CHAPTER 4:

FACTORS AFFECTING RURAL-URBAN INTERACTION AND DELINEATION OF ZONES OF INTERACTION

4.1 Introduction

Interaction between rural and urban areas is an important aspect of urbanization. It is expected that urbanization and urban growth will have an impact on rural areas, and that rural activities will have an impact on nearby towns and cities. The literature on social science has frequently exaggerated contrasts and dichotomies between rural and urban social organisations and ways of life. More people live in cities than ever before. Nearly 7 out of 10 people in the world will live in cities by 2050. (World Bank, 2019). Urbanization rates in developing nation like India is substantially lower than the global average. This does not imply that urban development should be the only focus of attention. If rural development is not given its proper attention, there will still be no solution to the problem of assuring food security. In accordance with this, policymakers should prioritise achieving urban development viz-a-viz rural development in light of the continued, astronomical rates of urban population increase and physical expansion.

It is misleading to view urban and rural areas as distinct spheres as both areas are interconnected, and the growth of one area depends on the growth of the other. Urbanization brings about broader changes that benefit the entire population, including those living in rural areas. On the other hand, urban areas in addition to rural areas gain from rural development. The rural-urban connectivity is particularly important in the context of urban development, especially the linkage is essential for urban development. Urban poverty, lack of available space, rising food prices and inadequate safe drinking water supply are some of the issues that urban areas are currently dealing with as a result of the increasing rate of urbanization. In this situation, a strong rural-urban connection has a greater chance of minimizing these problems associated with urban areas. A rural-urban relationship is frequently seen as being more crucial for rural development, poverty reduction, and transformation (Akkoyunlu, 2015; Mayer et al., 2016; Tacoli and Vorley, 2015). Rural-urban linkages' crucial influence on urban growth is frequently disregarded, while rural ecosystems' contributions to urban development are underappreciated.

Various people have delineated the zones of rural-urban interaction by using a number of parameters. Wehrwein (1942) has used population density around the city of Indianapolis

for delineating the zones of rural-urban interaction. On the other hand, Blizzard & Anderson (1952) have used agricultural landuse characteristics and city utility services to delineate the zones of rural urban interaction. Pryor (1969) working on the same topic used utility services from the urban centre to delineate the zones of interaction. Preston (1975) took the help of movement of people, goods, capital, social transaction, administrative and service provision to carve out the zones of rural-urban interaction. Nengroo, Kuchay & Bhat (2012) in their study on Srinagar city has used distance from the outer boundary of the city to delineate various zones of rural-urban interaction. Zlender (2021) used weighted overlay method combining a number of indicators to delineate the zones of interaction between the rural and urban areas. Atharinafi & Wijaya (2021) used a combination of socio-economic, demographic and landcover data to delineate the zones of interaction between the rural and urban areas. Therefore, it is to be noted here that the methods to delineate the zones of rural-urban interaction is diverse. However, one of the easiest and commonly used parameter to delinate the zones are on the basis of distance. In this study based on distance the zones of rural-urban interaction has be formulated.

It is nearly universally acknowledged that urban and rural communities cannot coexist without being mutually dependent on one another. Government and associated organizations must endeavour to maintain and safeguard rural ecosystem services as well as construct infrastructure to transport rural goods to urban markets in order to improve rural-urban links. For the social and economic growth of both rural and urban communities, interaction between urban and rural areas is crucial. Instead of focusing on urban and rural areas individually, it would be important to consider how they interact. Rural-urban linkages can be viewed from two angles: sectoral linkages that connect agriculture, manufacturing industries, and services, and spatial linkages that connect people, goods, money, and information (IIED, 2018). Interactions between rural and urban areas can also include rural activities occurring in urban centres and urban activities occurring in rural areas. Urban food systems, ecological linkages that include ecosystem services, socio-economic linkages that include more direct supply chains, and governance linkages that integrate urban and rural governance structures in a democratic and participatory manner are additional perspectives on rural-urban linkage (Jennings et al., 2015). Services that directly deliver necessities like food, water, timber, and fibres like wool and cotton from the ecosystem are known as provisioning services. The majority of urban and rural regions rely on these services. Urban areas receive ecosystem services from rural areas such as food, water, energy, raw materials, and others.

4.2 Factors affecting rural-urban interaction

Rural-urban interaction and their linkages are governed by a number of factors. Some of which are economic in nature, some are social and others are related to infrastructure. In this section a systematic analysis has been made to understand how each of these factors govern and control the rural-urban interaction and linkages in general.

4.2.1 Population size

The number of people living within a geographical area is usually known as the population size. According to the 2011 census of India, about 70% of the population in the country resides in rural areas, where the population growth rate overall has significantly decreased. According to the Census of India 2011 Provisional Population Totals of Rural-Urban Distribution in the country, 83.3 crore of the 121 crore people in India reside in rural areas, while 37.7 crore are located in urban areas. While the percentage of people living in rural areas decreased from 72.19 to 68.84 percent, the level of urbanization rose from 27.81 percent in the 2001 census to 31.16 percent in the 2011 census. Around 68.13 percent of West Bengal's total population resides in rural areas. In fact, the total population in the rural areas of West Bengal was 62,183,113 in 2011 where as 29,134,060 people were estimated to live in urban areas. In 2011, within Siliguri sub-division of Darjeeling district, 55.11 percent of the total populations lives in rural areas with a population of 535221. On the other hand, the urban population of the sub-division is 435899 which is 44.89 percent of the total population. To meet their needs for food, water, wood, raw materials, and other items that are essentially the by-products of rural ecosystem services, the urban population depends on rural areas. However, it is important to recognise the advantages that urban areas brings to rural population, including access to markets, farm inputs, job possibilities, etc. In this respect it is pertinent to say that a larger population size will also result in a greater rural-urban interaction. This is because, more the number of people living in rural areas higher will be their need to visit the nearby urban centre in search of employment, education, facilities and services which are not available in the country side. On the other hand, a larger urban population base means higher demand for agricultural products, fresh fruits, vegetables, dairy products etc. which is usually supplied from the surrounding countryside resulting in a higher rural-urban interaction because the rural people, who are the producers of these goods bring them in the urban market for the purpose of selling their primary products.

Siliguri sub-division, in the recent years has been experiencing a continuous decrease in the share of rural population on one hand and continuous increase in the share of urban

population on the other. It is to be noted that the marked decrease in rural population in the study area is the result of conversion of rural settlements to census towns. The villages which were converted to census towns are usually large one with huge population size. According to the census report for 1991 and 2001, the total number of census town in the study area was two; however, the number increased to fourteen in 2011 census indicating a sharp increase in urban population and a resultant decrease in the rural population. However, in absolute terms the rural population in Siliguri sub division also shows a positive change in 2011 compared to 1991. Consequently, with increase in the population size with each census year, the rural-urban interaction is also bound to increase within Siliguri sub division.

4.2.2 Transport and communication

Roads are the key component of rural-urban interaction. Rural roads make a substantial contribution by establishing connections, so expanding the accessibility of goods and services available in neighbouring villages or significant towns and markets. This means that by providing better transportation options, rural roads can help rural producers gain greater access to market hubs and assure better availability of inputs and raw materials at lower rates, both of which can have a significant impact on the economic potential of the rural poor. Simply defined, rural producers can earn a solid income and significantly enhance their revenue if they have the ability to go to market places to sell their goods or purchase raw materials to improve production. As improved non-agriculture revenue prospects result from road development, changes in income sources may also be the result. As more people may move freely from one location to another, increased connection through better roads in rural areas can also improve off-farm work options. Those who can relocate out of their villages to the nearby employment centres and make more money in particular are women, labourers, and small contractors. Access to education services for the people living in rural areas can be improved through better road connectivity. They can travel to nearby towns and cities to pursue higher and technical education, which will increase their access to better job prospects. Rural impoverished people can improve their family's standard of living in this way. The development and improvement of rural roads has a socio-economic advantage in that it can raise rural residents' asset values, facilitating trade and commerce opportunities.

Any activity or vehicle that transports people and/or products from one location to another is referred to as transportation. Buses, trains, trucks, cars, bicycles, motor cycles, boats and other motorised vehicles are important modes of transportation for connecting rural areas with urban areas. Transportation systems can be managed by both private and public entities,

and this management may entail infrastructure upkeep and modernization to ensure system efficiency. Roads, bridges, bus stops, train lines, sidewalks, and ferry terminals are examples of transportation infrastructure.

The elements that affect a community's quality of life and its ability to be inhabited are strongly influenced by its transportation system. Access to food, healthcare, educational opportunities and jobs are all made possible by transportation. Furthermore, having access to transportation makes it easier for rural dwellers to participate in leisure, entertainment, and other activities that foster community involvement. In rural areas, efficient and economical transportation is a key factor in economic growth and ensures that residents can access services and participate in society. In the context of rural-urban linkage, transportation plays the most important role in determining the volume of interaction between an urban centre and its surrounding rural areas. Quick, easy and cheap transportation acts as a positive factor towards developing a strong rural-urban linkage in any geographical area.

In terms of transport and communication facilities the study area has a decent network of roadways as well as railways. In Siliguri city itself there are two major railway stations Siliguri junction and Siliguri town along with many minor railway station like Matigara, Bagdogra, and Naxalbari within Siliguri sub-division. The NJP railway station although, located outside the study area is an important railway junction under North Eastern Frontier Railway, which mostly serves the people of Siliguri Municipal Corporation and Siliguri sub division. The study area is also run by different highways namely the Asian Highway 2, National High ways 31, 31A, 55, along with one State Highway which is State Highway 12. These highways allow for easy transportation of people as well goods from one place to another within the study area. It is to be noted that the court more area in Siliguri town acts as nodal point from where bus services to different routes/areas within Siliguri sub-division are available. One can find bus routes like Siliguri-Bagdogra, Siliguri-Naxalbari, Siliguri-Kharibari, Siliguri-Chathat and Siliguri-Bidhannagar at court more bus stand. Buses are available in all these routes at a frequency of 20 minutes from 6 A.M. in the morning to 9.30 P.M. in the night. Along with bus services, auto service is also readily available from court more as it is the last stoppages for majority of the auto and makes for a convenient and cheap mode of transport facility for covering short distances within the study area. Some of the routes with very high frequency of auto services are Siliguri-Matigara, Siliguri-Medical, Siliguri-Khaprail, Siliguri-Bagdogra, Siliguri-Sukhna Siliguri-Milanmore, Medical-Phansidewa, Medical-Naxalbari etc.

Rural areas' economic growth, health, and quality of life are all influenced by access to transportation. Rural residents require dependable transportation in order to access social services, employment possibilities, consumer services, healthcare services and educational and training opportunities from urban areas. Accessing recreation and other daily activities also require access to transportation. The importance of transportation for the above mentioned activities are as follows:

a. **To access health care services**: The health and wellbeing of rural inhabitants are impacted by their access to safe and dependable transportation. In rural areas where walking or cycling may not be practical alternatives to reach a healthcare practitioner, transportation is essential for access to healthcare services from nearby urban areas. To meet their healthcare needs, rural residents rely on their own automobiles, public transportation, and non-emergency medical transport. The residents of rural communities might not be able to obtain essential services if certain modes of transportation are not available, because some are prohibitively expensive, or are difficult to access. Inability to go for medical appointments, delay in receiving treatment, and failure to take necessary drugs on time can have an adverse impact on the management of medical diseases. The ability to access dependable transportation can affect how people in remote communities choose their healthcare providers. Long distance travel can be harmful to their health even when they have access to transportation.

As far as the health care and medical facilities are concerned, the entire sub-division is served by one medical college which is North Bengal Medical College located at Sushrutanagar in Matigara block. Besides the medical college, Siliguri Distict Hospital, Matigara State General Hospital, Bagdogra State General Hospital, Naxalbari State General Hospital are some of the public health care centres/facilities available in the study area. It is to be noted that the North Bengal Medical College is the only medical college not just in Siliguri sub-division but in the entire district. In addition to these public health care institutions, important private health care facilities in the study area are Neotia Getwel (located in Matigara Block), Dr. Chang's Super Speciality Hospital (located in Matigara Block), Medica North Bengal (located in Siliguri Municipal Corporation), Anandaloke Hospital (located in Siliguri Municipal Corporation), Desun Hospital (located in Matigara Block), Paramount Hospital (located in Siliguri Municipal Corporation) etc. Thus prevalence of well-connected network of roadways and transportation system in the study area facilitates easy, budget friendly and safe movement of people for health and medical purposes which ultimately results in increased rural-urban interaction

b. **To access employment and educational opportunities**: In remote areas, using transportation services for commuting to work in urban areas is crucial. A dependable mode of transportation to a place of employment is essential for many rural residents to maintain their economic security. Longer travel times and a lack of transportation choices are frequent impediments to work in towns for certain rural residents. Due to long travel times and low population densities, existing transportation support services in rural areas may be more expensive per user than those in metropolitan areas. Increasing a community's access to education enhances both its liveability as well as economic competitiveness. For access to education at all levels, there is a critical need for transportation to and from schools in remote areas. Children in rural areas travel longer distances to get to schools, colleges and universities of urban areas which increases their travel time.

Siliguri, being one of the most important and the biggest urban centres for trade and commerce cater to a wide variety of job seekers throughout the study area. In this context small scale industries established in and around Siliguri Municipal Corporation which provide employment opportunities to surrounding rural population. The establishment of a number of shopping malls in the recent past along with the ones that are yet to come in and around Siliguri has successfully increased employment opportunity not only for urban population but for rural also. With efficient transport facility there will be a rise in the rural population seeking job opportunities in the urban area and in and around Siliguri Municipal Corporation, thereby increasing the incidence of daily commuting which further accentuates the rural-urban interaction. With regards the educational institutes, Siliguri Municipal Corporation has four General Degree Colleges, one Polytechnic College along with different private educational institute whereas Matigara block having one University, one Medical College, two General Degree College, Naxalbari block having two General Degree College and Phasidewa block having one General Degree College. The study area is also marked by a number of private college and schools which also attracts students from the surrounding rural areas. The presence of a number of governmental and private educational institutes throughout the study area result is increased frequency in the movement of students from one corner of the sub-division to another which calls for a robust transportation facility in the study area which can give the students easy, safe and budget friendly mode of transport.

c. **To access community activities**: Access to social services and consumer requirements may be hindered for rural residents due to a lack of transportation choices (such as running errands or shopping). Transportation may be necessary more in rural areas to ensure civic participation and other forms of involvement in community life. Due to a lack of polling locations and

transportation choices, voting in elections can be difficult for residents of remotely located communities. Furthermore, communication and digital technologies have accelerated urbanization as a result of the emergence of big metropolitan centres as hubs for knowledge-intensive sectors that offer well-paying, innovative jobs. Because of this employment, educated workers have been drawn to the big cities, causing knowledge to spread and widening the divide between prosperous urban areas and rural ones.

During post-independent era, Dinabandhu Manch and Mitra Sammilani located within Siliguri Municipal Corporation emerged as two of the most prominent cultural hotspots in Siliguri sub-division. However, with changing times new places emerged as cultural hotspots. In the recent times, increasing number of shopping centres in and around Siliguri city has resulted in a shift in local culture with these centres becoming the major centres for cultural exchange among people. These shopping centres have gradually become one stop solution not just for shopping, but also for other recreational activities. Also the presence of multiplexes in these centres attract people not just from urban area but from rural areas as well which further exposes the rural population to city cultural and urban way of life which add yet another dimension to rural-urban interaction.

4.2.3 Number and size of settlements

Number and size of settlement plays a significant role in rural-urban interaction, because it acts as a market town, mining town, service centre and administrative centre of any region. Urban and rural settlements interact because they are interdependent. They rely on each other for their continuous existence for instance. Urban settlements are particularly dependent on rural settlements for provision of food and unskilled labour supply. Apart from these, on one hand rural settlement always provide market for industrial goods and on the other hand raw materials for manufacturing industries located in the urban areas. Rural settlement is also depending on urban settlement for manufactured goods, market facilities, employment and medical services. Household goods like soap, shampoo, sugar etc. usually come from urban to rural areas. Urban settlements also act as markets for agricultural products from rural settlement. Employment in offices and industries, provision of medical services with specialized hospitals in urban areas attracts people from rural areas. For effective governance, rural areas rely on the urban areas as most of the administrative headquarters are located in urban areas. However, there are certain problems which may limit the interdependence of both rural and urban settlements. Large settlements have more than one function but relatively small settlements have less diversified functions which might affect the reciprocal relation between rural and urban. From the standpoint of rural-urban interaction, obviously higher the number

of rural settlements and bigger the size of the settlements, the interaction will also increase accordingly.

However, an increase in the number of settlements leads to changes in land use around urban centres from agricultural land to residential land which might change the dynamics of rural-urban interaction. Uncontrolled urban growth can pose a major threat to farm land and speculative purchases can also withdraw agricultural land from food production. Within the study area there were 335 inhabited rural settlements in 1991, which marginally decreased to 329 in 2001 and 313 in 2011. The size of these rural settlements vary in terms of their population. Out of these total number of inhabit village in the study area, 136 in 1991, 164 in 2001 and 170 in 2011 recorded a population size above one thousand. Therefore, there is a steady increase in the number of villages with more than one thousand populations in the study area. This will definitely affect the frequency and volume of rural-urban interaction in the study area in future. Moreover, the population of Siliguri Municipal Corporation more than doubled in 2011 compared to 1991 which took place within a span of twenty years leading to increase in demand of fresh vegetables, fruits and dairy products from the surrounding rural areas, which again will affect the rural-urban interaction in a positive manner.

4.2.4 Trade and commerce

Rural-urban interactions have grown in emerging nations during the past few decades. According to Cour and Surech, a quick rise in rural-urban interaction was caused by population expansion, natural environmental changes and exposure to global markets. Urban centres grow and spread their influence out into the surrounding area, which is turn modernize a variety of facets of social and economic life. Agriculture has steadily become more business oriented through the production of export oriented commodities and food for urban consumers. Rural population densities have expanded along the same geographic lines as urban areas which has an impact on rural settlement patterns and agricultural production. Despite the fact that rural commodities increasingly respond fast to urban food demands, the transfer of urban commodities and services to rural areas typically lags behind. The concepts of social capital and agricultural marketing are the key features to understand the rural-urban interaction. Nowadays, manifestation of people's livelihood strategies is subject to a multitude of influence from a broader national and international economic context. A modern lifestyle is increasingly becoming popular in rural areas, especially those located very close to big urban centres because of growing exposure to global markets, international trends and ongoing population

growth. This new lifestyle also led to and influenced the intensification of rural-urban interaction.

Another important aspect to enhance rural-urban interaction is trade in primary goods which are prominent both at local and regional scale. Trading for crops and cattle from the rural areas to urban areas strengthen the social relation and kinship between rural and urban people which is turn helps to improve rural-urban interaction. Although, trade is an economic activity, rural-urban interaction is embedded in social relation. Access to other capitals, including information, may be made possible via social interaction. In a market that is often characterised by the lack of transparency regarding prices of goods and commodities, a trader can receive information on prices through close connections. Contacts, trust and the trustworthiness of market information are prominent issues in case of rural-urban interactions.

Small urban centres, or market towns provide market and services for regional farmers as well as retail and services offering for both their own residents and those in the surrounding area. Therefore, they are in a good position to have an impact on rural agricultural production and growth. They are also 'administrative towns', where a considerable part of the population receives income from services provided by or supported by the government. Small urban centres influence the rural development in various ways. Agricultural produce is consumed in small urban centres, in addition to being transported to national and international markets. In order for urban centres to connect to larger market network, their location is crucial. This is particularly the case for urban centres that are situated at significant intersections, alongside rail roads and river or near coastlines. Additionally, small farmers can make the most of their resource and adjust production to meet demand in a way that enables them to be competitive in local, national and international markets by having access to market information such as price fluctuations and consumer preferences through small urban centres. In addition to this, small urban centres provide for the distribution of goods and services to the surrounding rural regions. Demand for these products and services is influenced by the income and purchasing power of the rural population, which may be quite high if they produce high-value crops. Thus, rising rural incomes encourages small urban centre's economic growth. Li (2011) focused on the importance of peri urban areas in providing services and employment to the rural areas in China. Small urban centres attract rural migrants from the adjacent region through demand for non-farm labours. Both non-farm activity and the growth of small urban centres can be significantly impacted by trade and commerce. Particularly in small metropolitan centres, export-oriented sectors provide significant job prospects for rural residents. For instance, demand in emerging industry like the service industry and manufacturing with a focus on

export improved the work options for young generation of Bangladesh's minor urban centres (Afsar, 1999).

