

Impacts of Urbanization on Land Use in Urban Fringe (A case of Gaindakot as fringe of Bharatpur Metropolitan City)

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Abstract

The urban fringe areas go through lots of transformations due to urbanisation but lack of proper planning and policies in such fringe areas leads to haphazard and unplanned growth, placing enormous pressures on natural resources, existing services and infrastructures. Bharatpur Metropolitan City is one of the fastest growing cities in Nepal which serves as commercial centre of Chitwan district. The city has been growing bigger and it will have its impacts on its fringe areas. Since migration rate is increasing in Bharatpur, this is likely to spread urban sprawl in adjoining areas, Gaindakot municipality being one of them. This paper uses multiple theoretical framework and qualitative research approach to find out the effects of urbanization on various aspects and the patterns of land use changes in Gaindakot with the increasing urbanisation over the years. Managing rapid urbanization poses challenges that require urgent policy attention. Otherwise, this may lead to rapid and uncontrolled sprawl; irregular, substandard, and inaccessible housing development; loss of open space, and decreased livability as in Kathmandu valley due to unplanned urban development.

Keywords

Urbanization, Urban fringe, Urban sprawl, Land use, Gaindakot (Nepal)

1. Background

Urbanization is the phenomenon of increase in urban centers and migration of people from rural and suburbs to such centers ultimately increasing the population living in urban areas. As a city grows, more people are attracted in the cities and the increasing concentration and economic activities demand more lands to be developed for public infrastructures, housing, and industrial and commercial purposes. Thus, the need of planned and organized urbanization become a great concern with the addition of new urban areas [1]. For the growth of new development areas, the most suitable locations may be found adjacent to existing amenities such as roads and urban centers [2, 3]. Although urbanisation of these fringe areas provides opportunities for employment, better housing, education, etc., it also places enormous stress on natural resources and existing social services and infrastructure [4]. Since several studies have found out that the anthropogenic activities greatly influence the urban environment, it is required to give proper attention towards monitoring the land use and land cover changes in urban areas

[5, 6].

Nepalese cities have been urbanizing haphazardly. The fast growing urbanization process and the consequences of land acquisitions for construction of buildings and expansion of real-estate areas demands urgent policy responses from the government to address the problems brought by the rapid urbanization and real-estate development in Nepal [7]. Rapid urban population growth increases various urban uses, specially housing and this certainly affects the fringe areas [8]. The rapid expansion of urban centers into their “fringe zones” (peri-urban, peri-agricultural, agricultural and undeveloped land) and the impact of urbanization on ecosystem sustainability two issues that at present are not considered to the extent their impact merits, particularly in regional and urban planning [9].

Bharatpur Metropolitan City is one of the fastest growing cities in Nepal which serves as commercial centre of Chitwan district. It is located at the centre of Mahendra Highway and Kathmandu-Birgunj road corridor thus, has important geographical location. The population of Bharatpur was 199,867 population

according to census 2011 [10]. The population has now reached 280,502 and it is the now fourth largest populated city in Nepal. It has large shopping areas, big hospitals, colleges, agriculture-based industries (small-scale processing industries, poultry industries, honey, mushroom, floriculture) and service industry (education and health). Further, multinational companies like Coca-Cola and San Miguel are also situated in Bharatpur. Major business and trading houses have opened branches in Bharatpur, leading to steep rises in land values. Now with the proposal of developing Bharatpur as Smart City, the city will even grow bigger and it will have its impacts on its fringe areas. Since migration and the population growth is increasing in Bharatpur, this is likely to spread urban sprawl in adjoining areas, Gaindakot municipality being one of them.

The population of Gaindakot is 55,205 according to census 2011 [10]. The migration rate is increasing in Gaindakot now and the trends of unplanned settlements, unorganized land plotting and unplanned growth are already taking place. If the process continues and the concerned authorities are not able to make proper policies for the area, the municipal area is likely to suffer from haphazard settlement and unplanned urbanization in near future. Thus, the efforts should be made to study the challenges that comes along with the opportunities of urbanization. This research tries to find the contextual reality of effects of urbanization in fringe areas with the case of Gaindakot, with the objectives of studying the pattern of land use changes and identifying urban sprawl.

