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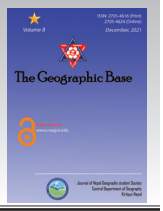

Analysis of Urban Infrastructures and Facilities in Pakhribas Municipality, Dhankuta, Nepal

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Abstract

The study presents condition of spread of urban infrastructures to over the Pakhribas municipality, Dhankuta, Nepal. Both the primary and secondary data were used for the study. Secondary data was collected from municipal profile of Pakhribas municipality and the primary data i.e. field observation, household questionnaire survey and focus group discussion were carried out for identify existing condition of the physical infrastructure, the access of the local people to the infrastructure, and the expectation of the dwellers with the municipality. Statistical analysis was preformed through arithmetic mean, population density and infrastructure development index. The result shows ward number four has the highest population density, and the people have more access to urban facilities including heath facilities and schools. The rest wards of the municipality have similar condition with its neighboring rural municipalities in terms of infrastructures and facilities. Among the total households most of them (90.45%) use pipe water for drinking. Most households (95.02%) use hydro-electricity. Most of the area of municipality

have easy access for the transportation with different status of road i. e. feeder road, district road and Highway. There have eight recreation centers within the municipality, which promoted domestic tourism in the region. The information screened through this study provided the overall infrastructure and facilities status of the municipality.

Introduction

Urbanization is a complex socio-economic process that converts rural settlements into urban settlements (Güneralp et al., 2018). In this shifting process changes occur in the occupations, lifestyle, cultural behavior; and the demographic and social structure of the area as well (Güneralp et al., 2018). Change in land use, market, physical infrastructures, employment generation in any region give a boost to the economy and then the area become urban, so the urbanization is define as the process of civilization (Roy, 2005). Urbanization is not an increase in the proportion of the urban population, but it is a continuing process which encompasses all factors underlying the process of economic growth and socio-cultural change (Pacione, 2005). Urbanization is considered as an indicator of modernization and an essential process of development. Urban area is a type of human settlement area and the densely populated area comprising manmade structures that contain all of a society's administrative, cultural, residential, and religious functions (Vision, 2015). An urban settlement engages in predominantly in secondary and tertiary activities such as food processing and banking. The term 'urban' and 'city' are used interchangeably in many cases (Subedi, 2010) and there is no widely acceptance definition of urban. Each country defines the term urban in its own way and they determine the different criteria and legal provision to declare urban. The settlement with 300 population in Island, 30000 population in Japan, 20000 population in Nederland, 25000 population in United States of America is known as urban (CDC, 2020). In the process of designing urban areas population size appears to be the single most dominant criteria to define urban area, which too often is changed in Nepal (Pradhan, 2004). The population should be 10000 in the Mountain region, 40000 in the Hilly region, 50000 in the Inner Tarai region, 75000 in the Tarai region and 100000 in Kathmandu Valley with other urban facilities to declare municipality (GoN, 2017).

Infrastructure is the main driver for urban economic growth. It includes strategic assets such as basic and utility infrastructure (transport and communications, drinking water, electricity, sewerage system, waste management, etc.), buildings, and structures necessary for the production and delivery of the goods and services (Pacione, 2005). Infrastructure is a specific substructure, or subsystem of urban structure which supports production and development of the city. It includes

the basic set of technical facilities and its management institutions, essential for an adequate economic growth and development of inhabited area stated (Wesołowska, 2016). Urban infrastructure is accepted as the driving forces for two aspects of people activities in urban i.e. livability and competitiveness for urban economic growth (Pradhan and Sharma, 2016).

Although, population, annual income, and the level of infrastructure development are the basic criteria to declare municipality, the political decision and the population criteria has been adopted in practice (Chapagain, 2018). As a result, maximum urban areas are as same as rural area in terms of their infrastructures in Nepal. After the promulgation of the Constitution in 2015, the government of Nepal formed a Local Level Restructuring Recommendation Commission (LLRC). The commission recommended the formation of 753 local government units including 6 metropolitan cities, 11 sub metropolitan cities, 276 municipalities and 460 rural municipalities (LLRC, 2018); and then Government of Nepal declared it formally. After the declaration of new municipals the urban population becomes 62.2 percent (NPC, 2020).