Due to lack of information and economic limitations, the poorest rural populations are only able to travel locally or within regions. Small metropolitan centres are therefore vital travel hubs for the most underprivileged rural inhabitants. Diversification is supported in part by accessible and inexpensive transportation options. For instance, in South-East Nigeria accessible and inexpensive transportation amenities enable low-income rural dwellers to frequently commute from their villages to the neighbouring small metropolitan centre of Aba while yet maintaining a foothold in farming (Okali et al., 2001).

Siliguri and its adjacent areas form the commercial hub of entire North Bengal. As a consequence of its occupying a central position in terms of rail and road connectivity, merchandise from all over the country gets assimilated here and is then distributed in the surrounding areas. Bidhan Nagar, Naxalbari, Kharibari, Matigara are very important trade centres of this sub-division. Siliguri city is very well connected with these four blocks and as a result there is considerable interdependence. Over time this interdependence increased with increase in population size and volume of trade.

4.2.5 Agricultural activities

One of the activities that connect rural and urban communities is agriculture as overall improvement in the agricultural sector is very much dependent on the interaction between rural and urban areas. For instance, both regions are dependent on one another for a variety of reasons, including the provision of markets, inexpensive labour, increased farm production, increased commercialization of products, and the supply of food. The agricultural activity in rural areas needs to be sustainably increased, and services need to be provided to the rural areas so that they can receive the benefits in exchange for their services. In order to get a competitive advantage in the urban market, farmers must increase the quality and output of their agricultural products. Additionally, strategies must be developed to better meet the requirements of rural and urban residents primarily, by highlighting the advantages of rural-urban contact in both rural and urban areas. Soil nutrients and high-water efficiency will improve sustainable agricultural production systems, promoting the growth of agriculture in rural areas. Additionally, maintaining soil resources, preserving wetlands for agricultural use, and ensuring that farming systems are adaptable to natural calamities and climate change are important steps towards maintaining growth of agricultural productivity. Rural-urban interaction can also be strengthened by ensuring easy access in rural areas to fundamental resources and infrastructural

services (land, water, modern energy, transit, mobile and internet communication, and advisory services) in agricultural sector. The second crucial factor to be taken into account to benefit the rural-urban interface is focusing on infrastructural services that can improve rural-urban interaction. There is strong evidence that improving access to rural and urban areas through roads has a positive impact on agricultural productivity and output. In China and India, the agricultural production has increased as a result of public investment in roads that link rural and urban areas, according to Fan and Hazell (2001). According to Dorosh et al. (2010), agricultural production in sub-Saharan Africa is strongly connected with the distance of roads from urban market centres. Industrial and related institutions that depend on agricultural inputs are concentrated in urban regions. By raising farm revenue and generating jobs in the areas of resource utilisation, raw material processing, and new product development, the commercialization of these agricultural raw materials will revive rural economies. A stronger rural economy results from more income because it enables farmers to invest more in their businesses and the local community. The contribution of rural economy towards expansion of agriculture-related businesses in cities is enormous. Despite the fact that agricultural production occurs throughout the entire rural area, some cities become hubs for carrying out agricultural business with other rural areas. According to a study by Roberts et al. (2013), the contribution connecting agricultural companies to the towns and cities immediately nearby is crucial. Contrarily, farm households will profit from spatially concentrated agricultural transactions as a result of the regional agribusiness consolidation. There is evidence to suggest that selling to agricultural-related sectors greatly boosts farmers' economies (Roberts et al., 2013). Harrison (1993) also asserted that the rural economy is significantly impacted by industries associated to agriculture. Thus, farmers will have more money to spend on agricultural supplies that will help them produce more food. Therefore, governments should focus on raising rural agriculture's productivity and output, which would also have the added benefit of expanding the chances for industrial activity in cities.

The interdependence of rural and urban areas especially for agricultural activities is important from the view point of developing social, economic and political spheres. Nevertheless, the growth of the neighbouring rural areas has a significant impact on the development of urban centres. Numerous studies have interpreted the idea of rural area as farming regions and urban areas as densely populated areas. From 746 million in 1950 to 4.2 billion in 2018, the global urban population has dramatically expanded. Moreover, half of the world's population today lives in metropolitan areas. The number of people living in urban areas is expected to increase by 2.5 billion by the year 2050, bringing the proportion of

population living in urban areas to 66% (UN 2014). Urban areas will experience a strong rise in food demand as a result of population expansion, urbanization and income growth. Rural areas generate about 70% of the world's food supply on 66% of the earth's agriculture land (Locke, 2017). In order to generate income, the majority of these food is traded to metropolitan markets. Many cities completely depend on rural areas for their food supply, though this varies based on the city (FAO, 2017). The other possible markets for farmers in rural areas are those for vegetable oils, sugar and livestock products such as meat, milk and eggs etc. which are being consumed at an accelerated rate due to rising incomes and concerns about food that provides energy.

According to Proctor and Berdegue, meat, milk and eggs together makeup 29% of the total food consumed in impoverished countries and 48% in developed countries. The rapid rate of urbanization in urban areas makes it more likely that this share will rise. Rural farmer can be benefited from rural-urban interaction through the food supply in various regions both within and outside the country. For example, within the study area pineapple is grown in abundance and farmers export this fruit to various parts of the state as well as the country using transport and communication services available from Siliguri. This results in, food produced in rural areas having more market options. The modern food processing system enables food processing firms to look for external markets where the product may be sold for better prices. As a result, lot of food producers will see a rise in the price of their goods and a rise in demand. For instance, the sale of 13,000 tonnes of cow pear grown yearly in Burkina Faso's rural areas for the country's capital and for export. (Proctor and Berdegue, 2016). Natural resources utilized in the production of goods and services are known as raw materials. One of the primary raw materials supplied from rural areas is agricultural output, which includes goods like cotton and jute. Urban regions are the focus of industries and related organization that rely on agricultural inputs. For boosting farm revenue, generating jobs, utilization of resource, raw materials processing and the development of new goods, the commercialization of these agricultural raw materials is of utmost importance. Increased revenue, in turn, can help the rural economy by enabling farmers invest more in agricultural improvements and rural economies. Agricultural productivity like natural rubber, vegetable oil, sugarcane etc. mainly serve to industries engaged in food processing.

Many food manufacturers source their raw materials exclusively from local agriculture or fishing. Food processing units employs clean, fine quality ingredients to create good products primarily for urban markets. Industrial food consumption is increasing and as a result, food processing has emerged as the industry with greatest potential for employment generation.

Rural economy has played a significant role in the expansion of sectors related to agriculture in urban regions. The fact that agricultural production is dispersed over the entire rural area, certain urban areas have emerged as the hub of agricultural trade with the other rural areas. Therefore, from the perspective of rural-urban interaction a highly developed agricultural system requiring export of agricultural commodities and a lot of agricultural inputs ranging from high yielding variety seeds, fertilizers and agricultural equipment and machinery will make the rural people to travel to their nearly urban centre for fulfilment of their requirements. In Siliguri sub-division, paddy, jute, potatoes, various vegetables, various seasonal fruits, ginger, cardamom etc. are cultivated. Apart from this, pineapple and tea are also cultivated over a large area of the sub-division and constitute the main cash crops produced in this region. Efficient transportation facility conveys the produced goods quickly and efficiently and contributes towards strengthening the economic and agricultural sector.

4.2.6 Socio-economic aspects

Socio-economic aspects play a vital role in the dynamics of rural-urban interaction. Factors like the level of urbanization, economic condition, distribution of working population, educational level, industrial development etc. contributes towards rural-urban interaction.

a. **Levels of urbanization:** Interaction between rural and urban areas is crucial to urbanization process. Urbanization and urban growth are expected to have an impact on rural areas, and activities in rural areas are expected to have an impact on surrounding towns and cities. For the numerous opportunities it creates to enhance the quality of life, urbanization is appealing to many rural residents. The economy of the nearby villages is impacted by urbanization. The farmers from the rural areas can have access to better quality seeds and fertilizers and a range modern agricultural equipments and machineries which contribute towards improved agricultural productivity. Rural and urban sectors are highly inter-connected, which is evident from the reciprocal exchange of goods and services. On one hand rural residents rely on urban residents for their banking and credit needs, for buying supplies and equipment for farming, for marketing their produce, and even for recreational purpose. On the other hand, the rural sector provides the urban sector with inexpensive labour, reliable source of food, and a sizable market for its produced goods. Due to the concentration of hospitals and courts in metropolitan areas, urban professionals like doctors, lawyers, and others, receive a substantial portion of their patients and clients from the rural populace. Migration, therefore constitute an important two-dimensional phenomenon that has an impact on rural-urban interactions. Young boys from rural areas who relocate to metropolitan areas tend to take up unskilled and semi-skilled jobs.

Even rural residents with higher education choose to live in cities. Rural to urban migration places strain on urban public services and causes issues with social disorganization. For food supply, inexpensive labour, and a sizable market for its produced goods, the urban sector is reliant on the rural sector. The rural residents live in a different kind of environment than urban residents, who live in an artificial setting. In contrast to urban work, which is done indoors under controlled conditions, rural work is influenced by the seasons and weather. Consequently, they create slightly unique sub-cultures of their own that further sculpt their social structures and personalities. Urbanites typically end up dominating most aspects of life, despite the fact that rural population outweigh urbanites numerically. Urbanites are better off economically in comparison with the rural folks and therefore greater level of economic as well as political security.

Urban areas carry out tasks that are distinct from those of rural ones. It has also been described as a big group of individuals residing in close quarters and demonstrating great density. The percentage of urban residents compared to the overall population and the density of people in urban areas are two factors that can help define the levels of urban development. The study area i.e., Siliguri sub-division of Darjeeling district exhibits unequal expansion of urban centre with respect to the surrounding rural areas. In 2011 there has been a mushrooming of census towns in the study area. Its number has increased manifold compared to earlier years. Most of these newly emerged census towns are located in Matigara and Naxalbari block which are relatively closer to Siliguri Municipal Corporation. Another interesting fact is these newly emerged census towns are dotted along the major transport lines in these two blocks. This is due to the fact that population increase in these census towns have taken place keeping in mind the ease of transportation to Siliguri. People have flocked to these locations with a twin advantage of relatively lower property cost compared to Siliguri as well as the better transport network to reach Siliguri whenever required. This leads to a higher interaction with Siliguri and these census towns.

b. **Distribution of working population:** A key component of rural-urban interaction is the distribution of the working population, which makes it easier for rural labourers to move from their villages to surrounding towns or cities. An increasing working-age population offers potential for economic growth. However, the labour market and the economy can be greatly impacted by changes in the number of the working-age population since the growing number of people in the working-age does not only offer potential for economic growth but also create difficulties in absorption of new workers into the labour force. In contrast, a declining working-age population creates hindrance in the way of economic growth, coupled with increase in

dependent population. One of the key components of the development process, especially in rising market economies is migration of rural residents to urban centres in search of employment which eventually results in declining number of agricultural workers and labourers in rural areas. Better employment and income opportunities, better access to infrastructural facilities coupled with the desire to lead an urbanized way of living frequently motivate rural population to migrate toward nearby towns and cities. Urban residents' ambitions for better lives are dependent on decisions made at the household level to either maximise expected income or reduce risk by diversifying the household's portfolio of revenue-generating activities.

Most of the working population in rural settlements of the study area are engaged in primary economic activity whereas population from Siliguri Municipal Corporation are mostly engaged in secondary and tertiary economic activity. Siliguri Municipal Corporation attracts a sizeable number of population from its surrounding rural areas due to its better job opportunities for semi-skilled as well as non-skilled job seekers. Rural unemployment has been found to be strongly correlated with migration from rural to urban areas.

c. **Educational level:** Education makes people more confident and allows them to venture into new things. In rural areas, those who want to experiment in non-farm activities need knowledge to prosper. Since it is an already proven fact that for rural areas to prosper and develop rapidly, the economy needs to be diversified from traditional agriculture. Therefore, the educated people in rural areas will be in a better position to experiment in rural non-farm sector. In the study area, although the literacy rate of rural population was considerably low in 1991, but it has improved rapidly in subsequent years for majority of the villages. The average literacy rate although varies among the villages but the rural settlements located closer to Siliguri Municipal Corporation recorded far better literacy rate compared to those villages located in remote locations. Here, the availability of educational infrastructure comes into question. This is because in rural areas given the lower income level people can only send their children to schools if it is only located very close to their village. In this context, the challenges to higher education is far more obvious given their scarcity in the rural areas. However, rural-urban interaction is heavily dependent on the educational level of the population. An educated youth from rural area will try to look for employment opportunities in non-farm sectors located in the nearby urban centre. This will have an impact on the level of rural-urban interaction. Moreover, to pursue higher education and also for various types of coaching thousands of students from Silguri sub-division travels to Siliguri regularly.

d. **Industrial development:** The potential for industrial growth to increase economic activity is greater, and in the long run, it will contribute to the improvement of rural assets, income generation, infrastructure development, a higher standard of life and higher per capita income for rural residents. India is the country of villages, and the majority of its people reside there. In addition to aiding in economic growth, encouraging the growth of rural industries also serves to improve rural residents' quality of life, reduce poverty, etc. The interplay between rural and urban areas is impacted by the location of major and small-scale industries away from metropolitan areas through migration. Young males from rural areas who relocate to metropolitan areas tend to work in unskilled and semi-skilled industrial jobs. However, the advantages of industrial growth for rural communities include market, farm inputs, employment prospects, etc. Because of concentration of industries, urban areas often have more diverse market segments and higher income levels. In fact, rural areas close to cities frequently enjoy a comparative advantage in producing the food, energy, tourism, and other rural goods and services that urban customers want. Therefore, understanding how these interconnected economic flows impact the economic health of rural areas may help establish strategies for rural-urban interactions. When a region becomes more industrialized, communication and transportation improve, which allows more people to live in a smaller area and increases and enhances the workforce. Near industrial bases are several other establishments, such as educational and school buildings, banking and healthcare centres, as well as dining and leisure hubs. These businesses prosper as a result of the influx of people from an industrial area, which boosts total commercial activity and strengthens interactions between rural and urban areas. A region's unemployment and poverty rates may decline as industry advances. With the increase in the number of industries, both small as well as large, more job and employment opportunities will be generated thereby increasing job opportunities for people who otherwise would have been without work. Additionally, it creates jobs for residents in the suburbs and fringes which are close to industrialised areas. With easily available advanced agricultural tools like tractors and harvesters and good quality fertilisers and insecticides, agriculture has witnessed significant improvement over time. Sophisticated transportation industry and high speed internet connectivity have not only allowed businesses to sell their goods over greater distances but also accelerated the pace at which many firms operate. As a result of all these industrial advancements, people in rural and urban areas now depend on one another ultimately contributing towards overall growth of economy.

From the traditional tea and timber industries to the tourism sector, automobile, real estate, banking, information technology, chemical manufacture, organic fertilisers, and many

other industries, Siliguri has been a home to a sizable number of businesses. These industries and service providers create employment opportunities for people living in the vicinity of Siliguri. Since agriculture is seasonal, many people from rural areas come to Siliguri to get employment in various industries and services during off season. Seasonal employment opportunities are available in retail sector, tourism sector, shopping malls, etc.

e. **Power development:** Modern economic & overall social growth of the nation depends on access to electricity and power supply. Electricity creates new opportunities for technological advancement in the field of mass communication, public health care and education. Communities without electricity may be kept isolated and effectively in the dark, unable to benefit from modern advancements. The rural economy is frequently viewed as having its foundation in rural electricity. Energy is needed in rural areas for things like cooking, basic lighting, irrigation, communication, water heating, and other things. Most of these can be addressed by rural electrification, which has positive effects on farm production, health and education, communication, and economic development by generating jobs in rural communities that have historically relied on agriculture-related sources of income. In Siliguri sub-division the villages have access to electricity and enjoy the benefits of power supply. Electrification of rural areas allows the local residents to enjoy the benefits of mass media, internet facilities by keeping them updated about the outside world. Today internet has become the largest platform for learning new ideas and techniques that help in individual growth as well as collective growth of the communities.

4.3 Delineation of zones of interaction within the study area

There is a distance-decay function with respect to rural-urban interaction. Distance plays a huge role in governing the level of interaction taking place between a rural settlement and its nearby urban centre. As already being mentioned in the first chapter that to study the level of rural-urban interaction in the study area, first of all the rural area of Siliguri sub division will be divided into three zones on the basis of distance from the outer boundary of Siliguri Municipal Corporation. The three zones will be as follows: Zone I - This will cover all the rural settlements which are located within 10 km from the outer boundary of Siliguri Municipal Corporation, Zone II - This will cover all the rural settlements which are located within 10 to 20 km from the outer boundary of the Siliguri Municipal Corporation and Zone III - This will cover all the rural settlements which are located beyond 20 km from the outer boundary of the Siliguri Municipal Corporation. In this process of zoning obviously, the block boundaries will be compromised and blocks will spread over more than one zone. The tables along with the

maps below shows the constituent villages and census towns of each block under each zones of interaction in the study area. While doing this process of zoning, 2011 census year has been taken into consideration and all those villages and census towns which were present in 2011 has been classified under the three zones in the study area. In 2011 there were 353 villages and 14 census towns in the study area. Out of these 353 villages, 313 were inhabited village and 40 were uninhabited village in the study area.

Table No. 4.1 Zone I along with the name of villages and census towns

Block Name	Name of Village and Census Towns
Matigara	Champasari, Galmakhari, Purba Karai Barir Chhat, Karaibari, Champasari Chhat, Dariagramer Chhat, Pachim Pasunath Barua, Jadubhitar Chhat, Mohorgan Tea Garden, Sisabari, Rupan Chhat, Damragayer Chhat, Bara Adalpur Dwitiya Khanda, Khoklong, Khoklong Chhat, Kamala Barir Chhat, Khaprail, Fulbari Chhat, Jhauguri, Jhauguri Chhat, Panchanai, Nunu Bairagi, Mahatram, Mahishmari, Malahar, Kalabari, Palash, Kalkut (CT), Daknikata, Udaysing, Salbari Chhat Pratham Khanda, Chamta, Rajpairi, Khopalasi, Ruhinir Chhat, Fulbari Pataner Chhat, Patan, Panchakulguri, Jugibhita, Dhukuria, Foutsingher Chhat, Bara Gharia, Nichitpur, Guria, Nimai, Gouri, Lalsara Chhat, Dumriguri Chhat, Bataliguri, Lachka, Rangia, Nengtichhara, Tari (CT), Baniakhari, Gaurcharan, Ujani, Matigarahat, Tomba, Mathapari (CT), Jitu (CT), Bairatisal (CT), Bara Mohansingh (CT), Kalam, Patiram, Kawakhari, Kawakhali, Thiknikata, Pelku, Nunu Bairagi Chhat, Duraimarir Chhat, Patan Chhat, Pataner Chhat, Purba Pasunathbarua.
Naxalbari	Bauni Bhitar Chhat, Dhemal, Panta Pari Forest, Tarabari, Tarabarir Chhat, Batlabari, Paschim Karai Barir Chhat, Mayaram, Baunibhita, Barabhita, Kamalpur, Dumriguri (CT), Rupsing, Uttar Bagdogra (CT), Bhujia Banir Chhat, Lalman (CT), Putimari, Bhujia Bani, Dakshin Bagdogra (CT), Rajajhar, Ranidanga, Bharatsing, Shaibhita, Rangapani.
Phansidewa	Harising Chhat, Jabrali Chhat, Kadopani, Chhata Pathuram, Bara Pathuram, Kalaram, Turibhita, Abhiram, Raghunath Chhat, Narayan, Dwarabaksa, Rahamu, Laldas, Hatiram, Mahammadbaksa, Nirmmal, Radha, Tarbandha, Baraigachh, Antigachh, Bhusibhita, Kashiram, Liusipukuri, Rupandighi, Sahananda, Guabari.
Source: Compiled by the Researcher.	

