role of driver for land use change in Chandragiri Municipality in Kathmandu Valley. The area covered by built-up area and road have been increased significantly and agricultural land decreased in high proportion in this municipality area. Similarly, the situation of forest cover has no more changed within the period of twenty years.

Keywords: Land use pattern; urbanization; population growth; Chandragiri Municipality; cultivated area; built up area



Introduction

Land use and land cover is an apparently changing phenomenon of the earth's surface due to natural and human modification which is an important content of global change research (Khanal, 2002; Li et al., 2017). There have been drastic changes in land use and land cover in the recent days (Houghton, 2003; Pradhan and Sharma, 2017). Land use changes in urban areas drastically due to urbanization. Urbanization at present is growing at greater rate than past and it is prominent in Third World countries. Today the largest and fastest growing cities are in developing countries, because of the new urban-industrial development. Urban land use change and urbanization is correlated with each other which are directly related with population growth living in urban areas (Li and Lian, 2012). However, concepts of urban land use change and expansion have been historically related to the economic development, specialization and industrialization that accompany them (Sharma, 2003). Although, there is a general consensus among researchers that a basic feature of an urban area is the structural shift in employment from agriculture to non-agricultural activities (Geyer and Kontuly, 1993). The division of labor, modern technology-based goods and production, good services and a wide variety of goods, intense interaction of spatial and economic activities, and high population density are all fundamental aspects of urban areas (Sharma, 2003).

The process of rapid urbanization has become common phenomenon in Nepal in the present days. The rate of urban land expansion over the past 30 years has increased fourfold, with urban land covering a total 469 km² in 2010 (Uddin et al., 2015), which was 0.32% of the country. Urban land expansion is occurring in the Tarai region at a rapid rate, as well as in some major cities in the Hill region i.e. Kathmandu, Pokhara etc, where there are easy access of transportation and other social services (Khanal, 1999). Nepal is a country of geographical and environmental diversity thus different places have different types of land use pattern (Mandal, 2013). Land is an important natural asset for human beings and therefore it plays a strategic role in the determination economic, social and cultural development (Vink, 1975 cited in Chapagain, Rai and Paudel, 2018). People use it to gain different kinds of resources and development practices i.e. farm base production system, human settlements, roads, industry areas and so on (Pradhan and Pradhan, 2006). Therefore with the base of time its value has been closely associated with the human livelihood. Urbanization is growing in Nepal with its own base and rural lands are being converted into urban ones.

Chandragiri Municipality is slowly developing suburb of Kathmandu valley. The urbanization process has become faster from the beginning of the Maoist insurgency and did not stop after its resolution too. It has changed both land use and land value in Kathmandu valley. Before the Maoist insurgency 1997 there was a small market center, which was dominated by agricultural land use. But now, population and built-up area are slowly increasing. Chandragiri is a newly designated municipality, which was declared as municipality by the government in 2014/15. Due to adjoining with the Kathmandu Metropolitan city, the land use of Chandragiri appears being affected by the rapidly growing. For this purpose it is necessary to be explored the land use pattern of Chandragiri Municipality.

The Study Area

Chandragiri Municipality extends between 27° 41' 25" to 27° 53' 23" north latitudes and 85° 13' 13" to 85° 22' 14" east longitudes. Chandragiri is a municipality in the central development region of Kathmandu district in the capital of Nepal. This is a new designated municipality being formed by merging eleven existing villages i.e. Baand Bhanjyang, Balambu, Dahachok, Mahadevsthan, Machhegaun, Matatirtha, Naikap, Naya Bhanjyang, Naikappurano Bhanjyang, Satungal, Thankot and Tinthana. The municipality comprises 25 administrative wards. The total area of Chandragiri Municipality is 43.9 square kilometers. It spreads 9 km north to south and 8.5 km from east to west. Newar is an indigenous community of this municipality especially in old settlements and mixed society of various castes and ethnicities appear in the new settlement of the municipality.