Among 276 municipalities of Nepal Pakhribas is one. At first Pakhribas was declared as municipality on 2nd December 2014 including the then neighbor Village Development Committees (VDC) *Pakhribas, Sanne, Falate, Ghorlikharka* and *Muga*. In 10th March 2017, *Chungwang* VDC was re-incorporated and declared as Pakhribas (Pakhribas, 2018). Condition of the urban infrastructures like road network facility, communication facility, drinking water, sanitation, and waste disposal services are still lower status in newly formed municipalities. In this context, this study investigates and analysis the existing condition of infrastructures and available facilities in the Pakhribas municipality, Dhakuta, Nepal.

Methods and Materials

Study area

Pakhribas municipality is located in hilly region and elevation ranges from 200 meter (*Muga Khola Dovan*) to 1852 meter (*Ramche Danda*) above mean sea level. It has an area of 144.29 square kilometer (Khadka et al., 2021). Different types of climate are found in this municipality, which is affected by topography. The average temperature of the municipality is 23.83 degree celsius in summer and 11.68 degree celsius in winter (Pakhribas, 2018). It is bounded in the east by *Chhathar Jorpati* rural municipality and *Dhankuta* municipality. *Bhojpur* district lies in the west, *Mahalakshmi* municipality lies in the north and *Sahidbhumi* rural municipality lies in the south of the municipality. There 10 wards in this municipality.

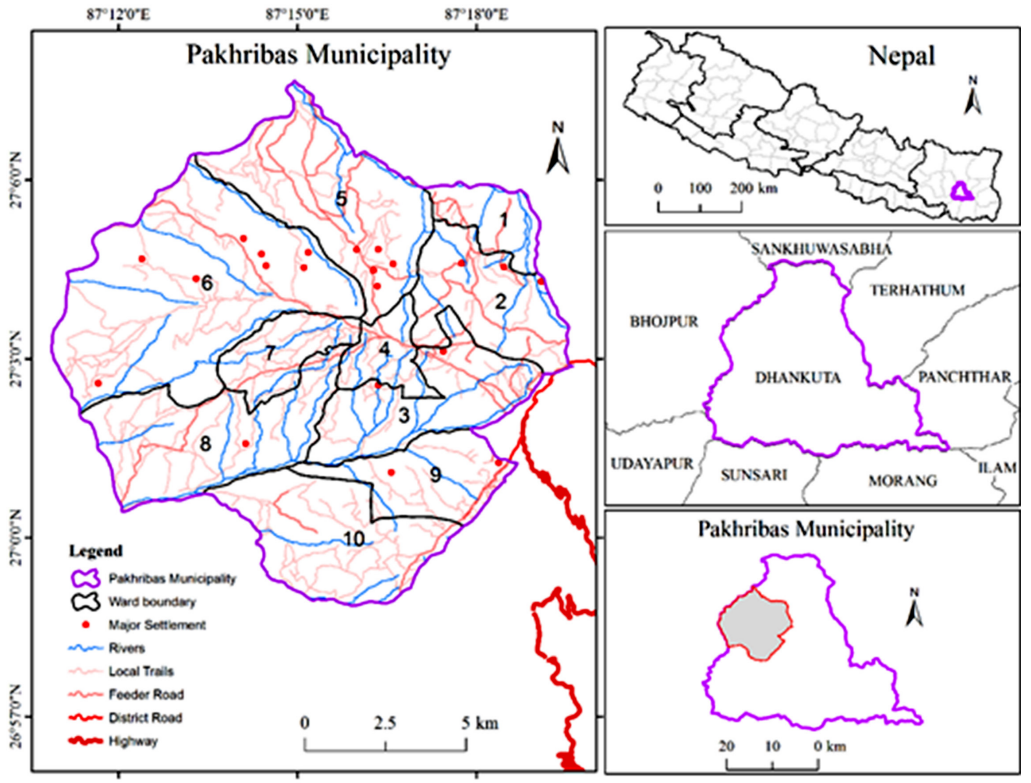

Figure 1. Location map of the study area.