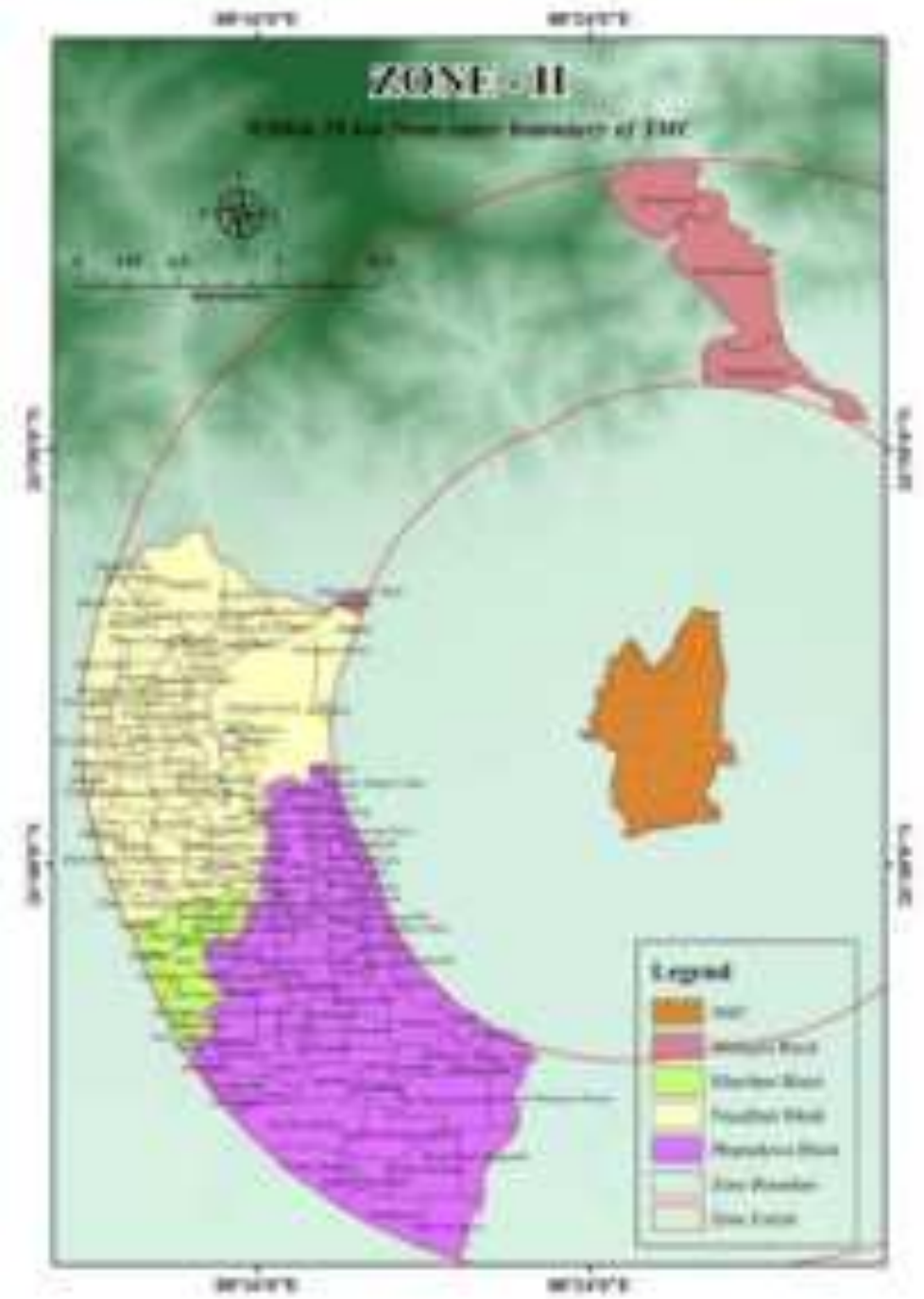
Map No. 4.1 Zone I along with the villages and census towns

Source: Prepared by the Researcher.

Zone I consists of 113 villages and 10 census towns from the three blocks viz. Matigara, Naxalbari and Phansidewa respectively. Out of these 113 villages and 10 census towns, 67 villages and 6 census towns belong to Matigara block, 20 villages and 4 census towns belong to Naxalbari block and 26 villages belong to Phansidewa block respectively.

Table 4.2. Zone II along with the name of villages and census towns	
Block Name	Name of Village and Census town
Matigara	Sivoke Hill Forest, Sivoke Forest, Patan Jharer Chhat, Chamtaguri Chhat, Sitong Forest.
Naxalbari	M. M. Terai, Panthabari Forest, Manjha Tea Garden, Marapur, Ord Terai Tea Garden, Trihana Tea Garden, Teprabhola, Kadma, Chhota Chenga, Belgachhi, Udiarip, Sirsia Tea Garden, Nipania, Lohasing, Mirjangler Chhat, Amarsing, Mirjangla, Jamidargurir Chhat, Bhelu, Jamidarguri, Jabar Chhat, Chhota Ganjer Chhat, Chhota Ganja, Dhanibani, Dhanibanir Chhat, Deoanbhitar Chhat, Pataram, Huchaimallik, Tepuchamaru, Omi, Birsing, Ketugabur, Fakna, Gaziram, Nandalal, Deomani, Lakshman, Grammani, Grammanir Chhat, Minghara, Nimubhitar Chhat, Raghuram, Bairbhita, Damdama, Bhakatram, Raghuramer Chhat, Ghusuru, Geni (CT), Barajharu, Mangalsing, Kamala, Budhkaran, Sebdella, Atal, Mahasing, Mudir Jangal, Shiubar, Uttar Chanded Chhat, Surajbarer Chhat, Satbhaia, Dalkajhar Forest, Mirjangler Chhat, Lakshmaner Chhat.
Phansidewa	Sannyasithan, Sannyasithaner Chhat, Jabrali, Mahideb, Krishnapur Tea Garden, Harising, Chaupukuria, Singijhar, Bhaisdubi, Liohakaichi, Rangali, Panaullar Chhat, Bhisti, Tepu Tea Garden, Dhemaler Chhar, Halal, Banur Chhat, Bangaru, Bhubangurir Chhat, Bharia Danga, Sangatram, Pathar Hirhirar chhat, Pathar Hirhira, Nitu Bhita Chhat, Sarcargachher Chhat, Sarcargach, Bharia Dangir Chhat, Bandi, Fakirdwip, Tarabari, Gangaram Tea Garden, Bandia Chhat, Barmala, Thuna, Thunar Chhat, Hetmuri, Mohan Laler Chhat, Sastugachh, Madhabbhita, Bhalamanasi, Nembutari, Kadmi, Dandrajhar, Kuchia, Tentulguri, Haodabhita, Churaman, Farabari, Haribhita, Molani, Thakurganja, Fulbar, Kantibhita, Mahipal, Bandar Gachh, Dhamnagachh, Foudigachh, Ambari, Jogibhita, Lachubhita, Uttar Bansgaon Kismat, Purba Bansgaon Kismat, Paschim Madati, Paschim Bansgaon Kismat, Paschim Bansgaon, Madhya Bansgaon, Bansh Gaon Mangachh, Purba Bansgaon, Dalur Chhat, Muktar Chhat, Gangaram Maler Chhat, Meherulla.
Kharibari	Tharu Bhita, Dakua, Dhulia, Dhuliar Chhat, Jatru, Dagdhu, Buraganja.
Source: Compiled by the Researcher.	

Map No. 4.2 Zone II along with the villages and census towns

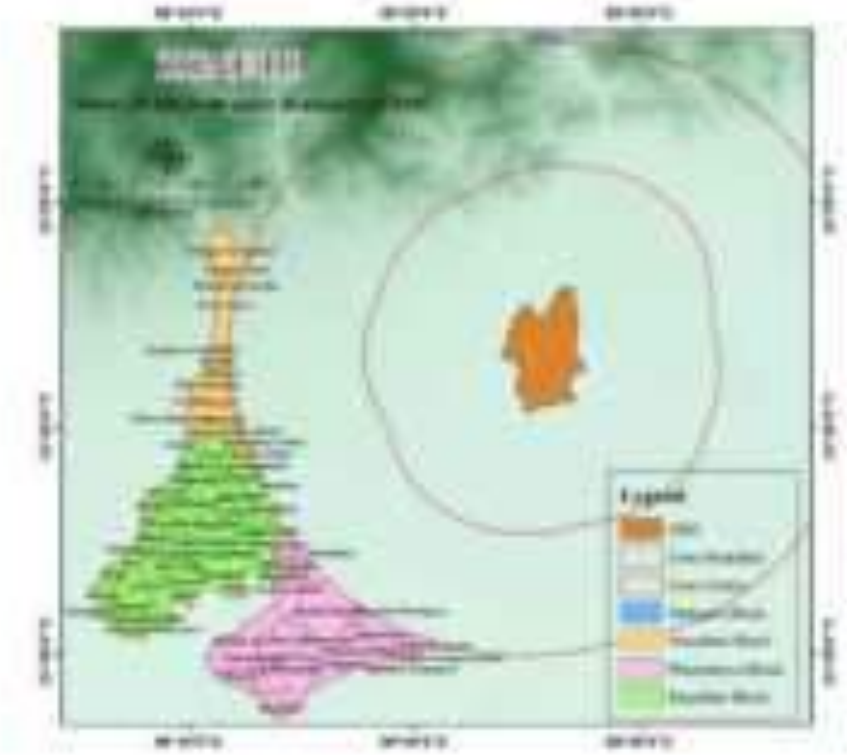


Source: Prepared by Researcher

Zone II consists of 146 villages and 1 census town across the four blocks of the study area viz. Matigara, Naxalbari, Phansidewa and Kharibari respectively. Out of these 146 villages and 1 census town in Zone II, 5 villages belong to Matigara block, 62 villages and 1 census town belong to Naxalbari block, 72 villages belong to Phansidewa block and 7 villages belong to Kharibari block respectively.

Table No. 4.3 Zone III along with the name of villages and census towns	
Block Name	Name of Village and Census town
Naxalbari	Mechi Forest, Surajbar, Surajbar Forest, Bara Maniram, Kilaram, Nehal, Dayaram, Naksalbari, Chhota Maniram, Bhimram (CT), Uttam Chand, Dhakna, Hoda Bhitar Chhat.
Phansidewa	Kadubhita, Dhakna Gachh, Purba Madati, Mandila Jhar, Bara Paikpara Arazi, Lahugaon, Chhota Paikpara Arazi, Budharugaon, Dhakpara, Chikanmati, Bansgaonchakla, Bansgaon, Purbba Bansgaobchakla, Dham Bhita, Hela Kadam Chhat.
Kharibari	Madan, Uttar Ramdhan, Singbhita, Subal, Tukriajhar Forest, Rangali, Bajarur Chhat, Dangarbhita, Gandagal, Manjoy, Antaram, Hatidoba, Deoanbhita, Badalbhita, Jorpakari, Panthabari, Bhulka, Jibansing, Saheburam, Budhsing, Fulbarir Chhat, Subalbhita, Nazir, Dudha, Bagulhagi, Guabari, Manasa, Fulbari, Salbari, Chuchur Muchur, Deburam, Bagha, Kelabari, Alokjhari, Badora, Balahijhora, Bhogbhita, Shyamdhan (CT), Paschim Rambandh, Chayansing, Jamatulla, Kungarpur, Tari, Maynaguri, Barsadbhita, Kishordoba, Pataram, Katia, Banchhabhita, Chekarmari, Debiganja, Gayen, Bhajanpur, Rangmuni, Bairagi, Duba, Chiku, Khopalashi, Gadhira, Bilakshu, Khunia Pukhari, Dohaguri, Dhupibhita, Kharibari (CT), Jagir, Arjunmahal, Sona Chandi, Bhattagachh, Chunilal.
Source: Compiled by the Researcher.	

Map No. 4.3 Zone III along with the villages and census towns



Source: Prepared by the Researcher.

Zone III consists of 94 villages and 3 census towns across the three blocks of the study area viz. Naxalbari, Phansidewa and Kharibari respectively. Out of the 94 villages and 3 census towns in Zone III, 12 villages and 1 census town belong to Naxalbari block, 15 villages belong to Phansidewa block and 67 villages and 2 census towns belong to Kharibari block respectively.

4.4 Road distance of villages and census towns of the study area from Siliguri Municipal Corporation

Although, in the earlier section the three zones were formulated on the basis of their straight distance from the outer boundary of Siliguri Municipal Corporation, however in this section the actual road distance of each village and census towns of the study area from Siliguri Municipal Corporation has also been calculated. This is because, rural-urban interaction takes place through lines of communication. Since roadways are the predominant mode of communication in the study area so this has been done to get the actual distance people from any rural settlement will have to travel to reach Siliguri.

Table 4.4 indicates the actual travel distance between the villages and census towns of Matigara block with Siliguri Municipal Corporation. The average distance between these units is 11.40 km. In terms of travel distance, Sitong Forest is farthest from Siliguri Municipal Corporation i.e., 40.8 km, followed by Sivoke Hill Forest and Lalsara Chhat village distancing 23.2 km and 18.5 km repectively. On the other hand, Tomba (3.5 km) is situated nearest to Siliguri Municipal Corporation followed by Patiram and Ujanu distancing 4 km and 4.3 km respectively.

Table No. 4.4 Road distance of villages and census towns (2011) of Matigara block from Siliguri Municipal Corporation

Sl No.	Village	Distance from SMC (Km)	Sl No.	Village	Distance from SMC (Km)
1	Bairatisal (CT)	11.4	40	Lachka	14.5
2	Baniakhari	8.4	41	Lalsara Chhat	18.5
3	Bara Adalpur Dwitiya Khanda	16.6	42	Mahatram	8.6
4	Bara Gharia	6.6	43	Mahishmari	9.4
5	Bara Mohansingh (CT)	9.8	44	Malahar	8.3
6	Bataliguri	15.8	45	Mathapari (CT)	7
7	Champasari	5.5	46	Matigarahat	6.1
8	Champasari Chhat	11.5	47	Mohorgon Tea Garden	13.3
9	Chamta	9.9	48	Nengtichhara	10
10	Chamtaguri Chhat	10.1	49	Nichitpur	9
11	Daknikata (P)	6.9	50	Nimai	11
12	Damragayer Chhat	11.4	51	Nunu Bairagi	12.9

13	Dariagramer Chhat	10.4	52	Nunu Bairagi Chhat	12.9
14	Dhukuria	8.7	53	Palash	7.9
15	Dumriguri Chhat	16	54	Panchakulguri	12.4
16	Duramarir Chhat	11.3	55	Panchanai	9.1
17	Foutsingher Chhat	5.8	56	Paschim Pasunath	11.1
18	Fulbari Chhat	15.9	57	Patan	15.7
19	Fulbari Pataner Chhat	15.2	58	Patan Chhat	15.7
20	Galmakhari	11.2	59	Patan Jharer Chhat	16.6
21	Gaurcharan	6.8	60	Pataner Chhat	15.4
22	Gouri	16.6	61	Patiram	4
23	Guria	10.7	62	Pelku	8.6
24	Jadubhitar Chhat	10.2	63	Purba Karai Barir	10.9
25	Jhauguri	12.4	64	Purba Pasunathbarua	11.5
26	Jhauguri Chhat	11.8	65	Rajpairi	11.1
27	Jitu (CT)	8.4	66	Rangia	10.5
28	Jugibhita	13.5	67	Ruhinir Chhat	14.3
29	Kalabari	8.5	68	Rupan Chhat	10
30	Kalam	8.1	69	Salbari Chhat Pratham Khanda	8
31	Kalkut (CT)	6.8	70	Sisabari	9.8
32	Kamala Barir Chhat	12.7	71	Sitong Forest	40.8
33	Karaibari	10.7	72	Sivok Hill Forest	23.2
34	Kauakhali	5.4	73	Sivoke Forest	17.4
35	Kawakhari	8.3	74	Tari (CT)	8.8
36	Khaprail	15.9	75	Thiknikata	7.1
37	Khok Long Chaat	16.2	76	Tomba	3.5
38	Khoklong	16.3	77	Udaysing	8.1
39	Khopalasi	14.1	78	Ujanu	4.3
Source: Calculated by the Researcher.					

Table 4.5 indicates the actual travel distances between the villages and census towns of Naxalbari block with Siliguri Municipal Corporation. The average distance between these units is 24.22 km. In terms of travel distance, Pataram is farthest from Siliguri Municipal Corporation i.e., 40.4 km followed by Mirjangler Chhat (33.5 km) and Suraj Barer Chhat (33.1 km). On the other hand, Rani Danga (10.3 km) is situated nearest to Siliguri Municipal Corporation followed by Bharatsing and Rangapani distancing 10.4 km and 10.6 km respectively.

Table No. 4.5 Road distance of villages and census towns (2011) of Naxalbari block from Siliguri Municipal Corporation

Sl No.	Village	Distance from SMC (Km)	Sl No.	Village	Distance from SMC (Km)
1	Amarsing	32.5	51	Lakshmaner Chhat	22.7
2	Atal	21.5	52	Lalman (CT)	11.4
3	Bairbhita	24.9	53	Lohasing	31.5
4	Bara Maniram	28.3	54	M.M.Terai	25.5

5	Barabhita	17.7	55	Mahasing	22.1
6	Barajharu	24.3	56	Mangalsing	22.1
7	Batlabari	12.9	57	Manjha Tea Garden	32.2
8	Bauni Bhitar Chhat	18.8	58	Marapur	31
9	Baunibhita	15.1	59	Mayaram	15.5
10	Belgachi	28.5	60	Mechi Forest	31.4
11	Bhakatram	25.4	61	Minghara	27.7
12	Bharatsing	10.4	62	Mingharar Chhat	25.9
13	Bhelu	24.1	63	Mir Jangla	29.1
14	Bhimram (CT)	27.1	64	Mirjangler Chhat	33.5
15	Bhujia Bani	15.5	65	Mudir Jangal	27.8
16	Bhujia Banir Chhat	13	66	Naksalbari	28.2
17	Birsing	23.7	67	Nandalal	21.6
18	Budhkaran	24.8	68	Nehal	30.5
19	Chhota Chenga	29.9	69	Nimubhitar Chhat	24.3
20	Chhota Ganja	28.5	70	Nipania	30.8
21	Chhota Ganjer Chhat	29.2	71	Omi	23.1
22	Chhota Maniram	32	72	Ord Terai Tea Garden	25
23	Dakshin Bagdogra	16.4	73	Panta Pari Forest	21.3
24	Dalkajhar Forest	21.8	74	Panthabari Forest	25.7
25	Damdama	23.1	75	Pashchim Karai Barir Chhat	14.8
26	Dayaram	29.3	76	Pataram	40.4
27	Deoanbhitar Chhat	27.7	77	Putimari	12.7
28	Deomani	19.1	78	Raghuram	25.7
29	Dhakna	29.7	79	Raghuramer Chhat	25.5
30	Dhanibani	27.9	80	Rajajhar	13
31	Dhanibanir Chhat	27.8	81	Rangapani	10.6
32	Dhemal	18	82	Ranidanga	10.3
33	Dumriguri (CT)	17.1	83	Rupsing	12.8
34	Fakna	27.7	84	Satbhaiya	25.5
35	Gaziram	24.2	85	Sebdella	24.1
36	Geni (CT)	26.6	86	Shaibhita	13.1
37	Ghusuru	25.2	87	Sirsia Tea Garden	29.5
38	Gram Manir Chhat	24.3	88	Siubar	29.4
39	Grammani	24.1	89	Suraj Barer Chhat	33.1
40	Hoda Bhitar Chhat	28.7	90	Surajbar	30
41	Huchaimallik	25	91	Surajbar Forest	32.1
42	Jamidarguri	26.4	92	Tarabari	15.9
43	Jamidargurir Chhat	26.1	93	Tarabarir Chhat	18.3
44	Jhabar Chhat	29.9	94	Teprabhola	25.7
45	Kadma	29.8	95	Tepuchamaru	26.5
46	Kamala	28.7	96	Trihana Tea Garden	22.9
47	Kamalpur	16	97	Udiarip	26.7
48	Ketugabur	28.6	98	Uttam Chand	28
49	Kilaram	28.4	99	Uttam Chanded Chhat	33.1
50	Lakshman	21.4	100	Uttar Bagdogra (CT)	14.8
Source: Calculated by the Researcher.					

Table 4.6 indicates the actual travel distances between the villages of Phansidewa block with Siliguri Municipal Corporation. The average distance between these units is 23.77 km. In terms of travel distance Dhakpara is farthest from Siliguri Municipal Corporation i.e., 47.4 km followed by Chikanmati (44.7 km) and Mandila Jhar (44.5 km). On the other hand, Chhota Pathuram (8.3 km) is situated nearest to Siliguri Municipal Corporation followed by Bara Pathuram and Kalaram distancing 9.5 km and 10.4 km respectively.