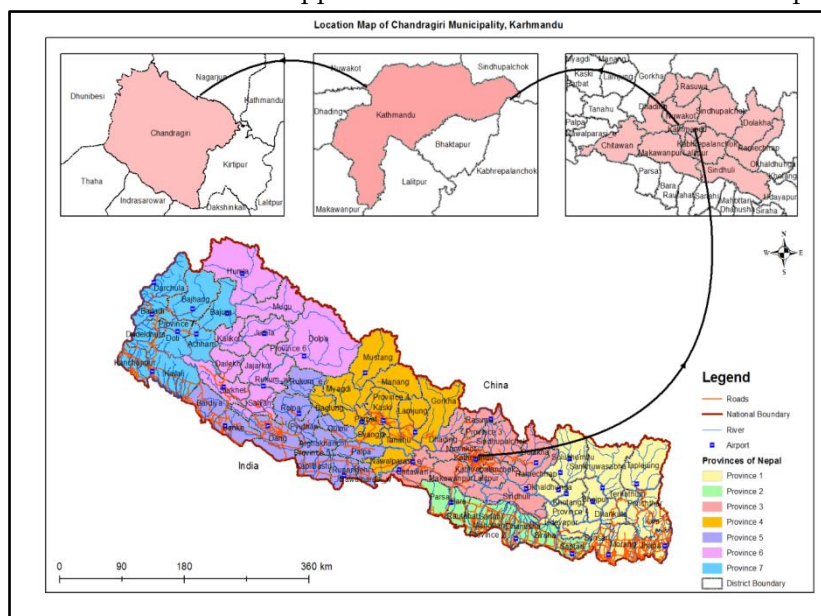


Figure 1: Map of Nepal Indicating Location Map of Chandragiri Municipality.

Methods and Materials

The present study was carried out by using both spatial as well as attributes data. First of all, required maps and images were collected. The major collected maps were Toposheet 1994, Google image 2004, and Google image 2014. Land use maps of 1994 in the study area were scanned separately. The scanned map is being geo-referenced by using Arc GIS 9.3 software. The layers of land use 1996 were prepared by digitizing the geo-referenced map. Similarly the land use 2004 and 2014 were prepared by digitizing the geo-referenced Google image. The topographic data layer and Google image were prepared by digitizing the geo-referenced maps and image. The digitization process was conducted by using Arc GIS 9.3 software. The next step was to compile vector layers of different land use (1994, 2004, 2014) prepared by digitizing process. These three data sets were analyzed in GIS. First of all, the changes in land use 1994 and 2004 were analyzed. Then the land use of 2004 and 2014 was compared. At last, change in land use of 1994 and 2014 were also analyzed. After analyzing the change, the observation and checklist survey of the built-up area was conducted by purposive sampling method. The possible minor error while working in different scales maps, it was tried to verify during field verification. The key informant survey was also conducted for finding the nature and causes of land use pattern.