Sources of data

The paper is based on the data of municipal profile of Pakhribas municipality published in 2018 and field survey was conducted in 2020. In addition, information has also been acquired from the policy, program and the budget of fiscal year 2020/021 of Pakhribas municipality. Relevant data and information have been carried out from the district transport master plan of Dhankuta, local level directing act, national population and housing census report 2011. A sample of 30 households from each ward was selected for questionnaire survey. Information on the condition of roads, drinking water, communication, parks and energy were obtained from the field observation. A focus group discussion was conducted in each ward involving the local ward residents to get information about the current condition of urban infrastructure and their expectations.

Data analysis and tools

In this study both quantitative and qualitative data and information were used. On the basis of nature of data, different ways and techniques like cause

and effects analysis, table, graph and chart have been used to analysis data. Ward wise population density has been computed by the using the equation 1.

$$PD = \frac{P}{A} \quad (1)$$

where, PD means population density of given ward, P means total numbers of population of given ward and A is the total area of same ward. The average of each facility and infrastructure user is calculated separately by using arithmetic mean.

Infrastructure Development Index (IDI) has been calculated to find out the rank of the wards according to the existing urban infrastructures and facilities. The idea of IDI calculation is carried out (Pradhan,2009). The index is built on the basis of logical expression of 0 to 1. While 0 indicates that no household has access to the particular facility or infrastructure, gradually increasing the degree according to the percentage of access to facility or infrastructure. In this degree 1 indicates that the hundred percent households have access to the facility or infrastructure. In this study, the IDI is calculated on the basis of households' access to road, drinking water, energy and communication infrastructure facilities (Table. 4). Total score is being calculated by adding of the degree of facility receivers and the score of all wards is more than one. The ward wise infrastructure development index is calculated by dividing the number of infrastructures to the total score, which is between 0 and 1.

Results and Discussion

Population of the municipality

Although this study is basically based on urban infrastructure, the existing state of population distribution in the wards has been mentioned here as peoples are the user, protector and conductor of development infrastructure in any area.

Ward number 9 has the highest and ward number 7 has the lowest number of populations. Average population density of the municipality is 130 per square kilometer (Table 1). Population density of ward number 5, 6, 8, 10 is lower than the average density of the municipality and rests of them are higher. Ward number 4 is the main administrative center of the municipality; where all services and facilities are available (Figure 2). Population density of the municipality is the least among all seven local levels of the Dhankuta district (Linkha, 2018); where overall population density of the district is 183 people per square kilometer (CBS, 2011).

Transportation

Transport is known as the infrastructure of the infrastructures; it is the main agent for the rapid economic growth of the nation (Pokhrel & Acharya, 2015). There is a close relation between increment of transportation (roads and vehicles) and socio-economic development of the nation however (Bhagat, 2017). Pakhribas municipality gives more priority to road sector development.

Table 1. Ward wise area and population distribution

Ward no.	No. of household	Population			Area (in square KM)	Population density (In per KM square)
		Male	Female	Total		
1	279	605	570	1175	5.1	230
2	513	1033	1177	2210	12.31	178
3	460	877	955	1832	13.56	135
4	395	825	897	1722	4.65	370
5	537	1060	1117	2177	20.48	106
6	493	1017	1075	2092	37.01	57
7	260	497	586	1083	6.38	170
8	539	1116	1154	2270	18.31	124
9	507	1171	1208	2379	9.6	248
10	415	881	882	1763	16.89	104
Total	4398	9082	9621	18703	144.29	130

Source: Municipal profile (Pakhribas, 2018).

However, majority of the people have no access to the standard blacktop and gravel roads till now. As ward no. 4 is also the center of the municipality, educational and business center; there is already a short distance blacktop road inside the market. There is 1 kilometers long blacktop road from *Singh Devi Chowk* to the Pakhribas Agricultural Center in ward no. 3. Since the establishment of the Agriculture Center, settlements have been developed on both sides of the road. As a result, many households have direct access to blacktop roads in these two wards (Figure 3.).