Table No. 4.6 Road distance of villages (2011) of Phansidewa block from Siliguri Municipal Corporation

Sl No.	Village	Distance from SMC (Km)	Sl No.	Village	Distance from SMC (Km)
1	Abhiram	18.1	58	Kalaram	10.4
2	Ambari	12.1	59	Kantibhita	30.7
3	Antigachh	16.9	60	Kashiram	15.2
4	Bandar Gachh	22	61	Krishnapur Tea Garden	17.4
5	Bandi	21.8	62	Kuchia	29
6	Bandia Chhat	22.7	63	Lachubhita	25.3
7	Bangaru	24.2	64	Lahugaon	44
8	Bansgaonchakla	34.8	65	Laldas	12.1
9	Bansh Gaon Mangachh	25.9	66	Liohakaichi	18.1
10	Banshgaon	30.6	67	Liusipukuri	16.5
11	Banur Chhat	21.5	68	Madhabbhita	25.1
12	Bara Paikpara Arazi	41.2	69	Madhya Bansgaon	25.6
13	Bara Pathuram	9.5	70	Mahammadbaksa	13.7
14	Baraigachh	19.7	71	Mahideb	18.1
15	Baramala	24.2	72	Mahipal	23.1
16	Bhaisdubi	17.8	73	Mandila Jhar	44.5
17	Bhalamanashi	25.3	74	Meherulla	19.8
18	Bharia Danga	25.7	75	Mohan Laler Chhat	34.3
19	Bharia Dangir Chhat	24.8	76	Molani	28.5
20	Bhisti	23.1	77	Muktar Chhat	21.9
21	Bhubangurir Chhat	23	78	Narayan	13.2
22	Bhushibhita	17.1	79	Nembutari	27.4
23	Budharugaon	42	80	Nirmmal	13.2
24	Chaupukuria	20.5	81	Nitu Bhitar Chhat	22.2
25	Chhota Paikpara	40.7	82	Panaullar Chhat	19.9
26	Chhota Pathuram	8.3	83	Paschim Bansgaon Kismat	26.9
27	Chikanmati	44.7	84	Paschim Banshgaon	28
28	Churaman	25.9	85	Paschim Madati	37.1
29	Dalur Chhat	20.7	86	Pathar Hirhira	27.2
30	Dandrajhar	33.3	87	Pathar Hirhirar Chhat	26.2
31	Dhakna Gachh	32.7	88	Purba Bansgaon	28.5

32	Dhakpara	47.4	89	Purbba Bansgaon Kismat	22.1
33	Dhambhita	32	90	Purbba	31.8
34	Dhamnagachh	20.9	91	Purbba Madati	35.5
35	Dhemaler Chhar	23.3	92	Radha	14.4
36	Dwarabaksa	12	93	Raghunath Chhat	20.8
37	Fakirdwip	29.1	94	Rahamu	11.8
38	Farabari	29.5	95	Rangali	31.4
39	Foudigachh	30.3	96	Rupandighi	18.3
40	Fulbar	23.7	97	Sahananda	18.3
41	Gangaram Maler Chhat	24.1	98	Sangatram	21.6
42	Gangaram Tea	21.1	99	Sannyasi Thaner Chhat	16.9
43	Guabari	19.2	10	Sannyasithan	18.2
44	Halal	21.5	10	Sarcargachh	20.8
45	Haodabhita	27.3	10	Sarcargachher Chhat	21.7
46	Haribhita	30.1	10	Sastugachh	32.5
47	Harising	19.1	10	Singijhor	18.1
48	Harising Chhat	16	10	Tarabari	15.9
49	Hatiram	14	10	Tarbandha	15.7
50	Helakadam Chhat	24	10	Tentulguri	31.1
51	Hetmuri	19.4	10	Tepu Tea Garden	22.2
52	Jabarali	16.6	10	Thakurganja	27.8
53	Jabarali Chhat	16	11	Thuna	22.7
54	Jogibhita	29.1	11	Thunar Chhat	23.1
55	Kadmi	20.5	11	Turibhita	20.4
56	Kadopani	16	11	Uttar Bansgaon Kismat	23
57	Kadubhita	33.7			
Source: Calculated by the Researcher.					

Table 4.7 indicates the actual travel distances between the villages and census towns of Kharibari block with Siliguri Municipal Corporation. The average distance between these units is 37.63 km. In terms of travel distance, Rangmuni is farthest from Siliguri Municipal Corporation i.e., 48 km followed by Bairagi (47.8 km) and Debiganja (47.1 km). On the other hand, Tharu Bhita (25.6 km) is situated nearest to Siliguri Municipal Corporation followed by Dakua and Dagdhu distancing 27.3 km and 27.7 km respectively.

Table No. 4.7 Road distance of villages and census towns (2011) of Kharibari block from Siliguri Municipal Corporation

Sl No.	Village	Distance from SMC (Km)	Sl No.	Village	Distance from SMC (Km)
1	Alokjhari	38.5	39	Gadhira	43.9
2	Antaram	36.3	40	Gandagal	34.4
3	Arjunmahal	35.3	41	Gayen	45.9
4	Badalbhita	35.7	42	Guabari	37.3
5	Badora	37.6	43	Hatidoba	33.5

6	Bagha	39.8	44	Jagir	37.4
7	Bagulahagi	35.2	45	Jamatulla	38
8	Bairagi	47.8	46	Jatru	29.2
9	Bajarur Chhat	33.6	47	Jibansing	37.1
10	Balahijhora	37.6	48	Jorpakari	35.5
11	Banchhabhita	42.4	49	Katia	41
12	Barsadbhita	41.3	50	Kelabari	37.7
13	Bhajanpur	44.2	51	Kharibari (CT)	37.3
14	Bhattagachh	34.1	52	Khopalashi	45.9
15	Bhogbhita	36.4	53	Khunia Pukhari	42
16	Bhulka	39.5	54	Kishordoba	41.2
17	Bilakshu	45	55	Kungarpur	39.8
18	Budhsing	35.4	56	Madan	32.2
19	Buraganja	30.5	57	Manasa	39.5
20	Chayansing	37.4	58	Manjoy	33.9
21	Chekarmari	43.8	59	Maynaguri	42.8
22	Chiku	46.2	60	Nazir	38.2
23	Chuchur Muchur	38.4	61	Panthabari	34.6
24	Chunilal	44.8	62	Paschim Rambandh	41
25	Dagdhu	27.7	63	Pataram	40.4
26	Dakua	27.3	64	Rangali	31.4
27	Dangarbhita	32.4	65	Rangmuni	48
28	Debiganja	47.1	66	Saheburam	35.9
29	Deburam	38.3	67	Salbari	38.9
30	Deoanbhita	34.5	68	Shyamdhan (CT)	37
31	Dhulia	34.2	69	Singbhita	32.8
32	Dhuliar Chhat	30.9	70	Sona Chandi	34.5
33	Dhupibhita	38.2	71	Subal	30
34	Dohaguri	39.5	72	Subalbhita	35.6
35	Duba	46.7	73	Tari	44.6
36	Dudha	34.3	74	Tharu Bhita	25.6
37	Fulbari	36.7	75	Tukriajhar Forest	34.3
38	Fulbarir Chhat	34.9	76	Uttar Ramdhan	32.3
Source: Calculated by the Researcher.					

4.5 Summary

The major objective of this chapter was to identify the various factors which control the rural-urban interaction in the study area and also to delineate the zones of interaction within the study area. Rural-urban interaction is an integral part of urbanization process and its associated development of the surrounding rural areas. In India as well as in West Bengal although, majority of their population still live in rural areas but the interaction between the rural and urban areas are increasing at rapid rate due to mutual benefit of both the communities. Infact, in an increasingly globalized world, it is misleading to view the rural and urban areas as distinct spheres as both are interconnected and depended on one another. As has been

strongly advocated, the solution to urban problems lies in rural areas, therefore in this given context this study on rural urban interaction gains greater significance.

Rural-urban interaction is governed by a number of factors, some of which are economic, some are social and others are related to infrastructure. The most important factor which control the volume of rural-urban interaction is the population size. This includes both the population of the urban centre as well as population of the surrounding rural area. In the study area the total population of Siliguri Municipal Corporation in 2011 was 513265 while the population of the four blocks viz, Matigara, Naxalbari, Phansidewa and Kharibari was 676574 persons. Siliguri being the second most important urban centre of West Bengal after Kolkata, depends a lot on rural population of its sub-division for supplies related to food grains, vegetables, fruits and dairy products. On the other hand, people living in rural settlements also depend a lot on Siliguri to fulfil their requirements related to services like education, health, trade and commerce, business etc.

Transport and communication facilities govern the degree of rural-urban interaction. Communication can take place by either roadways or railway in the study area. Since railway connectivity is very limited with fewer local trains so most of the people in the study area depend on roadways for interaction. The major roads which connects the rural area of Siliguri sub-division with Siliguri Municipal Corporation are Asian Highway 2, National Highway 31, 31A and 55 and State Highway 12. There is availability of both public and private bus as well as auto from Siliguri Municipal Corporation to various directions within the study area. The high frequency of bus and auto services along the major routes connecting important parts of the study area with Siliguri Municipal Corporation allows free movement of people leading to high volume of rural-urban interaction. Moreover, Siliguri being the major hub of employment opportunities, health care services, educational institutes, trade and commerce and recreational facilities, people from its surrounding areas come to Siliguri by availing the cheap modes of transportation facilities available to them.

It was also found that the number and size of settlements play a significant role in rural-urban interaction. There is a mutual beneficial relationship between rural and urban settlement in the area. In 2011, there were 353 villages and 14 census towns in Siliguri sub-division. Out of these 353 villages, 313 villages were inhabited and 40 villages were uninhabited. Out of these villages the highest number were in the size-class of 1000-1999. However, it was also found that with the passage of time smaller size-class villages in the study area has declined and bigger size-class villages have increased in number. This is the result of natural increase in rural population within the study area. The growth of urban population took place at a higher

rate within the study area. The total number of villages in the study area has not changed by much but an increase in the number of villages in the higher size-class category also points towards a higher rural-urban interaction in the study area.

Trade and commerce plays a vital role in shaping the dynamics of rural-urban interaction. People from rural areas trade with urban population with respect to primary goods like food grains, vegetables, fruits, and dairy products. On the other hand, they depend on the urban centres for fulfilling their requirements related to agricultural inputs, agricultural machineries and for other rural non-farm activities. A higher volume of trade and commerce between an urban centre and its adjoining rural areas will lead to a greater rural-urban interaction. If an urban centre is very well developed in terms of trade and commerce, it will generate enough employment opportunities which will attract people from the surrounding rural areas who are in a dire need of non-farm employment opportunities and are ready to commute daily to urban areas.

The level of development of agricultural activities in rural areas also have an effect on rural-urban interaction. Areas which are agriculturally developed require more farm inputs and agricultural machinery which is supplied from the nearby urban centre. Moreover, a highly developed agricultural sector will also bring economic prosperity in rural area. This will ultimately result in increasing demand for better healthcare facilities, educational facilities and consumer durable commodities among the rural population which will in turn increase their dependency on nearby large urban centre. Moreover, if cash crops dominate the agricultural system, people from the villages will have to bring their products to the nearby urban centre to sell their products. However, if the villages practise subsistence type of agriculture, very little rural-urban interaction is possible as subsistence agriculture is usually associated with confinement of rural population within the village boundary.

Various socio-economic factors like the level of urbanization, distribution of working population, educational level, industrial development and power development also plays a huge role in the process of rural-urban interaction. In general, a high level of urbanization means more people living in urban areas, which leads to higher demand for primary goods from the surrounding rural settlements. Moreover, a higher level of urbanization means more construction activities in urban areas, which require a lot of daily labour and are usually supplied from the nearby rural settlements. Share of the population in the working age-group is also important here. A higher share of population in the working age-group means more people are in demand of employment. Since the scope of employment opportunities in rural area are very limited with minimum non-farm occupation so people will depend on the nearby

urban centre to get absorbed in urban informal sector. In Siliguri, informal activities like hawkers, domestic help, construction workers, daily labourers, workers in hotels, restaurants and malls attract huge number of people from its surrounding rural areas who commute daily for their village to Siliguri in search of some gainful employment. Similarly, the level of education also plays a vital role in the process of rural-urban interaction. An educated person is in a better position to venture into new economic opportunities compared to an uneducated person. In the study area, the literacy rate of the villages located closer to Siliguri Municipal Corporation is relatively higher compared to those villages which are located at far-off places. A higher level of industrial development will lead to better rural-urban interaction. There are many industries which are either large scale or small and medium enterprises which depend on the rural areas for their supply of raw materials. Although within the study area there is absence of any big industrial unit, tourism, food processing, tea and timber industry have traditionally prospered in and around Siliguri. Since these are all labour intensive industries, they attract a lot of people from the surrounding rural areas for employment purpose.

4.6 References

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CHAPTER 5:

DEVELOPMENT OF TRANSPORT NETWORK AND ASSOCIATED LAND USE AND LAND COVER CHANGE

5.1 Introduction

The regional transport network is a collection of multiple and varied point-to-point movement that takes place between several points of origin and destination. Siliguri Municipal Corporation and its surrounding provides high-quality marketing, administrative, medical, educational, welfare, leisure and recreational and other services to urban residents as well as the rural residents of its embracing areas. Popularly known as the "gateway to the North-eastern India", Siliguri enjoys the status of administrative, economic and educational capital of northern part of West Bengal. Consequently over the last two-three decades, the study area has witnessed changes in the population composition along with significant economic advancements.

Being the centre of all activities, there is a high degree of mobility of people as well as goods between the city area and the surrounding fringe area/outskirts which automatically creates demand for better quality transportation network for easy movement of people as well as goods along with easy access to goods and services. The villages of this sub-division and other adjacent areas are connected to the service area of city via roads and railway lines. Network analysis thus seems relevant in the present study as it makes for an important assessment technique in transportation analysis. Network analysis portrays the arrangement of vertices and their relationships with plotlines, appears relevant for the study. In this regard, by using graph theory the present study aims to analyze the road connectivity and network accessibility of the villages within the sub-division. In addition, connectivity index, shimbel index and associated number have been used to define the magnitude of network accessibility in the study area. It has been observed that geographic imbalances in connectivity and network accessibility are evident. The results indicate that while the overall road network connectivity is more or less good, it is Siliguri Municipal Corporation and its outskirt villages that have the maximum accessibility and well-organized connectivity. However, the villages that are remotely located far away from Siliguri Municipal Corporation suffer poor accessibility and poor road network. Based on the above discussion it can be suggested that there is an urgent need to improve the connectivity and accessibility of the villages that lack proper connectivity and accessibility for unhindered development of the study area in the coming future.

5.2 Transport network in the study area

The flow of goods and services is highly dependent on the transportation system which in turn stimulates the overall socio-economic development of an area. Transportation system is indispensable to any part of the world. The improved road system improves accessibility and mobility, thus greatly reducing travel time and travel costs. The improvement of the road network not only facilitates easy movement of people and goods, but also promotes overall socio-economic development as a result of improved access to education, medical services, employment opportunities and consequent increase in family income and poverty reduction. Siliguri is situated in the northern part of West Bengal and connects the north-east India to the rest of the country. Neighbouring countries like Nepal, Bhutan and Bangladesh rely heavily on Siliguri for trade and commerce as a result the road network plays a vital role in the development process. To fulfil the objective, the study has been carried on using some secondary data sources like village level map of Siliguri sub-division published by the Census of India, 2011.

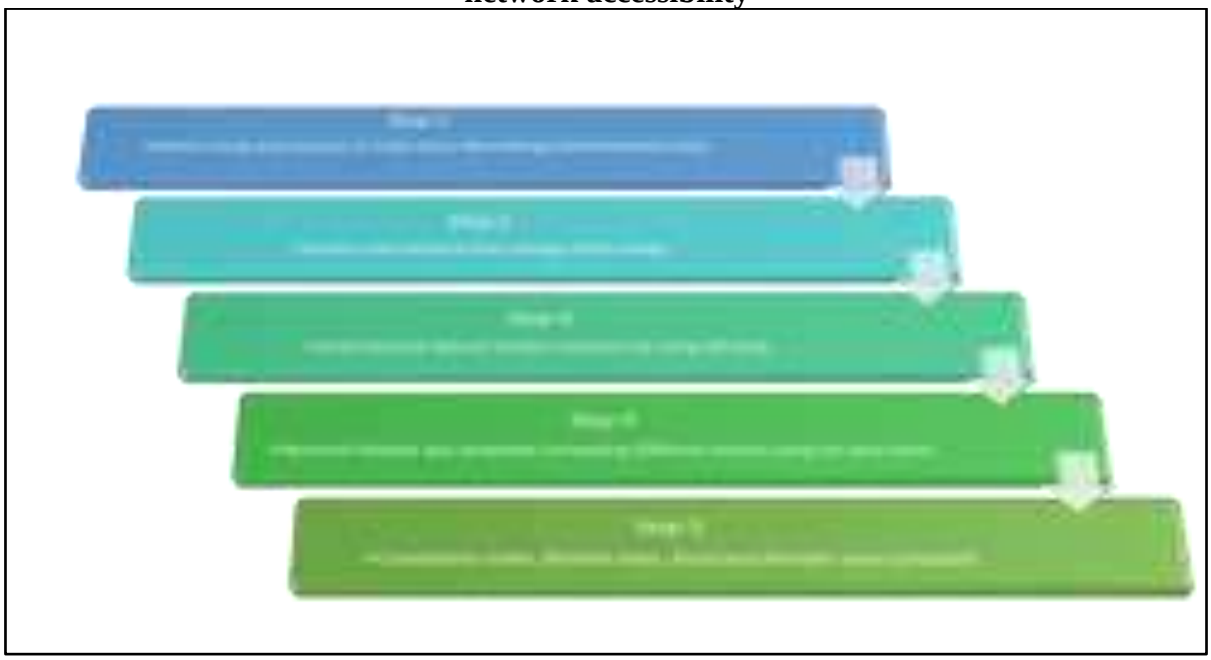
Map No. 5.1 Road and rail network in the study area

Source: Prepared by the Researcher.

This road and rail network map has been prepared from the West Bengal Administrative Atlas and Census of India, 2011. All villages in Siliguri Sub-division on this map have been manually digitized after geo-referencing the map in Arc GIS v.10.5 software with UTM projection. The roads are manually digitized from Google Earth Platforms followed by preparation of a network dataset by creating nodes and arcs in the selected villages. For calculation of different indices, the nodes and arcs are counted on the basis of important road junctions. For identifying the accessibility and connectivity of 50 nodes various measures such as Connectivity Index, Shimbel Index, Associated Number, and Average Shortest Path Length

have been computed using Microsoft Excel v.2007. For better understanding, maps are further elaborated by using Inverse Distance Weighted (IDW) method in the ArcGIS platform as these maps are very efficient in identifying the most accessible and the most efficient network zones in the study area.