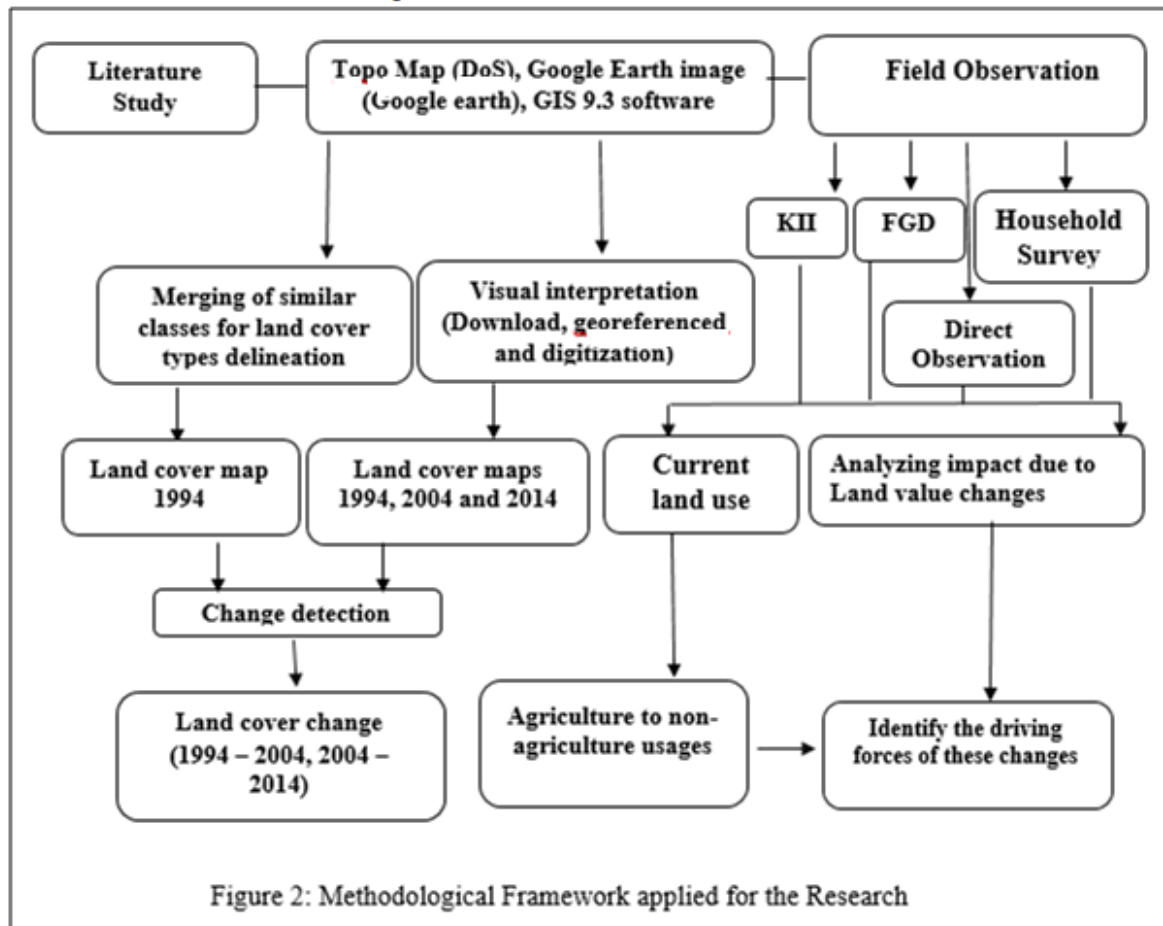


Figure 2: Methodological Framework applied for the Research

Land Use Pattern in Chandragiri Municipality, 1994

Digital GIS data from 1:25000 scale Topographical maps prepared by survey Department, 1994 were used as base data for GIS analysis. Digital GIS datasets including contour, land cover, river features and other topographic features have been used as additional data for GIS based analysis and the study of existing land use pattern. Table 1 depicts the average of each of the land use categories, without river and road.

Table 1: Land use categories in 1994 in Chandragiri

SN	Categories	Area (Ha)	Percent
1	Cultivated area	2279.09	51.88
2	Forest	1621.13	36.9
3	River	337.91	7.69
4	Road	143.75	3.27
5	Built-up area	8.17	0.18
6	Open space	2.6	0.059
	Total	4392.65	100

Source: Toposheet map, 1996

Chandragiri Municipality is known as agriculture based economic urban center. Agricultural land covered 51.88 percent of the total land in the municipality. More than 80 percent people were depended on agricultural activities in 1996. Here, agricultural system depended on rain water and some area depended on canals and underground water. According to field survey, the major crops were rice in the summer crops and wheat and vegetables in the winter crops produced in the municipality.