Hile-Pakhribas-Leguwaghat road (26 KM); which is a part of the Mid Hill (*Pushpa Lal*) Highway crosses the Pakhribas municipality from ward number three, four and five. Now this road is going to be completed as black topped road. Other major roads of the municipality are *Pakhribas-Sanne-Hatikharka-Jitpur-Marek kathare-Dandagaun* road (35 KM), *Pakhribas-Muga-Raighat* road (20 KM), *Pakhribas-Phalate-Aandherighat* road (15 KM). Those roads are graveled 7 KM, 5 KM and 4 KM respectively and rest of the length is unripe (DDC, 2013). These three roads cover ward number 1, 2, 7, 8 and 6. Ward number 9 and 10 are far from municipal centre, Pakhribas bazaar and *Hile-Uttarpani-Marga-Chungwang* road connected these wards (Figure 4.).

In annual policy, program and budget 2020/021, Pakhribas municipality gives most priority to the road infrastructure and it has adopted policy to preparation of Municipal Transport Plan (MTP) for systematic construction of road works in urban areas. The policy of allocating budget on the basis of the priority of the project will be finalized in the coming fiscal year (Pakhribas, 2020).

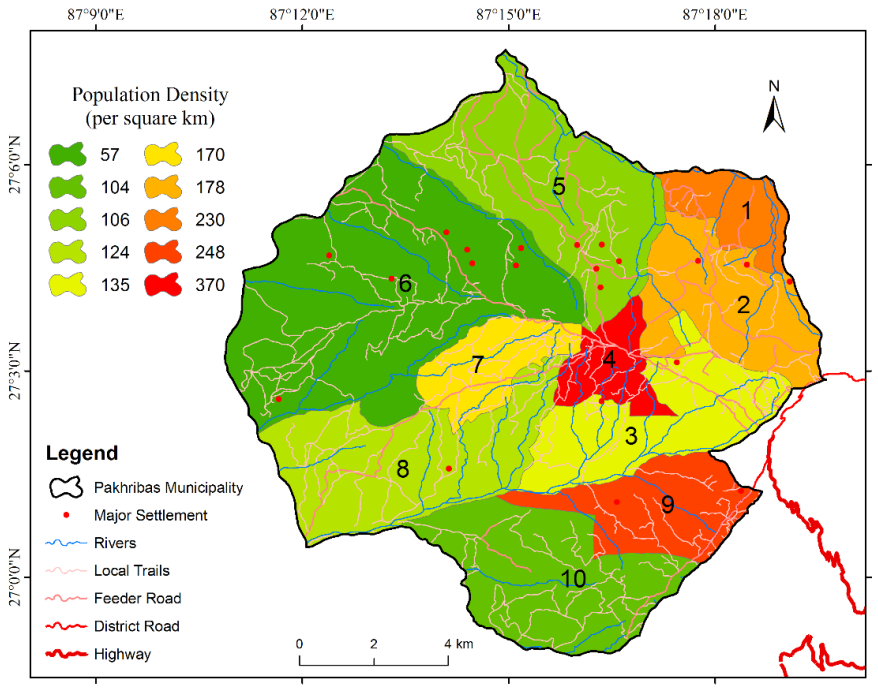

Figure 2. Population density map of the Pakhribas municipality.