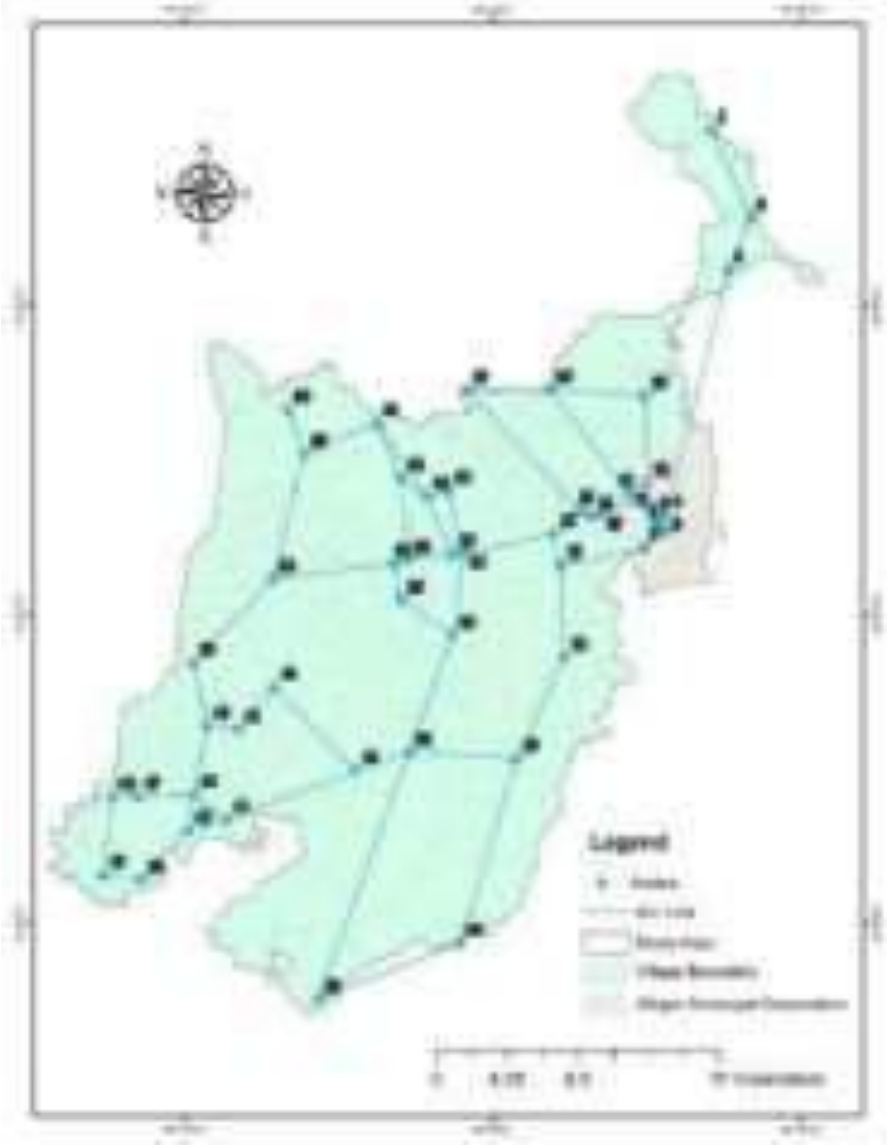
Fig. No. 5.1 Flow chart of the study showing the methodological hierarchy of road network accessibility



5.3 Transport network model based on graph theory

In order to analyze the transport network, it is necessary to idealize the network in the form of a graph. In topological networks, several components are recognized that describe the observed relationships in the network and evaluate the accessibility and performance of the network analysis. The vertices or nodes are points on the basic elements of the graph that are located at the junction of two or more areas. These nodes are connected to one another through lines, called edges. Different indices such as Alpha Index, Beta Index, Gama Index and Cyclomatic Number have been used to evaluate the degree of connectivity. The present study is based on some selected indices of graph theory. Total 50 nodes have been taken into consideration based on important road junctions of the study area.

Map No. 5.2 Road network along with the nodes in the study area



Source: Prepared by the Researcher.

Alpha Index (a) is one of the significant measures of network connectivity. The value of Alpha index varies within 0 to 1. The value 0 indicates lesser connectivity and the value 1 means higher connectivity. This index is also expressed in percentile.

Alpha Index (a) is calculated as

Alpha Index$(\alpha) = (e - v + p)/(2v - 5)$

Beta Index (b) is another important measurement of network connectivity. It is the ratio between the number of links and nodes. The value of this index varies within 0 to 1. Where 0 indicates minimum connectivity and 1 means maximum connectivity. Beta index value exceeds 1 when the graph is complex.

Beta Index (b) is calculated as:

$$\text{Beta Index}(\beta) = e/v$$

Gamma Index (c) is the ratio between the number of observed links and the number of possible links of a graph. The value of gamma index also varies within 0 to 1. Where higher the value grater the connectivity and vice versa. Gamma Index (c) is computed as follows:

$$\text{Gamma Index}(\gamma) = e/3(v-2)$$

Pi Index (p) is used to analyze the relationship between the transportation network as a whole and its diameter. Higher the value of Pi index means higher the connectivity and vice versa which is computed as:

$$\text{Pi Index } (\pi) = \frac{\text{total distance of network}}{\text{distance of diameter}}$$

Eta Index (g) is network's cumulative mileage ratio to the number of linkages observed. Low eta value indicates a complex network. Eta value decreases when adding new nodes, which is express as:

$$\text{Eta Index } (\eta) = \frac{\text{total network distance}}{\text{number of arcs}}$$

Grid Tree Pattern (GTP) Index is used to showing the pattern of the network. In this index, 0–0.5 indicates tree pattern, 0.5–1 indicates grid pattern, and 1–2 indicates the delta pattern which is calculated as follows:

$$\text{GTP Index} = \frac{e-v+p}{(\sqrt{v}-1)^2}$$

The degree of Connectivity (DC) is a simple measurement of network connectivity. It compares the relative position of an observed network's connectivity on a scale limited by maximum connectivity ratio. A higher value of the degree of connectivity means a higher level of connectivity. The degree of connectivity index is computed as:

$$\text{Degree of Connectivity (DC)} = \frac{v(v-1)}{2/e}$$

Cyclomatic number (l) is also an elementary measure of network connectivity. It is show by counting the number of basic circuits existing in a graph. A higher value indicates a higher degree of connectivity. The Cyclomatic number of the study area is calculated as:

$$\text{Cyclomatic Number } (\mu) = e - v + p$$

*e is the number of edges, v is the number of nodes, p is the number of non-connected sub graphs.

Accessibility, like connectivity, is another important attribute of a transportation structure. Therefore, *connectivity matrix* is one of the important indicators of level of accessibility of a given area. Places with high connectivity are considered as the best location whereas lower value of connectivity index indicates lower connectivity and vice-a-versa. Connectivity matrix is represented by the connectivity of node (i) with adjacent nodes (j). If two nodes are directly connected by an edge, the value is equal to 1 and if two nodes are not directly connected by an edge, the value is equal to zero. The Connectivity Matrix is thus represented as:

$$CI = \sum Cij,$$

where, CI is the Connectivity Index, Cij indicates the direct connection between i^{th} and j^{th} nodes (either 1 or 0) and n represents the number of nodes.

Shimbel Index is used to calculate the accessibility of the network. The index represents the summing-up of the length of all the shortest path distances among all links in a network structure. Lower the value of Shimbel Index higher is the accessibility and vice versa.

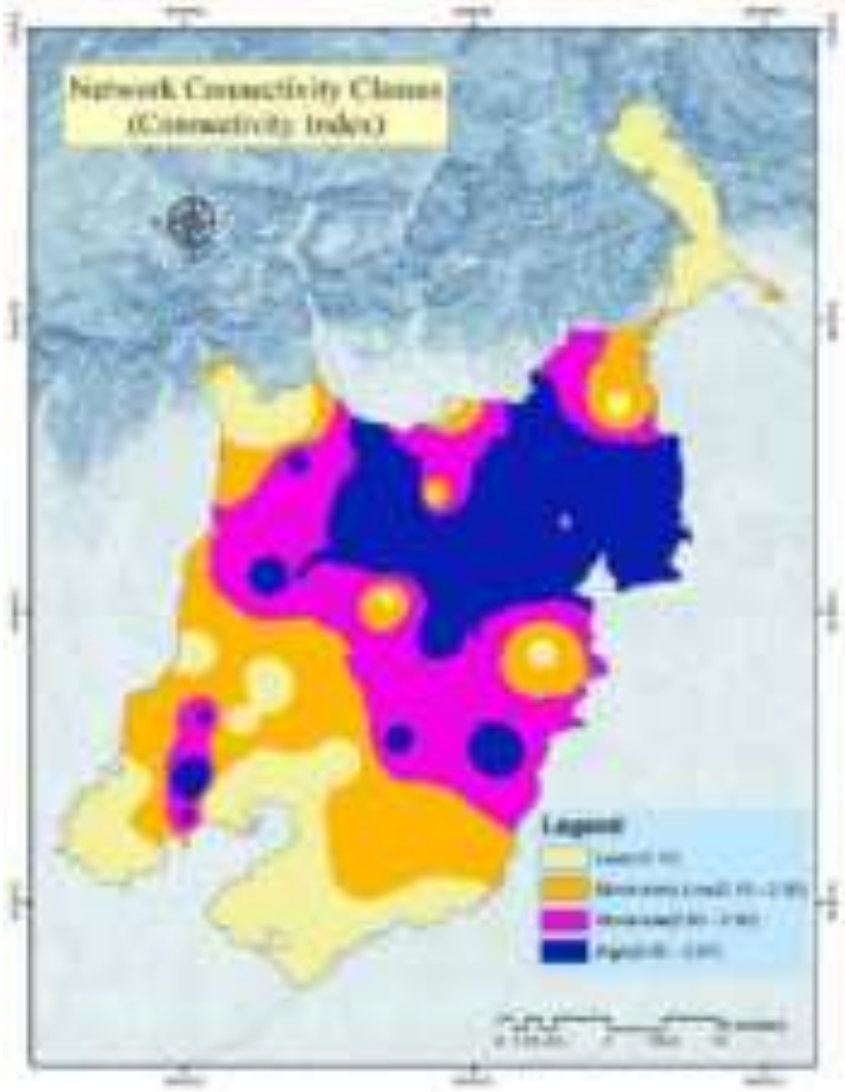
Shimbel Index is expressed as:

$$\text{SI} = \sum_{(i=1)}^{n} dij,$$

Where, SI is the Shimbel Index, dij indicates the shortest distance between i and j nodes and n represent the number of nodes.

Associated Number is yet another simple elementary measure of network accessibility. It is also known as Centrality Index. It is defined as the maximum distance from one location to all other places. It involves the number of arcs needed to connect the farthest nodes. The Associated Number is the highest number for each row. High value of the Associated Number indicates lower accessibility and vice versa.

Map No. 5.3 Network connectivity classes in the study area

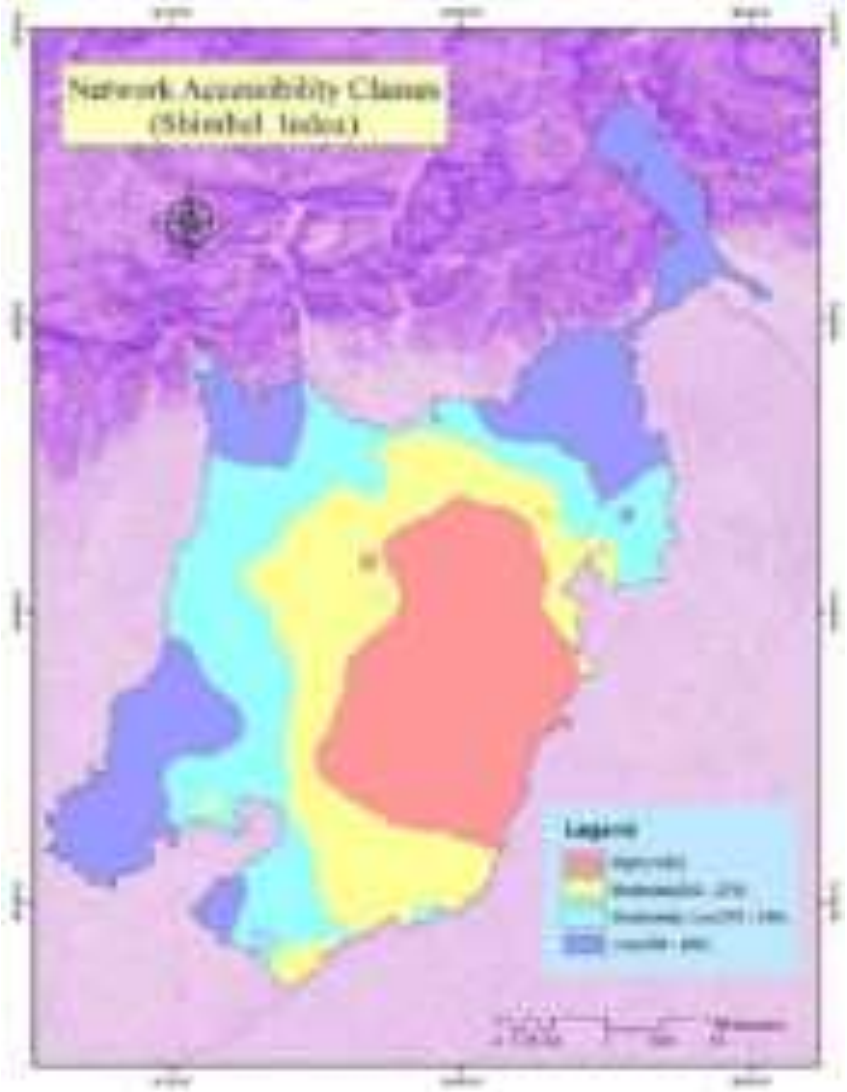


Source: Prepared by the Researcher.

In the map given above, network connectivity classes have been derived from connectivity matrix which basically shows the level of connectivity between two nodes. If two nodes are connected directly then the connectivity value will be 1, otherwise it will be 0. Thus, by calculating the values for all nodes it has been found that the highest connectivity value is 4 for the nodes located at Air View more and Darjeeling more of Siliguri Municipal Corporation, Khaprail more near Matigara bazar, Bagdogra, Khoribari and Ghoshpukur while the lowest connectivity value of 1 has been observed for distant nodes at Kalijhora and Bara Chenga. An accessibility map has also been prepared by showing 4 connectivity classes like high connectivity (2.90-3.97), moderate connectivity (2.60-2.90), moderately low connectivity (2.16-2.60) and very low connectivity (less than 2.16). However, from the above map we can say that the nodes located at the middle and eastern region of the Siliguri sub-division like Bagdogra, Sivmandir, Matigara, Naxalbari, Ghoshpukur, Kharibari and nodes under Siliguri

Municipal Corporation have very high connectivity; on the other hand the nodes situated at southern, south-western, north-western and north-eastern region of the Siliguri sub-division like Bidhannagar, Galgalia, Panitanki, Tari, Bara Chenga, Panighata, Sivok Bazar and Kalijhora have low connectivity with other regions of the map. The villages and nodes situated at the middle-eastern side of the map seem to be more connected with each other with a well-formed road network. However, it is to be noted that with increasing distance from Siliguri Municipal Corporation there is a decline in the connectivity status.

Map No. 5.4 Network accessibility classes in the study area

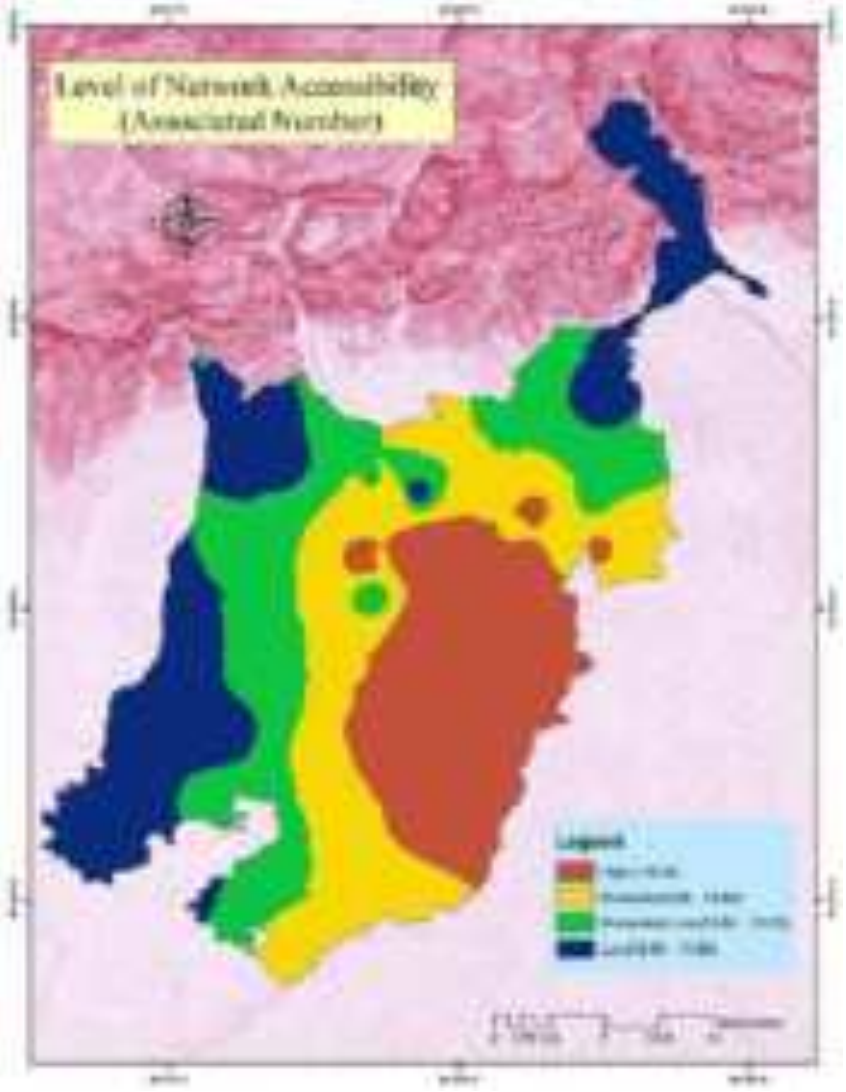


Source: Prepared by the Researcher.

Shimbel index (S.I) values for each node have been calculated by adding all the topologically shortest path distance among all nodes of the network graph. After calculating all the values it was found that the lowest S.I of 199 was for the node located at Bagdogra and the highest S.I of 452 was for the node located at Kalijhora. A map has also been prepared having 4 S.I classes showing high accessibility (less than 243) for the nodes at Ghoshpukur,

Baraigachh, Bagdogra, Shiv Mandir; moderate accessibility (243-270) for the nodes at Jalpai More and Air View More of Siliguri Municipal Corporation and Naxalbari, moderately low (270-296) for the nodes at Darjeeling More of Siliguri Municipal Corporation, Matigara, Haftia, Pataram, Dohaguri etc. and low accessibility (296-450) for the nodes at Bara Chenga, Champasari, Sivok Bazar, kalijhora, Tari, Galgalia etc. However, the only Municipal Corporation of this subdivision i.e., Siliguri Municipal Corporation falls mostly under moderately accessible zone as it is quite hard to reach the farthest nodes of the sub-division from Siliguri Municipal Corporation whereas nodes at Sivmandir and Bagdogra are comparatively more accessible because of their intermediate position and the passing of National Highway. Moreover, from the above map it can be comprehended that the middle region of Siliguri sub-division is more accessible and as we move outward from this region the accessibility decreases with increasing distance.

Map No. 5.5 Level of network accessibility (Associated Number) in the study area



Source: Prepared by the Researcher.

Associated Number is the topological distance of a node that connects it with the most distant node. After calculating all the associated numbers, it was found that the lowest associated number is 8 for the nodes at Bagdogra, Mahipal and Mahammadbaksa village and the highest is 14 for the nodes at Kalijhora and Galgalia. A map has also been prepared showing a total of four classes of associated numbers, i.e., high (less than 9.86) comprising node like Bagdogra, Jalpai More of Siliguri Municipal Corporation, Khaprail More etc.; moderate network accessibility (9.86-10.94) for the nodes at Venus More of Siliguri Municipal Corporation, Haribhita etc.; moderately low (10.94-12) for the nodes at Kharibari, Trihana, Sevok More and Darjeeling More of Siliguri Municipal Corporation etc.; low (12-13.99) for the nodes at Sivok bazar, Kalijhora, Bara Chenga, Galgalia etc. It is to be noted that the most distant places have the most associated number; at the same time the nodes situated at the middle region of the sub-division have less associated number because these are the central points and from these nodes it is very much easy to travel anywhere.

Owing to the elongated shape of Siliguri sub-division, the network graph also takes an elongated shape. The study area comprises well forested tracks, mountains and hills, foothills or terai areas and cultivable plain areas. The network graph and the accessibility analysis show that the mountainous and adjoining foothill areas enjoy lesser accessibility than the plain areas. On the other hand, road network is very much developed in the densely populated municipal areas of Siliguri. However, beyond the densely populated municipality area of Siliguri, the road networks remain under developed. Development of road network in forested areas, mountains and hills not just requires huge capital investment and man power but is also environmentally taxing at the same time especially in the already vulnerable mountain and hill ecosystem. These impediments however remain absent in plain areas giving way to better developed road networks. Due to the elongated shape of the network graph the two corners i.e., north eastern and the south western region of the sub-division remain less accessible in nature, whereas the middle region of the sub-division is well connected and accessible because of their locational advantage. Here lies one important aspect about the Sliguri Municipal Corporation, i.e., from the perspective of connectivity index this municipal region is well connected and falls under high accessible zone but from the perspective of Shimbel index and Associated Number the same area is not very accessible and falls under moderate or moderately low accessible zone, this ambiguous result is due the elongated shape of the network graph. Due to the well-connected road network Siliguri Municipal Corporation has high connectivity but its location makes it moderately accessible from other part of the sub-division. But from the broader aspect

it can be said that Bagdogra and its adjoining areas are the most accessible areas of this sub-division.