2. Literature review

2.1 Urban Fringe

The rural-urban fringe is the boundary zone outside the urban area proper where rural and urban land uses intermix. The term urban fringe was first used by T. L. Smith, to describe the built-up area just outside the corporation limits of the city. To analyze the “elements of urban fringe pattern”, Andrews, in his study, has tried to distinguish between the urban fringe and rural urban fringe. He defined, “the adjacent peripheral zone of the urban fringe . . . as the area of intermingling zone of characteristically agricultural and characteristically urban land use structure obtained in the area” [11]. It is believed that the rural urban fringe development started post World War II. After world war II, there was widespread inner

city development but could not develop housing units for all those needed. So, they went on to build houses on the edge of towns and cities. Thus, residential growth started outwards into the suburbs where population density as well as the land price are lower than that of inner city. As the trend continued, many shopping centers, offices and factories also move to the edge of the urban area for cheaper and larger areas, still being able to take advantage of the facilities in nearby city. Also the traffic congestion is less and the environment is more pleasant in such areas. Thus, this led to the expansion of smaller towns and villages in the areas nearby cities. However such areas do not grow in well-defined patterns rather sprawls haphazardly resulting into incoherent landscape which is the characteristics of the fringe. The general characteristics of the fringe areas are conflicting land uses, rapid residential expansion, mobile population, low or moderate density, inadequate services, change in land occupancy pattern, poor public transport network and intensive crop production [12].

According to Kivell, there are many forces that affect rural to urban conversion of land uses, ranging from macro scale (social, political and economic diagnosis) to meso and micro scale (housing and land market, planning decisions, ownership patterns, land characteristics, infrastructure and transportation structure and roles of actors within this process) in the fringe areas [13]. According to Velibeyo lu, developers also decide on buying the land, parceling and constructing infrastructure and houses directly affect the land-use decisions at urban fringe [14]. The research work carried by Timothy analysed the role of rural to urban migration in the developing countries play vital role in development of urban fringe as the new city immigrants with low income could not be absorbed by the city and hence they had to look for affordable accommodation within the fringe [15]. According to Bryant, improvement in transportation system increases the individual’s ability to commute which contribute to growth of fringe in developed countries [16].

2.2 Urban Sprawl

Urban sprawl is basically the spatial dispersion of settlements. Altshuler defined urban sprawl as “a continuous low density residential development on the metropolitan fringe, ribbon low density development along major suburban highways, and development that leapfrogs past undeveloped land to leave a

patchwork of developed and undeveloped tracts” [17]. The orienting powers affecting the development of sprawling are urban growth, increased mobility, transportation and technology, economic development, consumer demand and public policy. The movement of rural people to urban areas led to pushing of dense population of central cities to further into the surrounding country side. Thus, urban growth pushes the cities further out[18]. Similarly, the main driving force for urban sprawl in increased transportation accessibility, public investment in roads and associated infrastructure have played significant role in relation to the urban sprawl. The other driving force is information and communication technology like internet, local and wide area networks, fiber optics, portable computers, etc. The research work carried out by Velibeyo lu gives the knowledge about municipal fragmentation frequently associated with urban sprawl is likely to intensify problems like conflicting land uses, pressures and agricultural and open space, high costs of service provision, adverse consequences on traffic and public transport, social disparities etc. [14].

3. Methodology

The study of real and existing scenario in the study areas is based on the positivism in ontological position which provide the idea and concept of urban sprawl and urban fringe development in terms of land use and housing expansion, infrastructure and series, road networks, street patterns and transportation, and socio economic status. Constructivist paradigm is used to study real and existing scenario of social behaviors of the study areas. The social observations are treated as entities and real cause of social outcomes are determined reliable.

Constructivist paradigm is used to gather knowledge of the urban fringe development trend in epistemological position. Since the explanations are generated inductively from the data that is observed, constructivist paradigm is used. Thus the research is based on descriptive method.