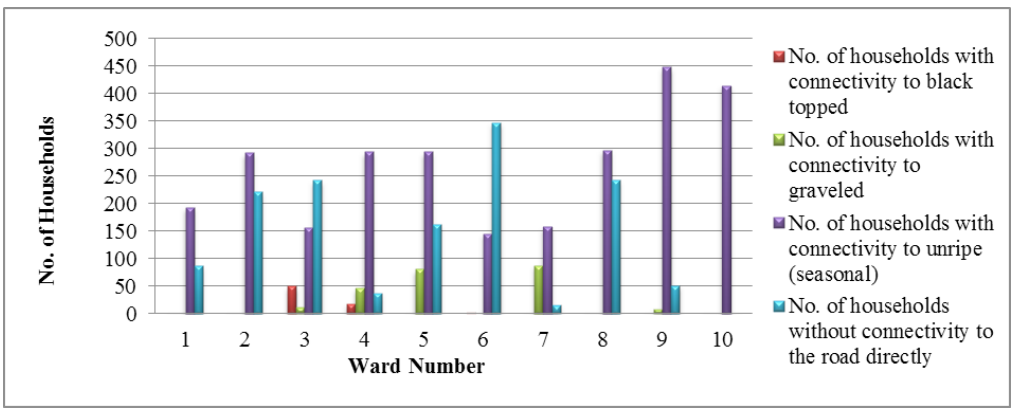

Figure 3. Direct road connectivity access to the households

In policy, program and the budget of fiscal year 2020/021, the municipality declared Pakhribas bazaar road upgrade project as the "municipality glory project" and allocated 8 million rupees budgets to the project. Ward wise total 44.4 million 79 thousand rupees budget is allocated; and the largest percent (41.39%) is to the road sector.

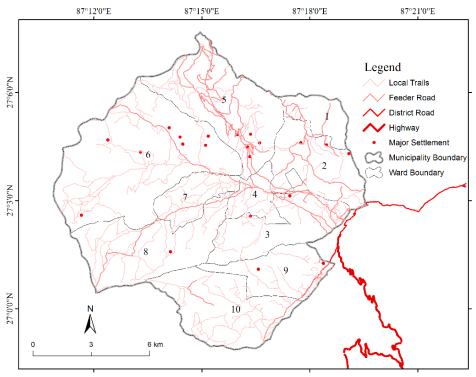

Figure 4. Spatial distribution of the road network in Pakhribas municipality

Even though so much investment has been made by giving priority to roads, unfortunately the condition of the roads is not satisfactory. Like Pakhribas municipality, Chhathar Jorpati rural municipality pays the attention and give more priority to physical infrastructure especially in road construction to its governing area. In this scenario Linkha et al. (2020) on their study has shown that the federal governments of Nepal have given high priority to the construction of roads to link to each ward of the Gaunpalikas (Rural Municipalities) or Nagarpalikas (Municipalities).

Drinking water

Water resource infrastructure is needed for water distribution from its source to the users. This infrastructure physically can be artificial facilities such as distribution channels, floodgate, dams, etc., or natural facilities such as lakes, rivers, waterfalls and springs (Taufik et al., 2019). Now, government and different nongovernmental organizations took initiation and have been working together for increasing accessibility of drinking water (Adhikari, 2017). As there is no possibility of ground water here due to the hilly terrain, drinking water is being distributed with surface water as the main source in Pakhribas. As there are more water sources in rural areas than in the market, drinking water is being supplied from those locally available sources in those areas, while the problem of drinking water is seen in the market area located in ward number 4. Therefore, almost all the households seem to have consumed piped drinking water in this ward (Table 2.).

The highest number of households in the municipality (90.45%) consumes pipe water; second highest number (8.40%) of households consumes well water. In this municipality 35 households are consuming river water. Comparatively, condition of ward number 2 and 4 is better than other ward in respect to the access of drinking water. The condition of access to drinking water in Pakhribas seems to be slightly better compared to the national level. In Nepal, 88 percent households have access to safe drinking water (CBS, 2011).

Sources of energy

Energy helps to improve the socioeconomic development and well-being of societies; therefore, it is known as one of the most important inputs for modern economic development of the society. (Pokhrel & Rijal, 2021).

Table 2. Sources of drinking water to the households

Ward no.	Sources of water and the consuming households					
	Piped	Tube well/ Hand pump	Well	River / Stream	Other	Total
1	242	0	36	1	0	279
2	509	0	3	0	1	513
3	417	0	40	0	3	460
4	394	0	1	0	0	395
5	476	0	61	0	0	537
6	446	0	35	7	5	493
7	205	1	50	4	0	260
8	474	0	47	16	2	539
9	416	1	80	7	3	507
10	399	0	16	0	0	415
Total no	3979	2	369	35	14	4398
Percentage	90.45	0.04	8.40	0.80	0.31	100

Source: Municipal profile (Pakhribas, 2018).