Chandragiri Municipality had limited built-up area before 1994. Out of the total area (4392.5938 hector), built-up area covered 8.17 hector (0.18 percent). In the same way, built-up area was extended into Santugal, Machchhegau, Balambu and Thankot etc. in the form of old settlement. Forest covered 1621.13 hector in the total area of municipality. Most of the hill slopes of this municipality were covered by dense forest. Those areas are still occupied by forest. In the past, there were sparse population in this area due to poor transportation, lack of drinking water, infrastructure and services. Road network is very necessary for development of any area. Certain area of Chandragiri Municipality is known as ancient city so there are several track roads, but the motor able had not accessibility every ward in 1994. The area covered by road was 143.75 hector at that time. The people often had to walk on foot. Similarly, out the total area, river network covered 137.91 hector in this Chandragiri Municipality.

Table 1 gives the information about the land use pattern of 1994, the highest percent of land use is occupied by cultivated land which accounts 51.88 percent and the least value of land use is open space which accounts only 0.059 percent. Similarly, covered area by forest, river, road and built-up area is seen 36.9, 7.69, 3.27 and 0.18 percent respectively. This figure indicates that most of the people were engaged in agricultural activities due to high proposition of cultivated area and settlement (built up) was scattering in 1994. It must be the land value was low.

Land Use Pattern in Chandragiri Municipality, 2004

Land use pattern in 2004 has been shown in map 3, which is computed from Google image 4 m. high-resolution imagery 2004 with field verification. The area under different six land types in Chandragiri Municipality in 2004 i.e. built up, cultivation, forest, open space, road and river are shown in the table 2.

Table 2: Land use categories in Chandragiri, 2004

SN	Categories	Area (ha.)	Percent
1	Cultivated area	1955.58	44.52
2	Forest	1587.41	36.14
3	Built-up area	489.17	11.14
4	Road	209.18	4.76
5	River	147.23	3.35
6	Open space	3.92	0.09
	Total	4392.49	100

Source: Google image 2004

According to table 2, the highest covered area belongs to cultivation i.e. 45 percent in 2004 and lowest area covered by open space 0.09 percent in this study area. Similarly forest has covered about 36 percent, built-up area has covered about 11 percent, road area has covered about 5 percent, and river area has covered about 3 percent.