The study of related articles, thesis, scientific papers, journals, reports, acts and collection of relevant maps, etc are done to collect wide range of data on various related subjects like urban fringe development, characteristics of urban sprawl,urbanization and urban land management process, etc.

Primary data is collected using different approaches

like field observation, questionnaire survey and interview of local experts and key informants. The field observation was made to know the physical status of study area as it helps to know the pattern of current urban development trends, infrastructure development and land use types. Secondary data was collected in the form of published data, records, reports etc. from different sources like DUDBC, Municipality offices, Ward offices, etc.

Stratified random sampling is used to carry out questionnaire survey. According to CBS 2011, the selected wards for the study have 6687 households. With the desired margin of error as 10 percentage, confidence level of 95 percentage and value of population proportion as 50 percentage, the sample size was obtained 95.

The data obtained from questionnaire and maps were analyzed using excel, GIS and AutoCAD to see association between variables and interviews were interpreted to explain the phenomenon.

4. The Study Area

Gaindakot is municipality situated in Nawalparasi District in the Lumbini Zone and has an area of 159.93 sq. km. It was declared municipality in May 2014 by merging the then existing three VDCs: Mukundapur, Amarapuri and Gaindakot. Ratanpurj VDC was also later merged in the municipality. The municipality is bordered with Chitwan and Tanahun districts on east, Devchuli Municipality on west, Bulintar Rural municipality and Tanahun district on north and Chitwan district and Chitwan National Park on south.

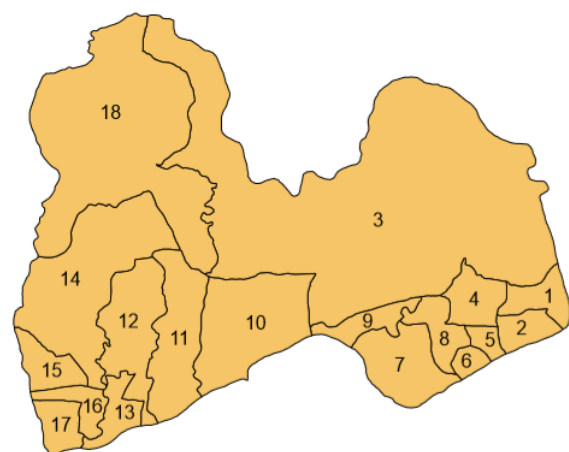


Figure 1: Gaindakot Municipality

Gaindakot municipality doesn't have native people of its own. Rather it is developed through migration because of which the caste/ethnicity seems to be a mixed one comprising of Brahmin, Chhetri, Janajatis and Dalits. Most of the people use Nepali language for communication but besides Nepali language, other languages like Newari, Tharu, Gurung, Tamang, Magar, etc. are also used. People from various caste/ethnicity and religious groups celebrate various festivals like Dashai, Tihar, Chhath, Lhosar, Teej, Buddha jayanti, Maghi, etc. Thus, Gaindakot municipality demonstrates multi culture and multi ethnicity. Similarly, there are various cultural heritages in the municipality like Maulakalika temple, Divya dham temple, Koteswor Shivalaya temple, Radhakrishna temple, Ram mandir, Ganesh temple, Harihar temple, Kalika temple, Durga temple, Boudhha gumba, Chaitya gumba, Boudhha stupa, etc. Maula kalika temple, British camp, Dhodeni and Narayani River are major tourist attraction areas in Gaindakot municipality.

4.1 Population

Since Gaindakot is developed through migration, the municipality seems to be mixed settlement ethnically comprising Brahmin, Chhetri, Janajatis and Dalits. The demographic status of municipality is shown below:

Table 1: Population Statistics

CBS	Households	Total popn.	Male popn.	Female popn.
1991	5105	28892	14148	14744
2001	8333	43060	21352	21708
2011	13623	58841	28209	30632

4.2 Existing Land use of Gaindakot Municipality

Land use consists of the percentage shares of total land area for various uses like agricultural, residential, recreational, industrial, etc. In Gaindakot municipality, the majority of land is covered by forests which is nearly 47 percentage of the total area. The forests provide great variety of trees like sal, saj, jamun, etc. and the forests provide various products and services like grass, fodder, timber, fuel wood, medicinal herbs, etc. The existing land use of Gaindakot municipality is given as below:

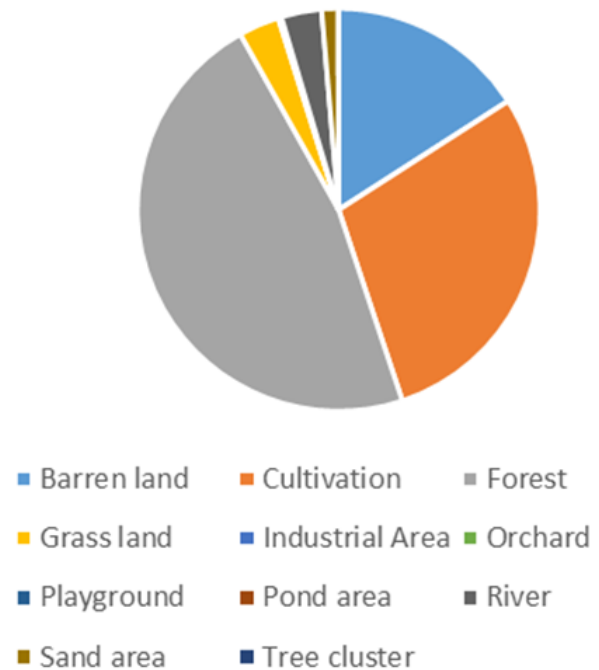


Figure 2: existing land use of Gaindakot municipality (source: draft report of IUDP Gaindakot)

4.3 Economic Condition

Since the municipality shows the characteristics of both rural and urban areas, there are various activities through rural urban linkages that generate economy. Agriculture is the main occupation of the people in Gaindakot. However, there is need of commercialization in agriculture as the prevailing system is subsistence and traditional one. The major crops produced in the municipality are rice, maize, wheat, mustard, etc. Vegetable farming, poultry, fish farming, etc. are gradually increasing and becoming an important source of income in the municipality. Besides, Gaindakot has got small and medium scale industries like textile industries, gas refilling industries, rice mill, water factory, plastic factory, block factory, chocolate factory, hatcheries, oxygen plant, cotton mill, etc. which generate employment opportunities. There are various financial organizations in the Gaindakot municipality like saving groups, co-operatives, remittance exchange firms and banks. Wage labor and service are other sources of income. Foreign employment is another main source of economy in Gaindakot now. The mobility of the people for employment ranges from different parts of India to Gulf countries, USA, Australia and various European countries as well.

4.4 Urban Development Infrastructure Indicators

4.4.1 Transportation and road network

Mahenda Highway runs through Gaindakot. Narayani Bridge is the only connector of Gaindakot with Narayangarh. Gaindakot municipality does not have an airport of its own and Bharatpur Airport is the nearest airport. For long route journey, the people of Gaindakot take vehicles from Narayangarh. Road networks have developed a lot over the past few years in Gaindakot. Nowadays, most of the roads are pitched and are of six meters width minimum. Public transportation is regularly available and large no. of people use private vehicles as well.



Figure 3: Transport Linkage

4.4.2 Water Supply

The major water supply for the Gaindakot area are Gaindakot pumping scheme water supply, situated in ward no. 4 and another is Jaluke drinking water supply, situated in ward no. 1. However, there are different sources of water like rivers (Naryaani, Jayshree), tube well, open wells, etc.

4.4.3 Education

According to CBS 2011, 80.35 percentage people are literate in Gaindakot [10]. There are several schools in the municipality, which can be government, private and community based institutions. Besides, many students go to schools in Bharatpur Metropolitan city for education. The students from Gaindakot mainly go to Bharatpur or other cities for doing graduation.

4.4.4 Health

There are few health posts, clinics and private hospitals in Gaindakot but mostly people in Gaindakot go to hospitals in Bharatpur for major treatment.