Energy is the driving force behind almost everything we do (World Bank, 2019). The majority of households in Pakhribas municipality use hydro power for lighting (Figure. 5).

About 95.02 percent of the households in the municipality have access to hydroelectricity, which is less than the national average in the urban and more than in the rural. According to the Asian Development Bank (ADB, 2017), about 97% of the urban population and about 72% of the rural population has access to electricity in Nepal. In terms of access to hydropower as sources of energy, ward number 10 is at the forefront with 100% access while ward number 8 is weak. There, only 86.82 percent of the total households have access to hydropower in ward number 8. Very few people seem to use solar power in this municipality. Other sources of energy here include traditional energy sources like firewood and animal dung. According to the ward-wise data, most of the households in ward number 6 (16 households) use this firewood and animal dung.

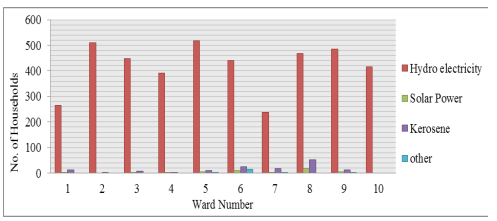

Figure 5. Ward wise households with energy for lighting

Communication

There is a post office and a local FM radio station in Pakhribas municipality ward number 4. Here, through the repeater towers of Nepal Telecom and Ncell, the mobile phone network can be accessed all

over the municipal area. Although internet service of various service providers has reached to all the ward offices, they have not been able to reach door to door. This facility is relatively better in wards 3 and 4.

A sample survey of 300 households in the municipality found that the majority of households (94.33%) have mobile phones, while the lowest number of households (10.33%) has internet facility (Table 3.). According to the survey, on the basis of communication facilities including mobile phone, television, computer, internet and radio, there are only 13 households with all these facilities. Comparing the access of the residents of this municipality to radio (85.66%) is less than the national average (87%) and access to television (84.33%) is more than the national average (82%) of Nepal (GoN, 2021). The number of households of access to the mobile phone is also higher in this municipality (89.33%) than national average (82%).

Table 3. Households according to the access of communication facility

Ward number	Communication facilities and using households					
	Mobile phone	Computer	Television	Internet	Radio	All facilities
1	27	5	23	1	28	1
2	28	6	22	2	26	1
3	28	7	27	11	24	4
4	30	9	28	13	22	5
5	26	5	22	1	26	0
6	26	6	27	0	24	0
7	27	5	26	0	29	0
8	25	6	22	0	28	0
9	25	8	27	2	26	2
10	26	7	29	0	24	0
Total number	268	64	253	31	257	13

Source: Field survey, 2020

Infrastructure development index

The infrastructure development index has been calculated on the basis of the data on the access of households to road, drinking water, energy and communication facilities (Table 4.). Households with any one or more than one type of road access are used to calculate this index. Only households that use hydroelectricity and solar energy as sources of energy are included. Similarly, only households using piped water have been included in the drinking water. Households with all the facilities like mobile phones, television, internet, radio and computer are included to the communication facility. Ward

wise weighted of road, drinking water, energy and communication facilities is calculated by the dividing the facilities user households by total number of households of same ward. Ward wise total score is calculated by adding the four types of facilities.

According to the infrastructure development index, ward number 10 is at the forefront and ward number 6 is at the back. All households of number 10 have access to energy and roads. So, this ward has got full score to both indicators. So, this ward is at the forefront due to these two indicators.