5.4 Road density network analysis

Roadways are the main lines of communication in the study area. However, the availability of roads is not uniform over the entire region. Normally, it is observed that areas which are at the close proximity of a large urban centre have high road density. As one moves away from a large urban centre, the availability of good quality roads tends to decline. In this section road density of the study area has been calculated to get an idea about the disparity in road development in Siliguri sub-division. Road network density refers to the ratio of the total length of the centreline of roads to the land area.

The fundamental equation is

$$\mathrm{D} = \sum_{\mathrm{i}=1}^{n} L_i / \sum_{\mathrm{j}=1}^{n} A_j$$

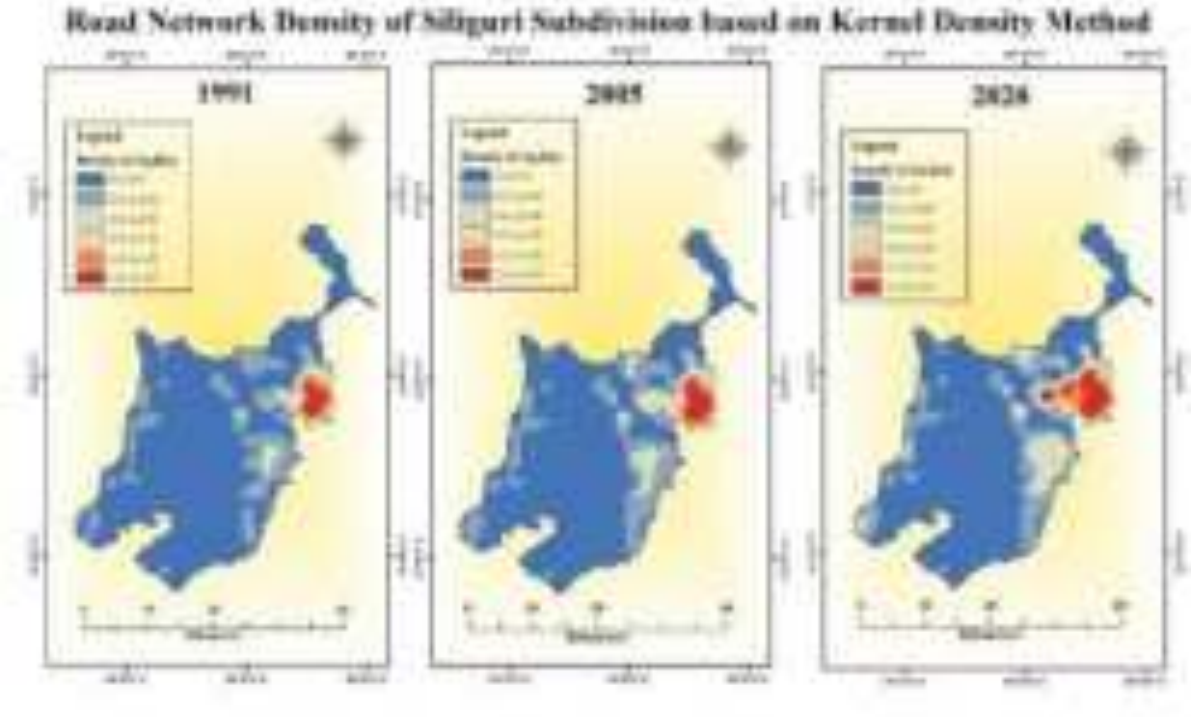
Where, D is the road density in km/km2,$\sum_{i=1}^{n} L$ is the length of the road centreline in km, and$\sum_{j=1}^{n} A$ is theland area in km2.

The kernel density is a widely used density analysis technique for spatial analysis that fits each point or line over a smooth tapering surface using characteristics from points or polyline data to calculate the value of a unit area. In the ArcGIS density analysis tool, the population field can be used to weight some features more heavily than others, depending on their meaning or to allow one point to represent several observations. By using default bandwidths, one can calculate the length of every road, and kernel density analysis was used to produce road network density maps. The area within which the density is determined is known as the search radius. The units are based on the output spatial reference's linear unit of projection. When an output area unit's factor is specified, it converts the unit of both length and area. For Example, if the linear unit is meter, the output area unit will default to square kilometers and the resulting line density unit will convert to kilometer per square kilometer. The end result, comparing an area scale factor of meters to kilometers, will be the density values being different by a multiplier of 1000.

To collect the road network data for different time period data were derived from the Open Street Map database in vector data format associated with the spatial distribution of the roads. For the network analysis of Siliguri sub-division, vector dataset is added in ArcGIS

software. Hence this analysis in done for three time periods which is followed by block level analysis. Then zone wise road network analysis has also been done.

Map No. 5.6 Road network density of Siliguri sub-division by Kernel density method

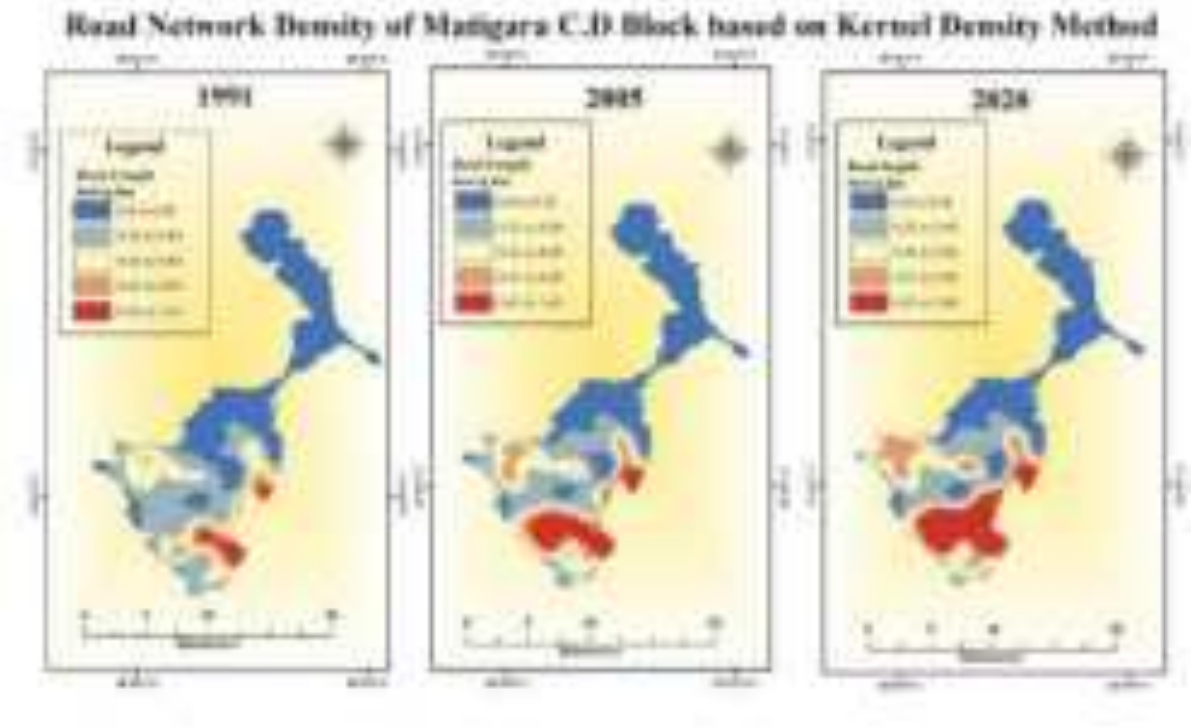


Source: Prepared by Researcher

Map 5.6 shows the road network density of Siliguri sub-division for three-time period viz. 1991, 2005 and 2020 respectively. Road network density map of Siliguri sub-division reveal that road network density in 1991 and 2005 was relatively low in comparison to 2020 (Map No. 5.6). Road density in the study area ranges from 0 to 1.81 km/sq. km. in the year 1991. The study area experienced a gradual increase in its road density with the highest value increasing to 1.94 km/sq. km. and 2.21 km/sq. km. in 2005 and 2020 respectively. It is worth mentioning that the road density in and around Siliguri Municipal Corporation area has consistently remained higher for three consecutive time period. It is also observed that the road density decreases in the study area with increasing distance from Siliguri Municipal Corporation. The concentration of road network near Siliguri Municipal Corporation could be attributed to the concentration of trade and commerce in the area. With time the population also witnessed gradual increase in the surrounding area which demands efficient development of transport facilities with greater connectivity at the surroundings. Among four blocks of the study area Matigara recorded the highest increase in road density from 1991 to 2020.

In the following section the road network density for each of the four blocks of the study area has been calculated for 1991, 2005 and 2020 respectively.

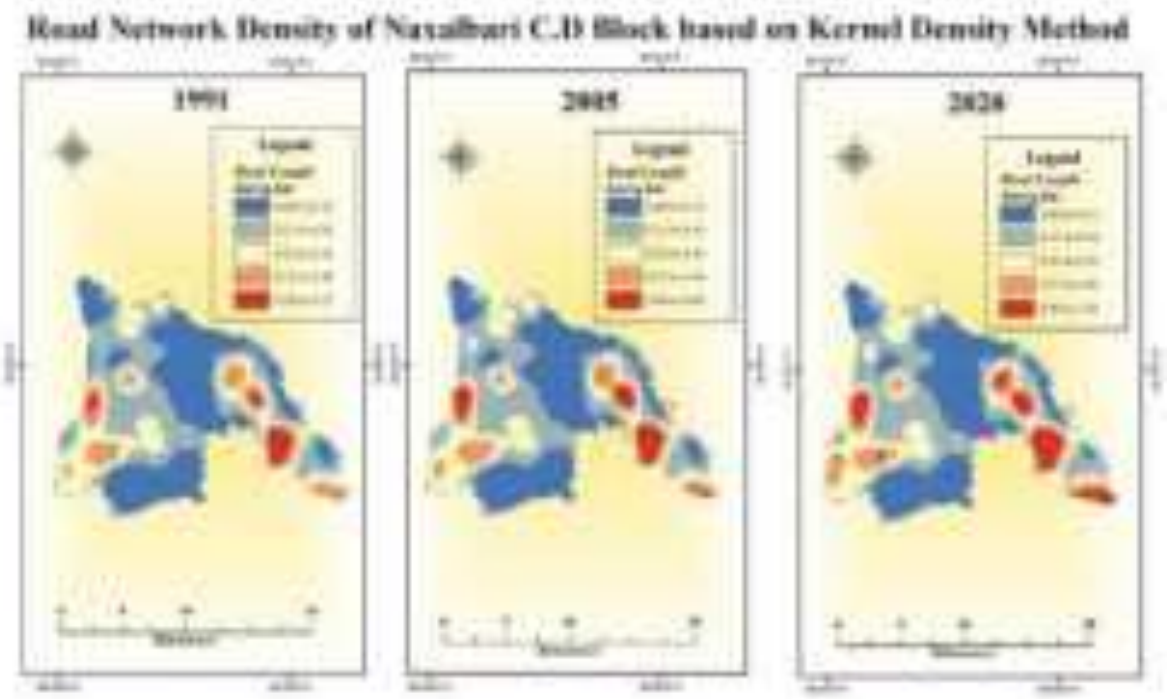
Map No. 5.7 Temporal change of road network density: Matigara



Source: Prepared by the Researcher.

Map No 5.7 shows the road network density of Matigara block in 1991, 2005 and 2020. It can be seen that the road density in Matigara block has increased by leaps and bounds from 1991 to 2020. The rate of increase was lot higher during 2005-2020 compared to 1991 -2005. The road density in Matigara block ranges from 0 to 1.36 km/sq. km. in 1991 which increases up to 1.62km/sq. km. in 2005. The Matigara block experienced further increase in terms of its road density in 2020 with density ranging between 0 to 2 km/sq. km. The southern part of this block recorded highest density than the northern part throughout these period. In 1991 a small portion of south-east corner of Matigara block had the highest road density. From the south-east corner, the highest road density zone captures almost the whole southern part of this block as depicted by the road density map for the year 2020. It is worth mentioning that Tomba and Patiram have the highest road density in Matigara due to the construction of a new bridge over the river Mahananda in that area.

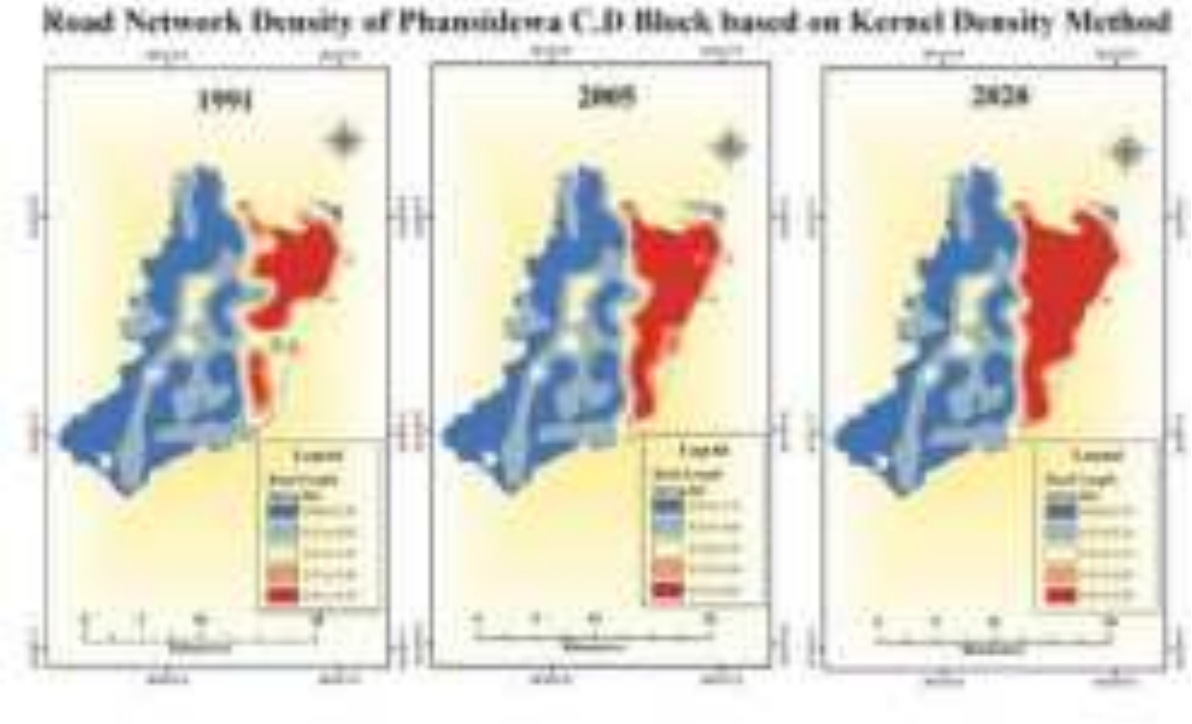
Map No. 5.8 Temporal change of road network density: Naxalbari



Source: Prepared by the Researcher.

Map No. 5.8 reveals the road density of Naxalbari block in 1991 2005 and 2020. The road density in Naxalbari block ranges from 0 to 0.72 km/sq. km. in the year 1991. Naxalbari experiences a relatively low increase in terms of road density in 2005 and 2020 ranging from 0 to 0.80km/sq. km. and 0 to1.02 km/sq. km. respectively. The highest road density i.e. greater than 0.49 km/sq. km. is observed over Uttar Bagdogra and Dakshin Bagdogra census towns in the eastern part of the block and near Jeni, Bhimram and Naxalbari in the western part.

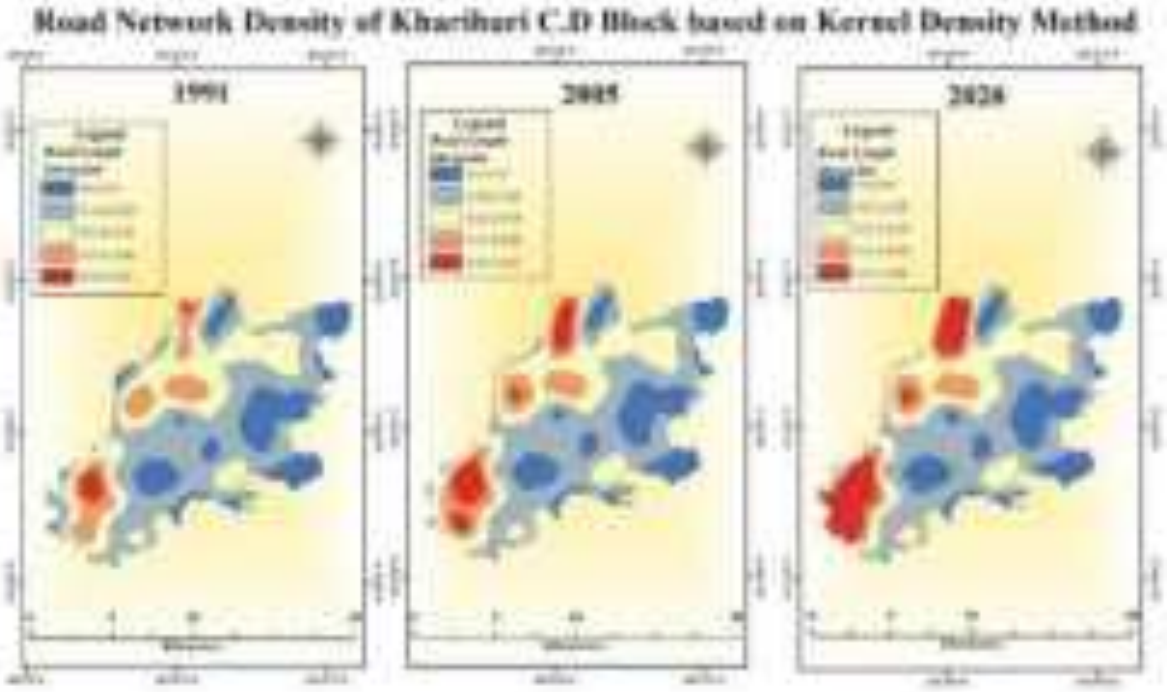
Map No. 5.9 Temporal change of road network density: Phansidewa



Source: Prepared by the Researcher.

Road network density of Phansidewa block of 1991, 2005 and 2020 is shown in Map No. 5.9. The road density in Phansidewa block ranges from 0 to 0.79 km/sq. km. in 1991 and 0 to 0.83km/sq. km. in 2005 and 0 to 0.94km/sq. km. in 2020. Phansidewa block recorded very low increase in road density from 1991 to 2020. The highest road density is observed over Purba Banshgoan, Madhya Banshgoan, Paschim Banshgoan due to the presence of an old village market centre. Later in the years 2005 and 2020 these two separate nucleus merged into a one large area of high road density covering the whole eastern part of this block after the construction of Fulbari-Ghoshpukur bypass road.

Map No. 5.10 Temporal change of road network density: Kharibari

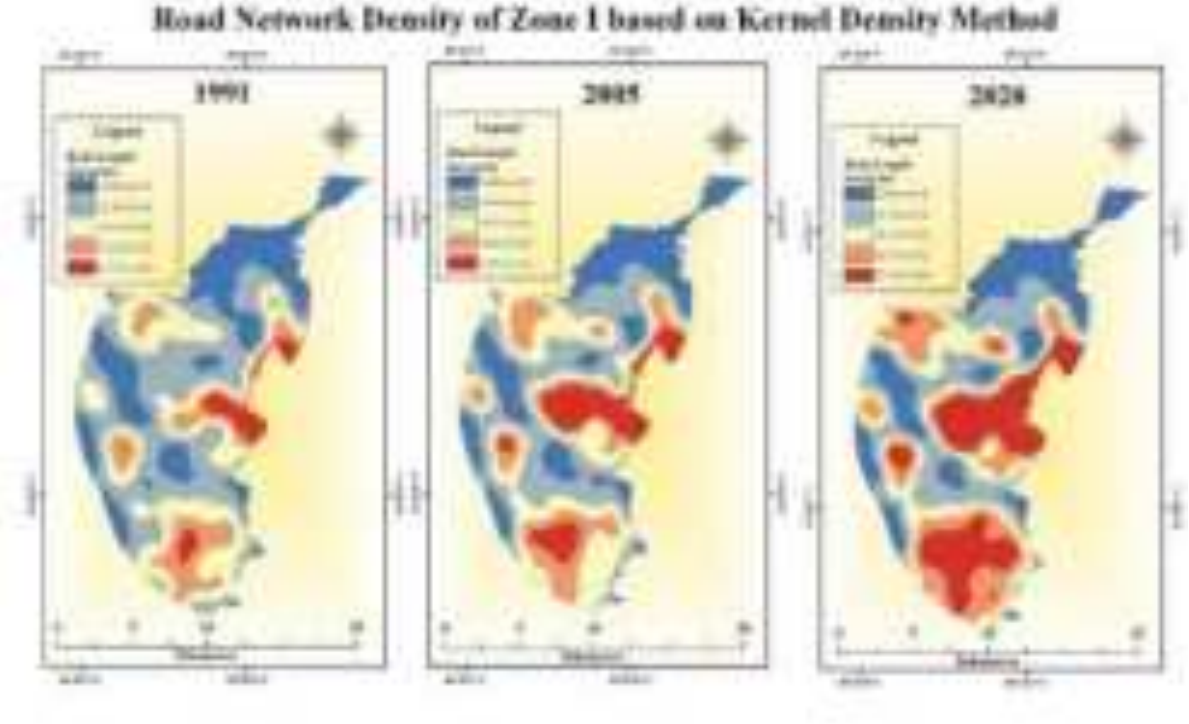


Source: Prepared by the Researcher.