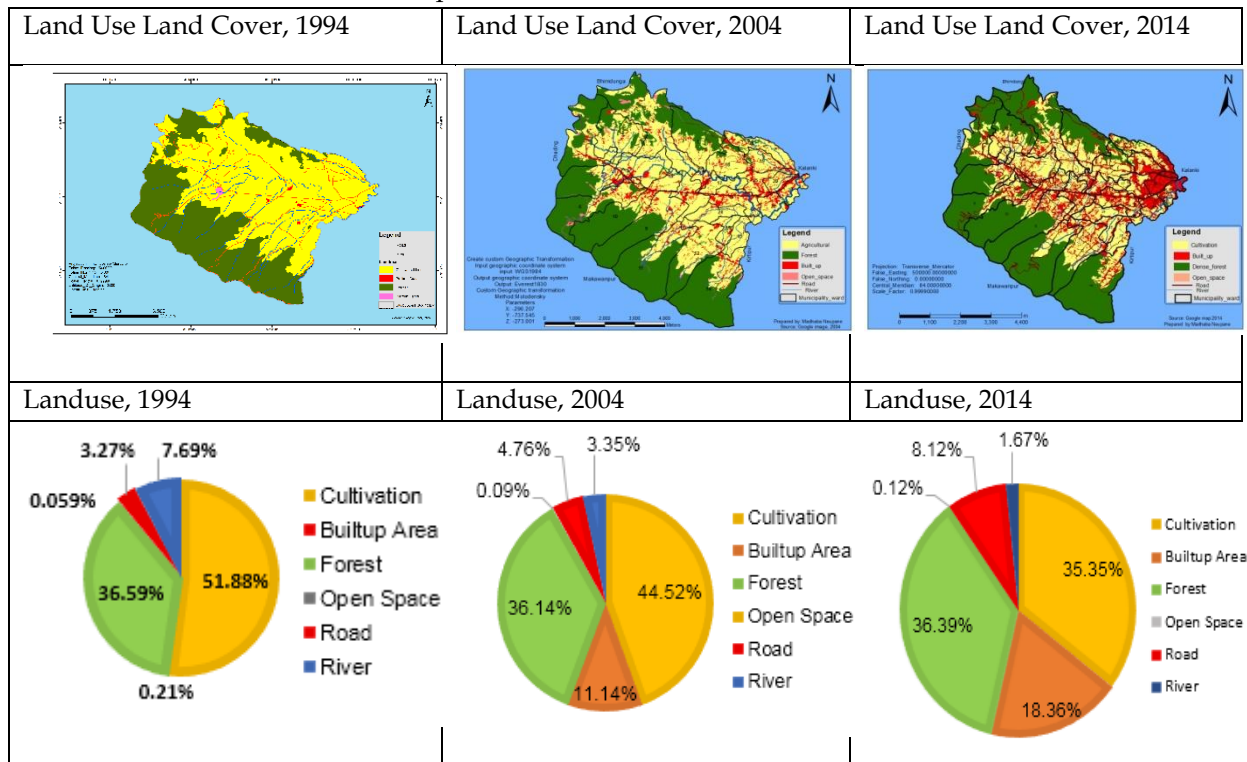


Figure 3: Land Use Land Cover Map of -1994, 2004 and 2014

Land use pattern during the period of 1994 to 2004 has been changed. Excessive change has been appeared especially in agricultural land and built-up area. Most of the occupied area by built-up category has come from agricultural land. Some changes have occurred in the area of road network. Not only Chandragiri Municipality, but also the whole Kathmandu Valley has extremely urbanized in this period. Internal migration from rural to urban centers especially in big cities is the main cause of expansion of built-up area in Kathmandu Valley including Chandragiri Municipality.

Land Use Pattern in Chandragiri Municipality, 2014

Remarkable changes have been seemed in land use pattern between 2004 and 2014. The cultivated area has covered 35.34 percent of the total area of Chandragiri Municipality in 2014. Similarly, built-up area covered 18.36 percent of the total area of Chandragiri municipality, forest covered 36.39 percent, road covered 8.11 percent, river 1.67 percent and open space covered only 0.12 percent.

From 2004 to 2014, there has been notable change in the case of agricultural land and built-up area. A large area of agricultural land converted into settlement during this period. Nearly, 9 percent area of cultivated land decreased. Rapid population growth due to in-migration from several districts of the country is the main cause of this. Likewise, it is the consequence of ten years conflict in the country. The situation of forest cover has same in this period. Most of the land occupied by forest has remained in sloppy areas which are not so suitable for agriculture and settlement. In those days, people are not much dependent on forest for fuel, timber and fodder. Therefore, encroachment of forest is not appeared as serious problem in this area. Furthermore, the area of forest is fixed in the sloppy land previously which is marginal land of the valley. Thus, the major driving factor of land use change in Chandragiri Municipality from agriculture to built-up area is population in-migration from different places of the country in the later days.

Table 3: Land use categories in Chandragiri, 2014

SN	Categories	Area (ha)	Percent
1	Forest	1598.53	36.39
2	Cultivated area	1552.54	35.35
3	Built-up area	806.36	18.36
4	Road	356.59	8.12
5	River	73.28	1.67
6	Open space	5.26	0.12
	Total	4392.56	100

Source: Google image, 2014

The role of community forestry is also vital in this matter. The area covered by road network has increased excessively from 4.76 percent to 8.12 percent. After the expansion of built-area, certainly the area of road network increases naturally. The municipality has also adopted policy to be broadening road within municipality as motor-able. Public encroachment in the river and stream area has been increased. So, the land cover of river has decreased within the period of ten years. Similarly, the area of open space slightly increased.