Table 4. Ward wise infrastructure development index

Ward no.	Weighted of facility types and user households				Total score	Infrastructure development index
	Road	Drinking water	Energy	Communication		
1	0.69	0.86	0.95	0.003	2.50	0.62
2	0.56	0.99	0.99	0.001	2.54	0.63
3	0.47	0.90	0.98	0.008	2.35	0.58
4	0.90	0.99	0.99	0.012	2.89	0.72
5	0.69	0.88	0.97	0.000	2.55	0.63
6	0.29	0.90	0.91	0.000	2.11	0.52
7	0.94	0.78	0.92	0.000	2.65	0.66
8	0.55	0.87	0.90	0.000	2.33	0.58
9	0.89	0.82	0.96	0.003	2.67	0.66
10	1.00	0.96	1.00	0.000	2.96	0.74

Source: Calculation based on data of (table 2. and 3.) and (figure 2. and 3.)

Health facility

A basic municipal hospital has come into operation since 2021 A.D in Pakhribas municipality ward no. 4. There are health posts in 6 out of 10 wards. There are basic health service centers in rest of the wards (Figure 6). There are five private sectors' pharmacies and clinics in Pakhribas market center. One clinic provides MBBS doctor's service to patients. As mentioned in the budget to be run by the municipality from its own resources and received from the financial equalization grant of the province government and the federal government, 0.82 million rupees has allocated for health service (Pakhribas, 2020).

Educational facility

Some schools and colleges are running in Pakhribas municipality. Those institutions provide both general and technical education for the students. There is more than one basic school in all the wards.

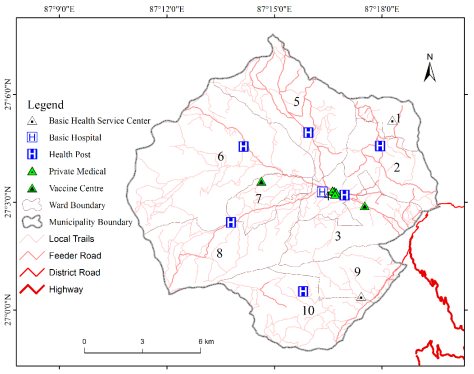

Figure 6. Spatial distribution of the health services in the municipality

In ward number 5, there are two secondary schools and rest of the wards has one secondary school in each ward. There are two institutional basic level schools in ward number 4, one and one secondary level school in ward number 3 and 9 (Figure 7.). A community secondary school in ward number 4 has been conducting technical educational programs for overseers and sub-overseers. In ward number 4, there is a community college, affiliated from Tribhuvan University is in operation. It provides bachelor's in education. There is a Natural Resource Management College in ward number 3, which is affiliated with University of Agriculture and Forestry. It has a bachelor's degree in agriculture science. In comparison, the educational facilities in wards 3 and 4 are in good condition than other wards. The municipality has been allocated total 1.42 million rupees budgets received from the province financial equalization grant and federal financial equalization grant in wards number 4, 5, 6, 7 and 8 for the physical improvement of the education facility (Pakhribas, 2020).

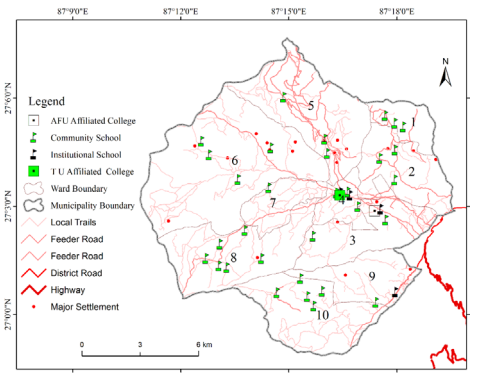

Figure 7. Spatial distribution of the educational institutions in the municipality

Waste management

Solid waste is unwanted by-products of consumer; also refers as garbage. This includes both perishable and non-perishable wastes. It has observed that the municipality collects and manages the waste from the market area of ward number 3, 4 and 5 to the landfill site, while the waste management of other areas is being done by the locals themselves (Table 5.). Out of the 300 surveyed households, waste of only 9.33 percent households managed by municipality and the rest of the households do it themselves. It is seen that 52 percent of the households make compost from decomposable waste and separate non-decomposable waste and dump it in unused open space. In the rural areas of this municipality, especially plastic waste seems to be rampant.