4.4.5 Drainage

The municipality has no proper sewerage system and drain facility. Due to poor drain facility, many areas of Gaindakot municipality have to face floods during rainy season. The waste products in the municipality are collected by municipality vehicle, however, there is no land fill site in the municipality. The provision of dust bin for waste collection in public areas is developing. Degradable wastes are converted into compost manure for farm lands.

4.4.6 Irrigation

Narayani River, Jay shree khola, kakarsoot khola, dhunge khola, khahare khola, hadbade khola, etc. are the water resources for irrigation in Gaindakot municipality. The municipality does not have sufficient irrigation facility. A small irrigation dam is located on the way toward Dhodeni, north of Ranital.

4.4.7 Selection of Wards

The study area of my research are the wards 1, 2, 4, 5, 6 and 8. Among the nine wards of the then existing Gaindakot VDC, ward no 3 is largely covered by forests and is far from Mahendra Highway whereas the wards for the study show major settlement growth. The land use in these wards are changing rapidly than remaining three wards of the then existing Gaindakot VDC. Thus these wards are selected for the research.



Figure 4: Satellite image 2005



Figure 5: Satellite image 2010



Figure 6: Satellite image 2015



Figure 7: Satellite image 2019

5. Development Pattern and Analysis

5.1 Socio economic profile of study area

Population: The ward wise population of the study wards according to CBS 2001 and 2011 are shown below:

Table 2: Increment in population

Ward	Total population		Increment in Total population	
	2001	2011	2001	2011
1	3405	5042	1	1.48
2	4556	7517		1.64
4	2115	3818		1.80
5	2836	5319		1.87
6	1833	2518		1.37
8	2243	3056		1.36

Occupation: The major occupation of most of the people is private service followed by business then abroad study and work. As per the survey data, the agriculture is not the main occupation in these wards.

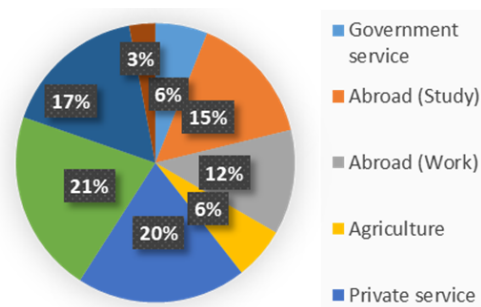


Figure 8: occupation

According to the survey data, employment opportunities are available both in Gaindakot municipality and Bharatpur Metropolitan city for the people residing in these wards. Previously, people of Gaindakot mainly were dependent on Bharatpur for job opportunities but now days since Gaindakot municipality is itself growing and developing, the economy is being generated within the municipality itself.

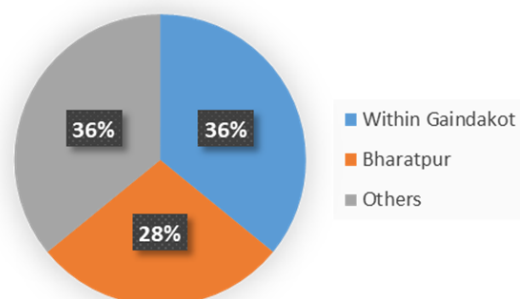


Figure 9: Work place

Education: According to survey data, the students going to schools and colleges is higher within the municipality as the schools and colleges are increasing in number and the quality is also getting better. But for undergraduate and graduate studies, people have to go either Bharatpur or other cities as there are very less colleges/campuses providing the degrees.

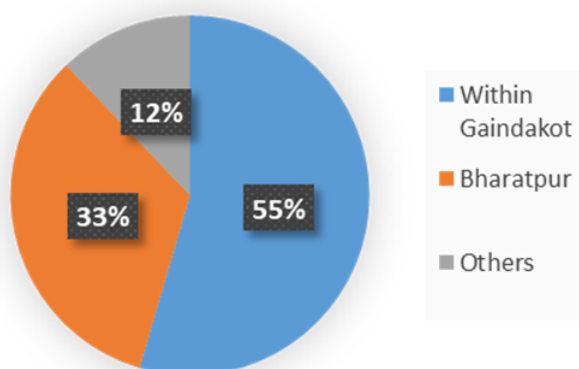


Figure 10: Educational institutions

The students going to school nearby the houses prefer to go on foot whereas for farther distance, the students mainly use private motorbike or scooter as travel mode. According to survey data, the use of public vehicle is less.