Map No. 5.10 indicates that road network density of Kharibari block has shown a substantial improvement from 1991-2020. It can be seen that the rate of increase in road density was higher during 2005-2020 compared to 1991-2005. Road density in Kharibari block ranges from 0 to 0.51km/sq. km. in 1991. As depicted from the above maps, Kharibari experienced a gradual increase in road density in 2005 and 2020 ranging 0 to 0.61 km/sq. km. and 0 to 0.82 km/sq. km. respectively. The highest road density zone i.e. greater than 0.41 km/sq. km. was observed around Rangmuni, Gayen and Maynaguri in the south-western part and in the surrounding areas of Madanand Uttar Ramadhan in the north-western part of Kharibari block.

In this section, the road network density has been shown for the three zones delineated on the basis of distance from the outer boundary of Siliguri Municipal Corporation for 1991, 2005 and 2020 respectively.

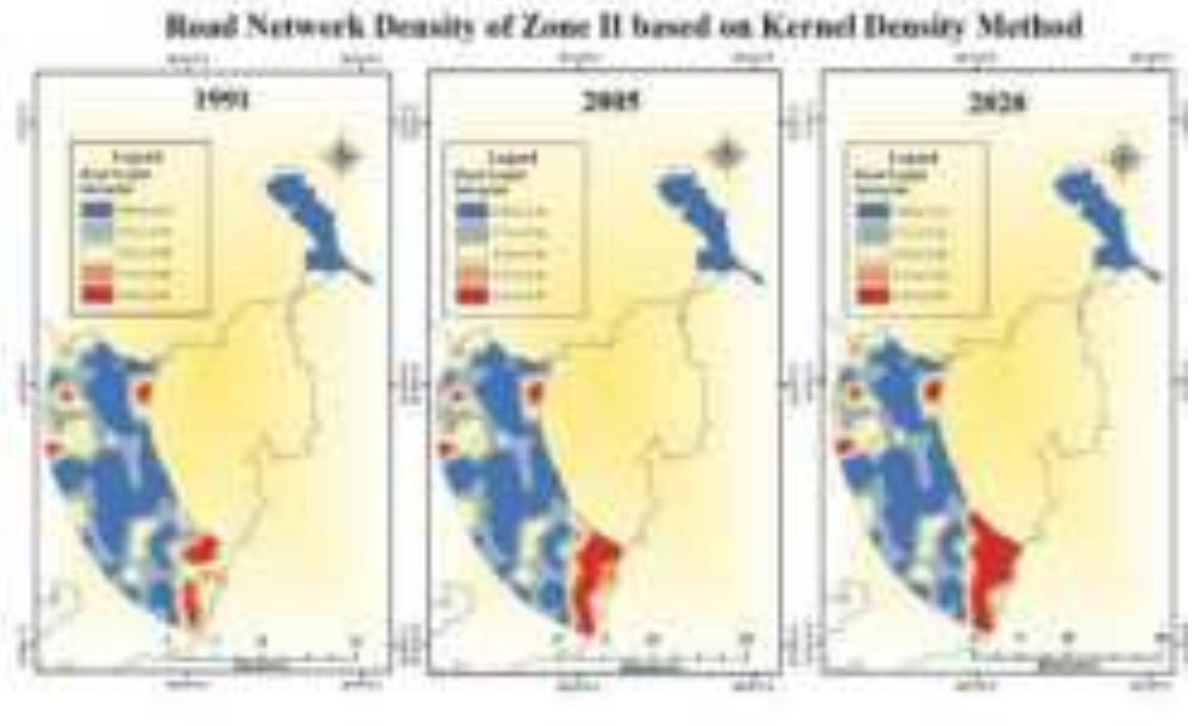
Map No. 5.11 Temporal change of road network density: Zone I



Source: Prepared by the Researcher.

Map No. 5.11 shows the road network density of Zone I in 1991, 2005 and 2020. It can be seen that the road density of this Zone increased very rapidly from 1991 to 2020. The rate of increase was much higher during 2005-2020 compared to 1991 -2005. The road density in Zone I range from 0 to 1.44 km/sq. km. in 1991 which increases up to 1.62 km/sq. km. in 2005. This Zone experienced further increase in terms of its road density in 2020 with density ranging from 0 to 2 km/sq. km. The middle and southern part of this zone recorded highest density compared to the northern part throughout this time period. This is because the northern part is heavily forested. In 1991, middle and southern outer edge of Siliguri Municipal Corporation had the highest road density. With the passage of time this small edge continued to grow as the area with highest road density zone and captured almost the entire middle and southern part of this Zone in 2020. Ujanu, Lachka, Tomba, Patiram have the highest road density in this Zone due to the establishment of a shopping mall (City Centre) and construction of a new bridge over river Mahananda.

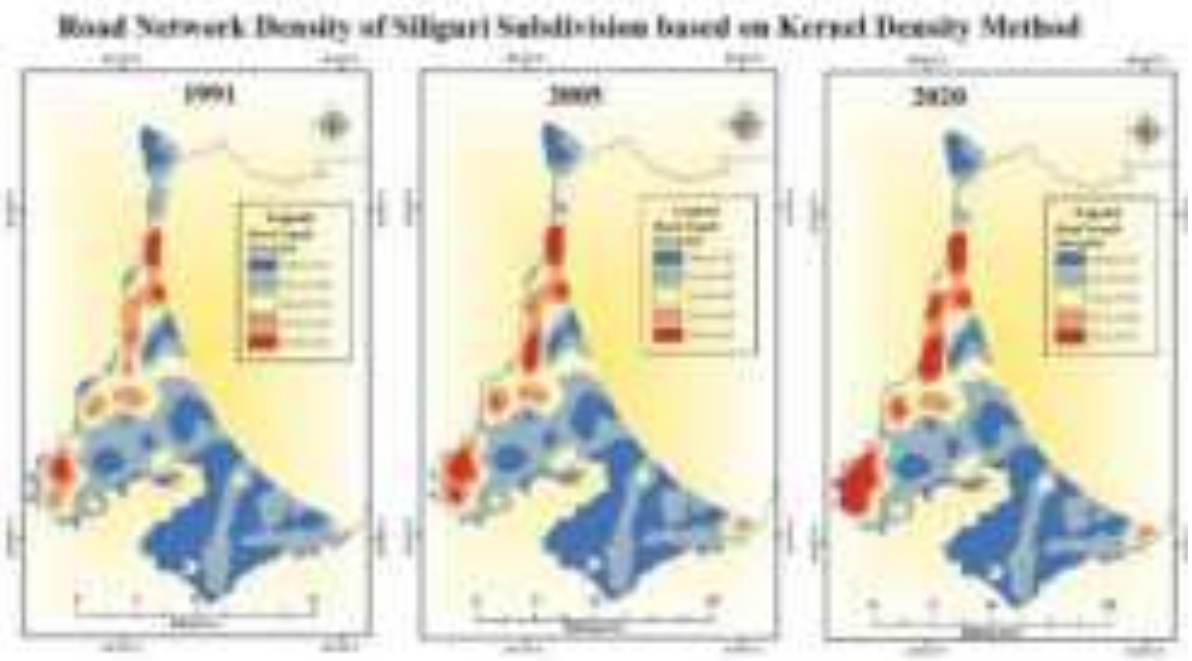
Map No. 5.12 Temporal change of road network density: Zone II



Source: Prepared by the Researcher.

Road network density of Zone II of 1991, 2005 and 2020 has been shown in the Map No. 5.12. The road density in Zone II ranges from 0 to 0.63km/sq. km. in 1991 and 0 to 0.70 km/sq. km. in 2005 and 0 to 0.85km/sq. km. in 2020. Zone II recorded very low increase in road density from 1991 to 2020. The highest road density is observed in surrounding areas of Purba Banshgoan, Madhya Banshgoan, Paschim Banshgoan in the southern part and Uttar Bagdogra and Dakshin Bagdogra in western part due to faster development of transport facilities with greater connectivity over the surrounding areas.

Map No. 5.13 Temporal change of road network density: Zone III



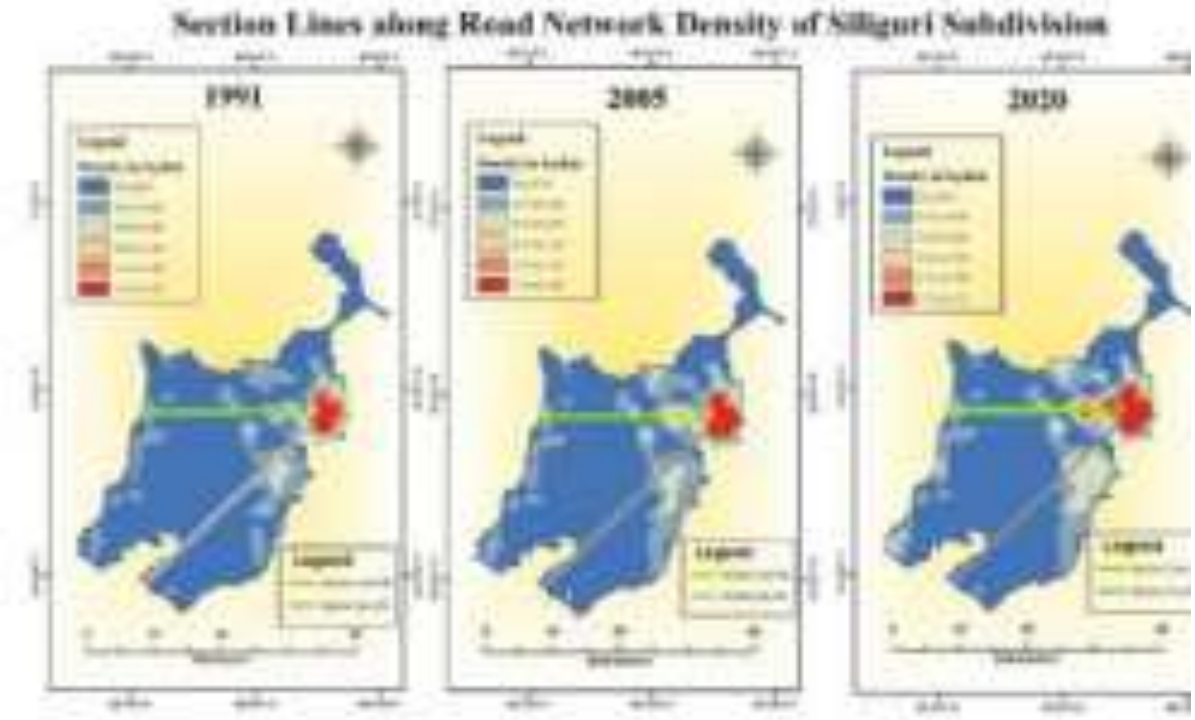
Source: Prepared by the Researcher.

Map No. 5.13 shows the road network density in Zone III. It indicates that road network density of Zone III in 1991, 2005 and 2020 witnessed a gradual change over the years. It can be seen that the rate of increase in road density was higher during 2005-2020 compared to 1991-2005. Road density in Zone III ranges from 0 to 0.52km/sq. km. in 1991. Zone III experienced a gradual increase in road density in 2005 and 2020 ranging 0 to 0.63km/sq. km. and 0 to 0.82 km/sq. km. respectively. The highest road density was found in areas surrounding Rangmuni, Gayen, Maynaguri in the south-western part and around Madan and Uttar Ramadhan in the north western part of this Zone. This can be attributed to the presence of business activity with the surrounding state like Bihar.

Road network is more developed over urban areas compared to rural areas. Road density is also much higher over urban areas compared to rural areas. Within rural areas also road density varies. Rural areas located close to large urban centres have relatively higher road density compared to rural areas located far away from the urban centre. In this part two section lines have been drawn from the outer boundary of Siliguri Municipal Corporation, one along the western direction (section line AB) and the second along the south-western (SW) direction (section line CD). Along these lines road density in km./sq.km. has been plotted for 1991, 2005 and 2020 respectively. For both the section lines and for all the years it is clearly visible that road density is maximum near the outer boundary of Siliguri Municipal Corporation and it has gradually decreased with increase in distance from outer boundary of Siliguri Municipal

Corporation. The regression equation showing the relationship between distance from outer boundary of Siliguri Municipal Corporation and road density is also negative for both the section lines for all the years. The coefficient of determination calculated is also significant, varying from 0.3304 to 0.6504. Therefore, the third hypothesis that road density decrease with an increase in distance from Siliguri Municipal Corporation is validated and proved and it can be said that within the study area with an increase in distance from Siliguri Municipal Corporation the road density also decreases.

Map No. 5.14 Section lines along road network density of Siliguri sub-division



Source: Prepared by the Researcher.

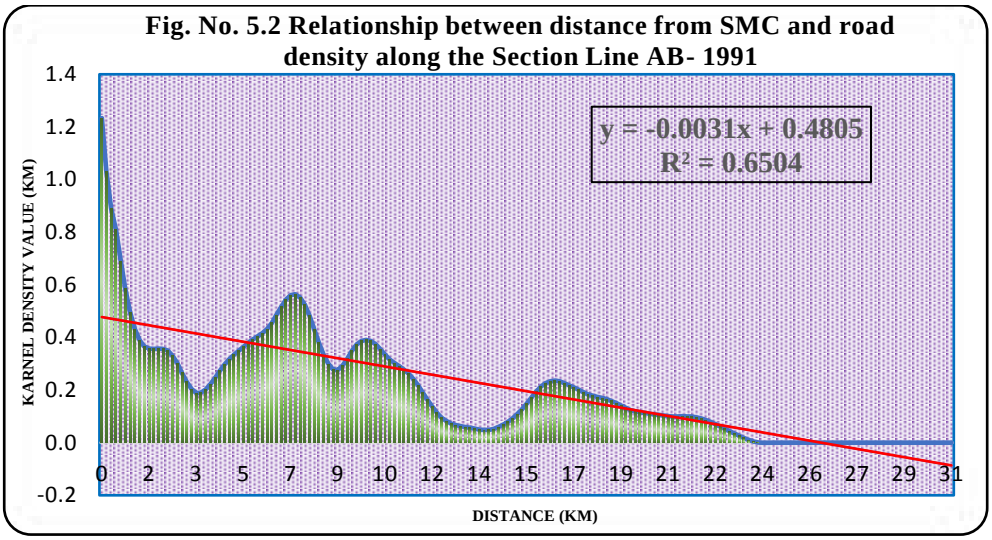


Fig. No. 5.2 Relationship between distance from SMC and road density along the Section Line AB- 1991

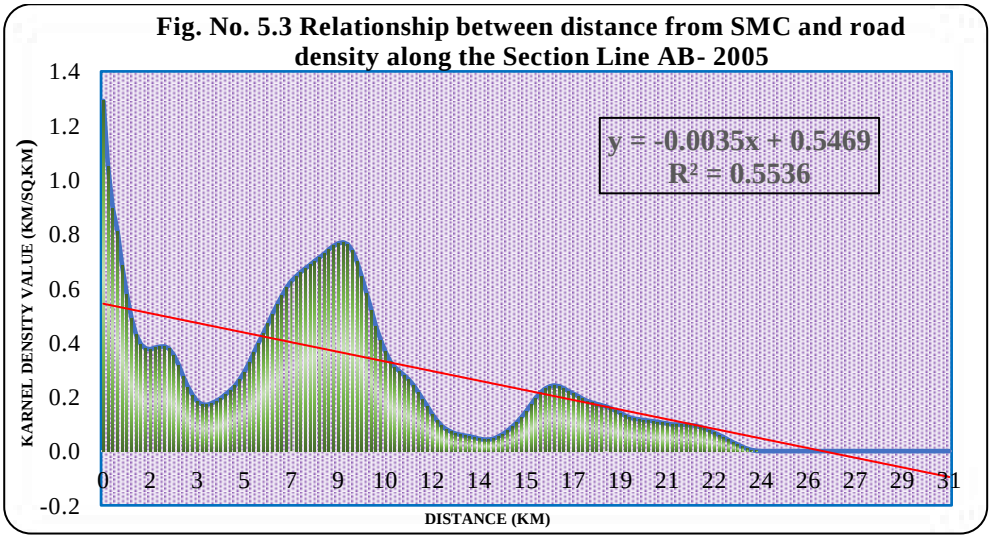


Fig. No. 5.3 Relationship between distance from SMC and road density along the Section Line AB- 2005

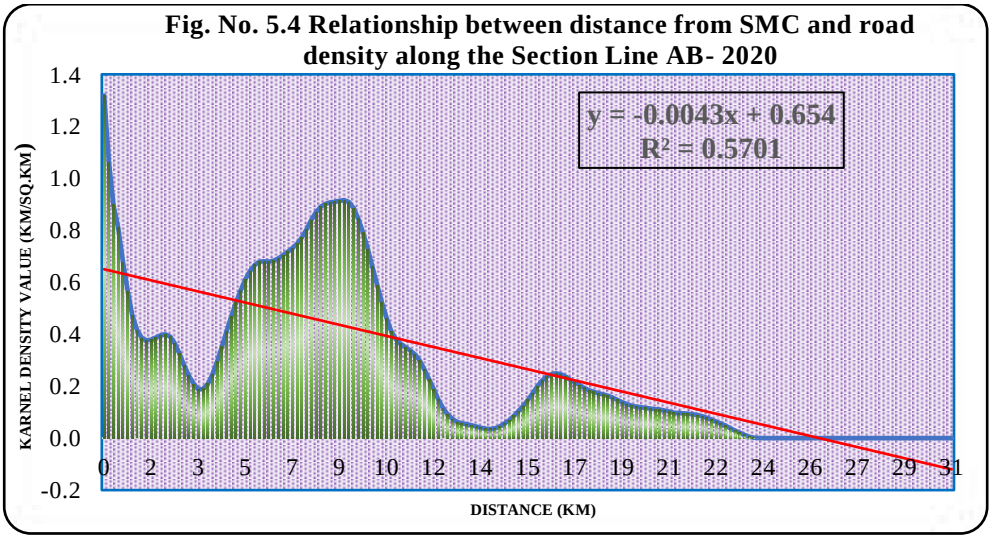


Fig. No. 5.4 Relationship between distance from SMC and road density along the Section Line AB- 2020

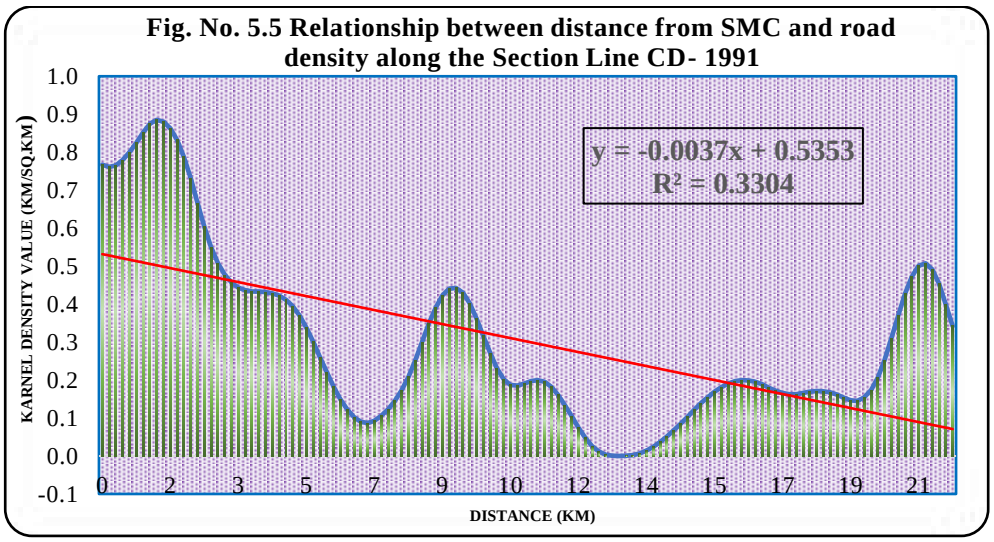


Fig. No. 5.5 Relationship between distance from SMC and road density along the Section Line CD- 1991
y = -0.0037x + 0.5353
R² = 0.3304
KARNEL DENSITY VALUE (KM/SQ.KM)
DISTANCE (KM)
1.0
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0.0
-0.1
0 2 3 5 7 9 10 12 14 15 17 19 21