Table 5. Ward wise solid waste management status

Ward no.	Households with different ways of solid waste management				
	Manage by municipality	Make compost	Throw every where	Burn	Total
1	0	17	4	9	30
2	0	16	3	11	30
3	11	14	4	1	30
4	15	9	0	6	30
5	2	15	4	9	30
6	0	21	9	0	30
7	0	14	9	7	30
8	0	13	9	8	30
9	0	17	13	0	30
10	0	20	9	1	30
Total number	28	156	64	52	300
Percent	9.33	52.00	21.33	17.34	100

Source: Field survey, 2020

Open space, picnic spots and recreation centers

Some recreation centers, parks and picnic spots have already been developed. Although there are beautiful natural sites in all the wards, some well-organized parks and recreational sites are mentioned here (Figure 8.). In some of these sites, people visit not only from within the municipality but also from outside the municipality and district as well.

Among all recreation centers *Sansari mai tal-talaiya* picnic spot and park is well managed sites. It is located in near the Pakhribas market center. The lake, tea garden, the idol of Lord Buddha, Shiva and Hanuman provide entertainment. There is also the facility of boating on the lake and touring the entire area on horseback.

Table 6. Major picnic spots and recreation centers

Spot's name	Area (in hectare)	Ownership	Situated ward
Jalapa Devi park	0.03	Community	1
Jautar picnic spot	0.76	Community	2
Tham danda picnic spot	0.76	Community	2
Talukharka picnic spot	2.00	Community	2
Sansari mai tal-talaiya picnic spot and park	1.53	Community	4
Shanti park	0.36	Community	5
Ramche danda picnic spot	2.54	Community	6
Saleri ban picnic spot	1.27	Community	10

Source: Municipal profile (Pakhribas, 2018), and field survey, 2020.

A view tower is in *Ramche danda* picnic spot. The area is well known as sightseeing and picnic spot. The most famous picnic spot is *Jautar,* which is lies in the middle part of Pakhribas market and Hile (Figure 8.).

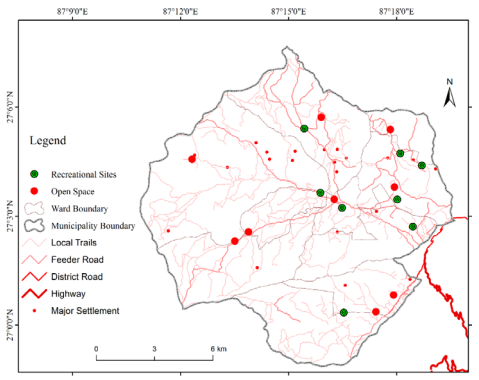

Figure 8. Spatial distribution of the recreational sites and open space in the municipality.

Conclusion

Urbanization is a complex socio-economic process that converts rural settlements into urban. After the proclamation of Nepal's constitution in 2015, the number of municipalities has increased and the urban population has reached 62.2 percent. In 2017, Pakhribas is declared as municipality. In total there are 10 wards; and ward number 6 is the largest and ward number 4 is the smallest in terms of occupied area. Ward number 4 has the highest population density and it is the main center of the municipality, so all services and facilities are available here. A small part of the Mid Hill (*Pushpa Lal*) highway crosses the Pakhribas municipality from ward number three, four and five. Connecting roads to other wards of the municipality except wards 9 and 10 have been constructed from this highway. Of the total 90.45 percent households use piped drinking water. In ward number 10 all the household has access to the hydroelectricity and ward number 6 is the lowest in terms of access to the hydroelectricity. Radio, television and mobile phone are common means of communication facility. People of ward number 3 and 4 have access to internet facility too. There are schools in each ward and colleges in wards 3 and 4. Ward number 4 is far ahead in health care facilities. Although there are beautiful natural sites in all the wards, well-organized parks, picnic spots and recreational sites are in ward number 2, 4 and 6. From the point of view of urban infrastructure and facilities, ward number 4 is at the forefront compared to other wards.

Acknowledgement

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