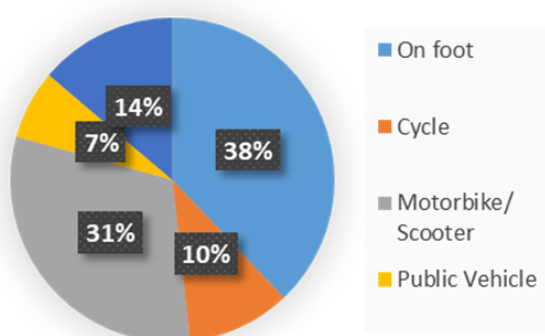


Figure 11: Travel mode

Migration: From the survey data, it is seen that most of the people migrated themselves in search of job opportunities, affordable land, easy life and other facilities. As per the survey data, most of the people (41 percentage) were migrated from Baglung, followed by Gorkha and Tanahun.

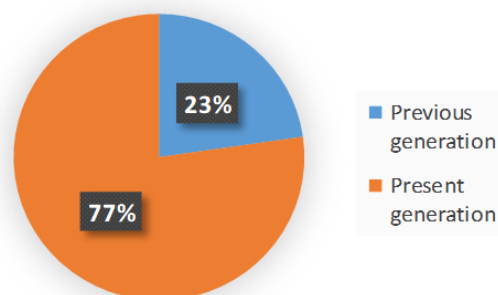


Figure 12: migrating generation

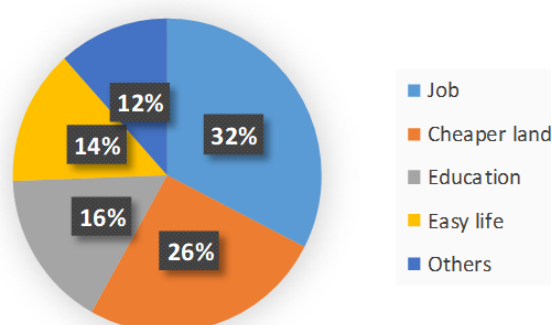


Figure 13: reasons for migration

6. Findings and Discussions

Whenever any projects or development works are done in Bharatpur Metropolitan city, it surely has at least some kinds of impacts on Gaindakot municipality as Gaindakot lies within the fringe of Bharatpur. The survey conducted in the municipality area also shows the relation between the municipality and metropolitan city. The survey shows that the migration trend started to increase in Gaindakot with the construction of Narayani Bridge which connects Gaindakot with Narayangarh. The bridge made access to the services and facilities easier in Bharatpur for the people of Gaindakot. According to the survey, the main reason for migration is employment opportunities followed by cheaper land prices despite being near to well serviced area. From the survey, it is found out that the people of Gaindakot are dependent on Bharatpur Metropolitan city for everyday use goods to employment opportunities, health facilities, higher education, shopping, entertainment purposes, etc. However the dependency of Gaindakot on Narayangarh for everyday goods is decreasing, as Gaindakot itself is growing as a city and facilities and services are being made available in the municipality

itself.

7. Conclusion

Since Gaindakot municipality is adjacent to Bharatpur Metropolitan city, separated only by Narayani River, the people of Gaindakot have easy access to all sorts of services available in the Bharatpur Municipality. Due to the accessibility of services nearby, migration is increasing in Gaindakot, settlements are growing, infrastructures are being built, development is taking place but the process is haphazard and not guided properly. If the process continues, Gaindakot municipality is very likely to face the problems in future which the fringe areas of Kathmandu are facing today. Over the years, the haphazard urbanization will directly affect the municipality contributing to degradation of declination of natural habitats such as wetlands forests, reduction of farmland and open spaces, increment in environmental pollution, etc. Thus the proper planning interventions should be made on time to ensure proper and sustainable development in the municipality.