Conclusions

There is a drastic change in land use from 1994 to 2014 within the period of twenty years in Chandragiri Municipality. Significant changes have occurred especially in cultivated area and built-up area. The dominant pathway of change is from agriculture to built-up area. A large area covered by cultivated land for rice production in summer and wheat in winter converted into built-up area during this period. In the total, the area occupied by cultivation was nearly 52 percent and it declined 35 percent. Similarly, the built up area increased 18 percent from 0.18 percent. The status of forest cover has remained constant in this period. Network of road transportation has been expanded within valley and elsewhere. In this context, the road area has also increased significantly from 3 percent to 8 percent in this municipality. Likewise, river encroachment has appeared markedly in Chandragiri Municipality. The area covered by river was about 8 percent in 1994 while it is nearly 2 percent in 2014. This is a serious problem of geo-hazards for settlement caused by river cutting in the future. The area of open space has been increased in negligible percent within this period. The present trend indicates that the area of agricultural land will be changed into built-up area in the future in this municipality.

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References

- Chapagain, P. S., Rai, M. K. & Paudel, B. (2018). Land use and land cover change and its pathways in Sidin VDC, Panchthar district, Nepal. *The Geographical Journal of Nepal*. Vol. 11: 77-94.
- Geyer H. S., Kontuly, T. (1993). A theoretical foundation for the concept of differential urbanization. *International Regional Science Review* 15(2): 157-177. DOI: 10.1177/016001769301500202
- Houghton R. A. (2003). *Revised estimates of the annual net flux of carbon to the atmosphere from changes in land use and land management. 1850–2000*. *Tellus B* 55(2): 378-390. DOI: 10.1034/j.1600-0889.2003.01450.x
- Khanal N. R. (1999). *Land use/land cover dynamics in Nepal*. *The Himalayan Review*. Vol. XXX. pp. 71-83.
- Khanal, N.R. (2002). *Land use and land cover dynamics in the Himalaya: A case study of the Madi watershed, western development region, Nepal* (Unpublished doctoral dissertation). Tribhuvan University, Faculties of Humanities and Social Sciences, Kathmandu.

- Li C.,and Lian L. (2012) Theoretical research of the urban comprehensive carrying capacity in the epoch of urbanization. *International Journal of Financial Research* 3(1): 105-113. DOI: 10.5430/ijfr.v3n1p105
- Li, L., Guangbin, L.,Cao, X., Zhao, W., Deng, W.and Koirala, H. L. (2017). Land cover change and its driving forces in Nepal since 1990.In (Eds) A. Li, W. Deng and W. Jhao.*Land cover change and its eco-environmental responses in Nepal*. Research Center for Mountain Environment, Institute of Mountain Hazards, Chinese Academy of Sciences, Chengdu, China. DoI: 10.1007/978-981-10-2890-8.
- Mandal, U. K. (2013).Soil suitability analysis for sustainable landuse planning in Maheshkhola watershed, Central Mountain Region, Nepal.*The Himalayan Review*.Vol. XLIV. pp. 71-85.
- Pradhan, P. K. and Pradhan, B. (2006).*Environment and natural resources: Concept, methods, planning and management*, Kathmandu: Quest Publication Kirtipur. Nepal.
- Pradhan, P. K. and Sharma, P. (2017). Land use change and its driving forces in the Koshi Hills, Eastern Nepal.In (Eds) A. Li, W. Deng and W. Jhao.*Land cover change and its eco-environmental responses in Nepal*. Research Center for Mountain Environment, Institute of Mountain Hazards, Chinese Academy of Sciences, Chengdu, China. DoI: 10.1007/978-981-10-2890-8.
- Sharma P. (2003). Urbanization and development.*Population Monograph of Nepal*.pp 375-412.
- Uddin K, Shrestha H. L., Murthy MSR, et al. (2015). Development of 2010 national land cover database for Nepal. *Journal of Environmental Management*. 148: 82-90. DOI: 10.1016/j.jenvman.2014.07.047
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