References

- [1] Gopi Krishna Basyal and Narendra Raj Khanal. Process and characteristics of urbanization in nepal. *Contribution to Nepalese Studies*, 28(2):187–225, 2001.
- [2] José I Barredo, Marjo Kasanko, Niall McCormick, and Carlo Lavalle. Modelling dynamic spatial processes: simulation of urban future scenarios through cellular automata. *Landscape and urban planning*, 64(3):145–160, 2003.
- [3] Ross K Meentemeyer, Wenwu Tang, Monica A Dorning, John B Vogler, Nik J Cunneiffe, and Douglas A Shoemaker. Futures: multilevel simulations of emerging urban–rural landscape structure using a stochastic patch-growing algorithm. *Annals of the Association of American Geographers*, 103(4):785–807, 2013.
- [4] William E Rees. Ecological footprints and appropriated carrying capacity: what urban economics leaves out. *Environment and urbanization*, 4(2):121–130, 1992.
- [5] Douglas A Stow and Dong Mei Chen. Sensitivity of multitemporal noaa avhrr data of an urbanizing region to land-use/land-cover changes and misregistration. *Remote Sensing of Environment*, 80(2):297–307, 2002.
- [6] Suman Patra, Satiprasad Sahoo, Pulak Mishra, and Subhash Chandra Mahapatra. Impacts of urbanization on land use/cover changes and its probable implications on local climate and groundwater level. *Journal of urban management*, 7(2):70–84, 2018.
- [7] Bishnu Raj Upreti, Thomas Breu, and Yamuna Ghale. New challenges in land use in nepal: Reflections on the booming real-estate sector in chitwan and kathmandu valley. *Scottish geographical journal*, 133(1):69–82, 2017.
- [8] Adrián Guillermo Aguilar. Peri-urbanization, illegal settlements and environmental impact in mexico city. *Cities*, 25(3):133–145, 2008.
- [9] Allen L Clark. Environmental challenges to urban planning: Fringe areas, ecological footprints and climate change. In *Workshop on Key Challenges in the Process of Urbanization in Ho Chi Minh City: Governance, Socio-Economic, and Environmental Issues, Ho Chi Minh City, Vietnam*, pages 16–18, 2009.
- [10] Nepal CBS. National population and housing census 2011. *National Report*, 2012.
- [11] Richard B Andrews. Elements in the urban-fringe pattern. *The Journal of Land & Public Utility Economics*, 18(2):169–183, 1942.
- [12] I Audirac. Unsettled views about the fringe: Rural-urban or urban-rural frontiers. contested countryside: The rural urban fringe in north america. ojf a. mb lapping, 1999.
- [13] Philip Kivell. [book review] land and the city, patterns and processes of urban change. *Geography*, 78:330–331, 1993.
- [14] Hasibe Velibeyoğlu. Development trends of single family housing estates in izmir metropolitan fringe area. Master’s thesis, İzmir Institute of Technology, 2004.
- [15] Hakuyu Timothy. Unplanned urban development: spatial growth and typology of unplanned settlements, dar es salaam, tanzania. ITC, 1995.
- [16] Christopher R Bryant, LJ Russwurm, Alexander G McLellan, et al. *The city’s countryside. Land and its management in the rural-urban fringe*. Longman, 1982.
- [17] Alan A Altshuler and Jose A Gomez-Ibanez. *Regulation for revenue: The political economy of land use exactions*. Brookings Institution Press, 2000.
- [18] Basudeb Bhatta, S Saraswati, and D Bandyopadhyay. Urban sprawl measurement from remote sensing data. *Applied geography*, 30(4):731–740, 2010.
- [19] Ralph E Heimlich and William D Anderson. Development at the urban fringe and beyond: impacts on agriculture and rural land. Technical report, 2001.
- [20] TM Ruhiiga. Urbanisation in south africa: a critical review of policy, planning and practice. *African Population Studies*, 28:610–622, 2014.
- [21] Karen C Seto and Robert K Kaufmann. Modeling the drivers of urban land use change in the pearl river delta, china: integrating remote sensing with socioeconomic data. *Land Economics*, 79(1):106–121, 2003.