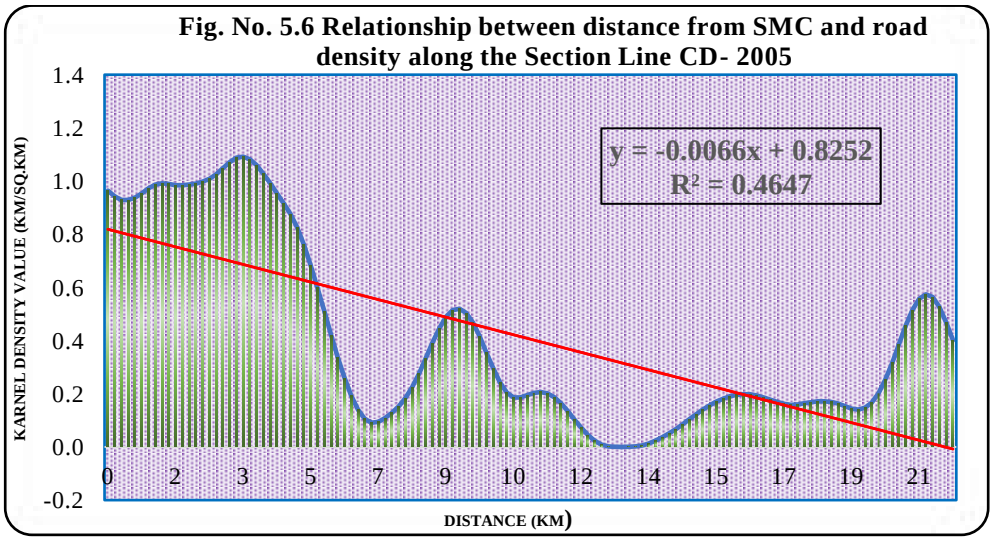


Fig. No. 5.6 Relationship between distance from SMC and road density along the Section Line CD- 2005
y = -0.0066x + 0.8252
R² = 0.4647
KARNEL DENSITY VALUE (KM/SQ.KM)
DISTANCE (KM)
1.4
1.2
1.0
0.8
0.6
0.4
0.2
0.0
-0.2
0 2 3 5 7 9 10 12 14 15 17 19 21

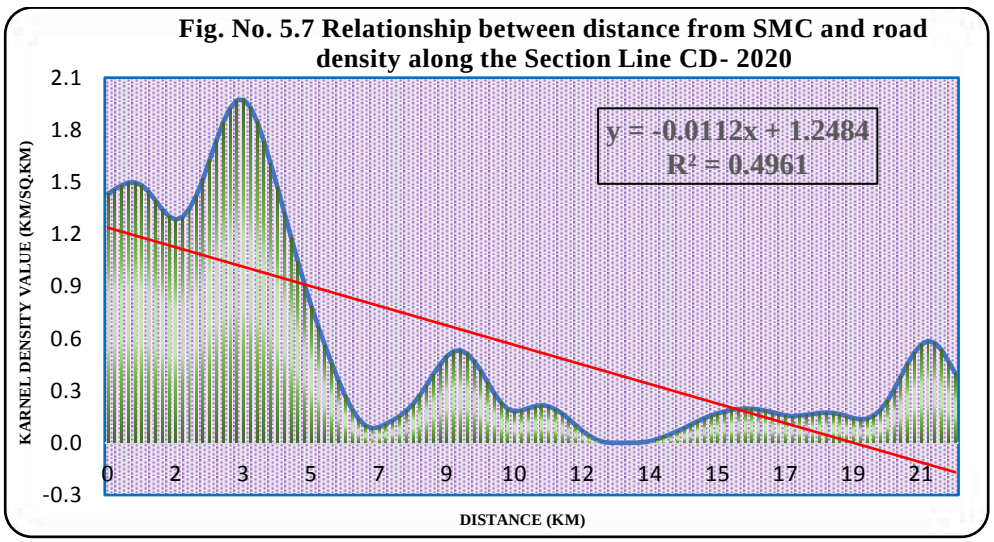


Fig. No. 5.7 Relationship between distance from SMC and road density along the Section Line CD- 2020
y = -0.0112x + 1.2484
R² = 0.4961
KARNEL DENSITY VALUE (KM/SQ.KM)
DISTANCE (KM)
2.1
1.8
1.5
1.2
0.9
0.6
0.3
0.0
-0.3
0 2 3 5 7 9 10 12 14 15 17 19 21

5.5 Land use and land cover analysis

Developmental activities in the recent years have inflicted a diverse range of environmental changes throughout the world, more so among the third world countries. While majority of these changes are human induced some are caused naturally. Urbanization and development are two sides of the same coin and has a cause and effect relationship. With Siliguri being the fastest growing urban centres in the Siliguri sub-division, the increased rate of urbanization in Siliguri and the surrounding area have been affected by natural as well as human induced environmental changes. Degradation/loss of agricultural land coupled with large scale deforestation for the purpose of conversion of forested areas into tea garden, residential and commercial land continue to remain one of the major environmental challenges since many years. As stated before, Siliguri City has been expanding at an alarmingly rapid rate to its surrounding region in order to cater to the needs of the increasing population growth. With large scale changes in the built up area of Siliguri, as a result of extensive construction of residential as well as commercial building, the city went on to become a concrete jungle. As a consequence of concentrated developmental activities in the last two or three decades have had multiple impact on the environment of the study area. Hence, in this study the land use and land cover change has been analyzed for the year 1991, 2005 and 2020. Remotely sensed data in geospatial software platform has been used for mapping, analysing, and disseminating the outcomes.

For this purpose three sets of rectified images of Landsat, five Thematic Mapper (TM) and Landsat 8 Operational LandImager (OLI) with 15-year intervals (images of 1991, 2005, and 2020) were downloaded from the United States Geological Survey (USGS) Glovis (http://glovis.usgs.gov) website and used for identification of the land use and land cover changes in Siliguri sub-division (Table No. 5.1). All of these images had UTM projection and WGS84 datum. In order to obtain cloud free images (< 10% cloud cover), the month of January was preferred and, accordingly, two scenes were downloaded for each year to cover the whole study area.

Table No. 5.1 Details of the collected Landsat data

Date of Acquisition	Satellite/ Sensor	Reference System/Path/Row
1991/01/22	Landsat 5 TM	UTM-45N/139/42
2005/01/14	Landsat 8 OLI	UTM-45N/139/42
2020/01/27	Landsat 8 OLI	UTM-45N/139/42

Landsat TM images consist of seven bands. It collected images in visible, near infrared, mid-infrared, and thermal bands with a spatial resolution of 30 and 120 meters. Landsat 8

consists of Operational Land Imager (OLI) and Thermal Infrared Sensor (TIRS). The Operational Land Imager (OLI) produces 9 spectral bands (Band 1 to 9) at 15, 30, and 60-meter resolution. Then, the Thermal Infrared Sensor (TIRS) consists of 2 thermal bands with a spatial resolution of 100 meters.

Table No. 5.2 Landsat 5: Spectral and spatial resolution of the bands

Band	Band1	Band2	Band3	Band4	Band5	Band6	Band7
Name	Visible			NIR	MIR	Thermal	SWIR
	B	G	R				
Spectral resolution (µm)	0.45 - 0.52	0.52 - 0.60	0.63 - 0.69	0.76 - 0.90	1.55 - 1.75	10.4 - 12.3	2.09 - 2.35
Spatial Resolution (m*m)	30×30	30×30	30×30	30×30	30×30	120×120	30×30

Table No. 5.3: Landsat 8: Spectral and spatial resolution of the bands

Band Feature	Band1	Band2	Band3	Band4	Band5	Band6	Band7	Band8	Band9	Band10	Band11
Name	Costal	Visible			NIR	SWIR	SWIR	Panchromatic	Cirrus	LWIR	LWIR
		B	G	R							
Spectral resolution (µm)	0.43-0.45	0.45-0.52	0.52-0.60	0.63-0.69	0.84-0.88	1.56-1.66	2.10-2.30	0.52-0.90	1.36-1.39	10.3-11.3	11.5-12.5
Spatial Resolution (m*m)	30×30	30×30	30×30	30×30	30×30	30×30	30×30	15×15	30×30	100×100	100×100

Pre-processing of the downloaded images was conducted in Arc-GIS software. Multi spectral datasets were prepared by the 'Band Set' process with different band combinations for each of the Landsat 5 TM and Landsat 8 OLI images. Thereafter, geometric corrections were conducted on all datasets having level-I processing. Image geo-referencing was done using several ground control points (GCPs) located by GNSS-based surveys (handheld Garmin 12 channel device). These GCPs were collected during pilot surveys, based on random sampling method. Subsequently, radiometric correction and atmospheric correction were also performed using the arc-catalog toolbox, to obtain accurate spectral reflectance values and to remove various noises. Subsequently, corrected set of multi spectral images were mosaiced and Siliguri sub-division was then clipped as the region of interest using the 'clip' raster tool.

5.5.1 Image classification

In order to identify the changing patterns in the LULC of Siliguri sub-division from 1991 to 2020, primarily dominant land use or land cover types were classified through supervised classification based on the maximum likelihood algorithm in Arc-GIS. Seven major

LULC classes were identified for the Siliguri sub-division based on prior field experience and high-resolution images of Google Earth geo-visualizer, viz. water body, forest cover, tea garden, built-up, agricultural land, barren land, and sand land. Amongst these, water body consisted of major rivers, water channel, small rivers etc. The extent of area falling under different types of forests like natural forest, manmade forest and social forestry were considered under the forest class. Built-up area consisted of houses, markets, shopping malls and government as well as private offices and commercial buildings to name a few. The Agricultural land class on the other hand comprised agricultural plots with/without crops during the time of image acquisition i.e., the month of January. Besides, the barren land class was primarily constituted of open spaces, playgrounds, industrial fallow, and tea gardens that were kept vacant. As the image acquisition date was during the month of January, sand bars were present in the rivers in the surrounding areas. For each land-use class, nearly 50 training sample signatures have been collected from the target area which is merged further into a single class. LULC patterns of the 100 plots identified during fieldwork and high-resolution Google Earth images were considered as references to validate the classification accuracy. Producer's accuracy, user's accuracy, overall accuracy and Kappa Coefficient were estimated under this assessment procedure. The overall classification accuracy for the year 1991 is 88.25%, for 2005 is 90.75% and for 2020 is 94.17% respectively.

5.5.2 Analysis of inter‐ class LULC transformation

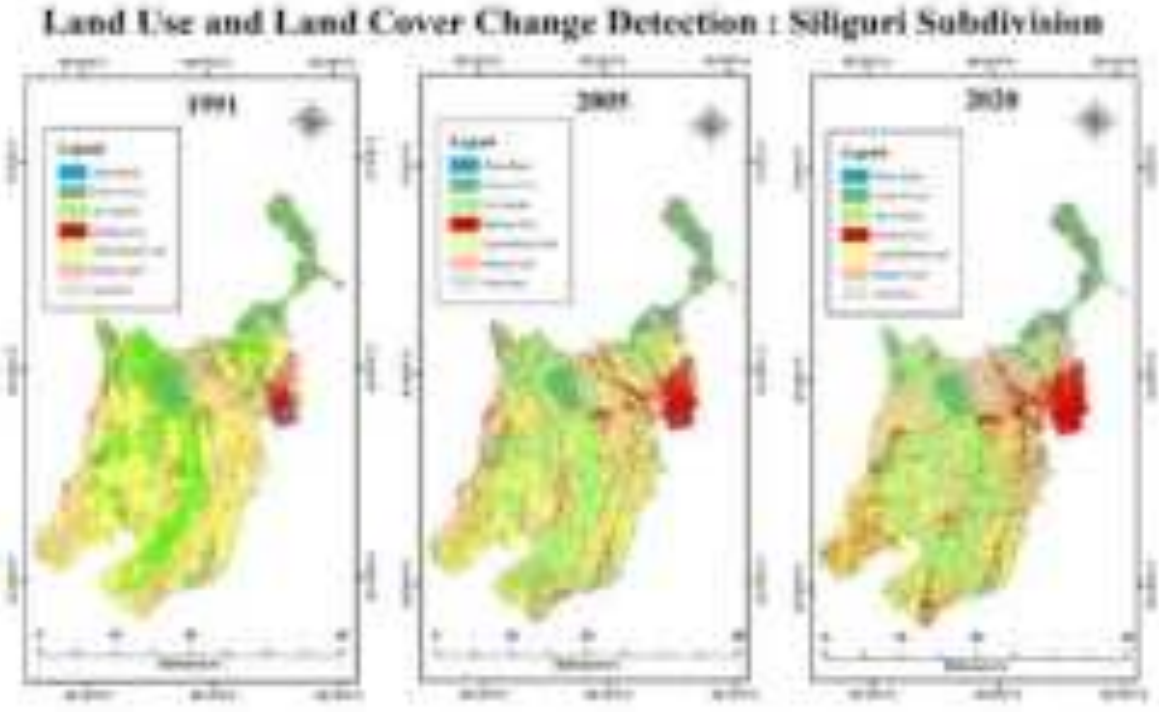
To fulfil the purpose of an in-depth analysis of LULC using the multi-ring buffer tool of ArcGIS, the entire sub-division has been divided into four blocks and three zones. It has been observed that, in case of Siliguri, the continuous built-up spreads over the boundary of Siliguri Municipal Corporation. A pre-defined conventional value of 10 km is chosen to create the multi ring buffers in order to examine as to how and why the changes in LULC have been taking place along different directions in different parts of the study area.

The LULC scenario of Siliguri Municipal Corporation from 1991 to 2020 portrayed intricate interplay between various land uses and land cover which varied considerably both at temporal and spatial scales. Between the year 1991 and 2000, notable increase in area under built-up and sizeable decrease in agricultural land had been found in all the zones of Siliguri sub division (Map No. 5.15). Primarily, a west oriented pattern of urban growth and emergence of new patches of built-ups were evident which had consumed considerable amount of agricultural land. Growth of new residential sectors to accommodate incessantly growing population and development of new shopping clusters had caused fragmentation of the

agricultural lands and tea garden in most of the areas surrounding the urban centre. Surprisingly, slight increase in vegetation cover had also occurred in three sequential years 11% in 1991, 12% in 2005, and 13% in 2005, mostly at the cost of existing agricultural lands. Thus, growth of vegetation was probably related with the increase in acreage of tree crops during this phase.

Agricultural land witnessed a sharp decline from 45% in 1991to 30% in 2005 and subsequently to 25% in 2020. Decrease in area under agricultural land consequent to its conversion into built-ups and fallow lands continued in the period between1991 and 2020. Continued spread of urban built-up had occurred mainly at the cost of vegetation as well as by engulfing agricultural lands, and barren lands particularly in the areas near to urban area. Notably, an increase in area under tea garden is found in this region. For example, 1991 recorded an amount of 154.74 sq. km land under tea garden which increased to 229.30 sq. km. in 2020 denoting primarily the conversion from agricultural areas. The reduction in croplands was most prominent in describing the LULC changing scenario. The growth of built-ups has been overwhelming throughout the Siliguri Subdivision.

Map No. 5.15 Land use & land cover change detection : Siliguri sub-division



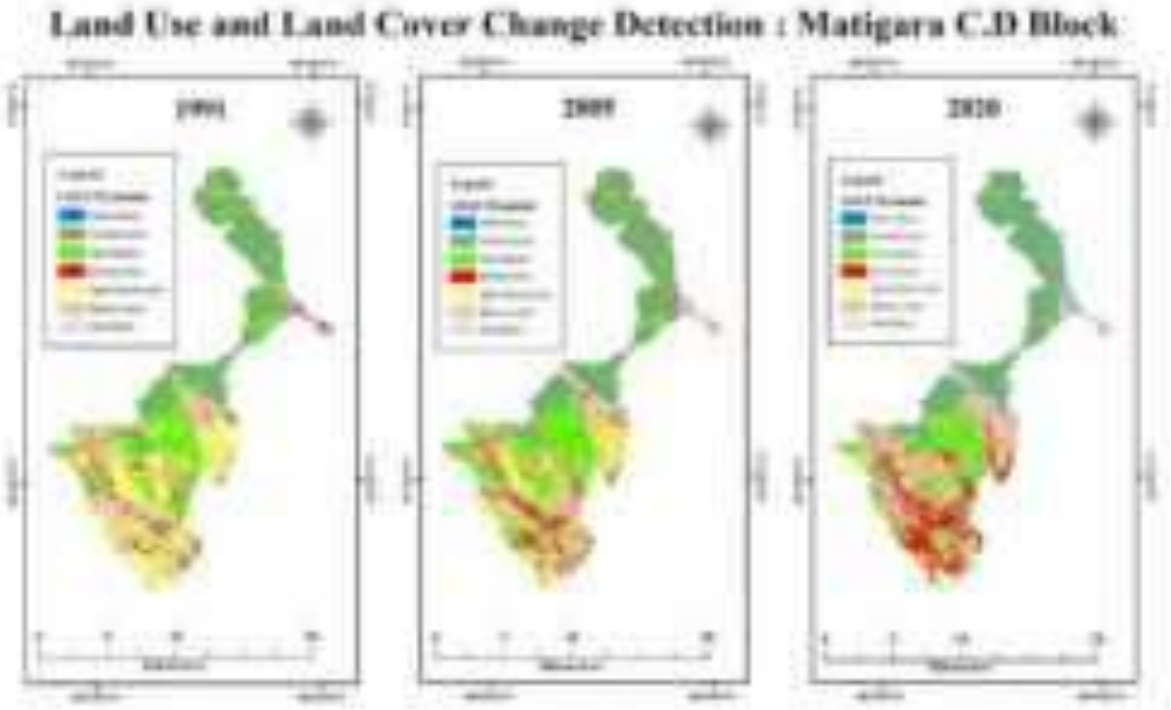
Source: Prepared by Researcher

Table No. 5.4 Land use & land cover change detection: Siliguri sub-division								
LULC 1991			LULC 2005			LULC 2020		
LULC Class	Area in sq. km	% of total area	LULC Class	Area in sq. km	% of total area	LULC Class	Area in sq. km	% of total area
Agricultural Land	368.82	45	Agricultural Land	247.47	30	Agricultural Land	207.92	25
Barren Land	122.94	15	Barren Land	108.59	13	Barren Land	131.33	16
Builtup Area	49.18	6	Builtup Area	96.10	12	Builtup Area	119.48	15
Forest Cover	90.23	11	Forest Cover	95.22	12	Forest Cover	104.98	13
Sand Bars	21.47	3	Sand Bars	10.80	1	Sand Bars	11.60	1
Tea Garden	154.71	19	Tea Garden	250.10	3	Tea Garden	229.30	28
Water Body	8.01	1	Water Body	11.33	1	Water Body	15.00	2
Grand Total	819.61	100	Grand Total	819.61	100	Grand Total	819.61	100
Source: Calculated by the Researcher.								

In this section the LULC change for each block of Siliguri sub-divusion has been analyzed.

Matigara Block - Located nearest to Siliguri Municipal Corporation, Matigara block has the highest area under built-up category of 18.32 sq. km. Since 1991, continuous and consistent growth of urban built-up area in Matigara block resulted into encroachment of scattered and tiny patches of agricultural fields, tea gardens and forest covers. As a result, agricultural land reduced by approximately 13 sq. km. between 1991 and 2005 which further got reduced by 11 sq. km. from 2005 to 2020. Similarly, area under tea plantation also reduced from 22.78 sq. km. to 18.20 sq. km. between 1991 and 2020. However, it is worth mentioning that during the same period of time, area under forest cover increased from 28% to 33% in the Matigara block.

Map No. 5.16 Land use & land cover change detection : Matigara



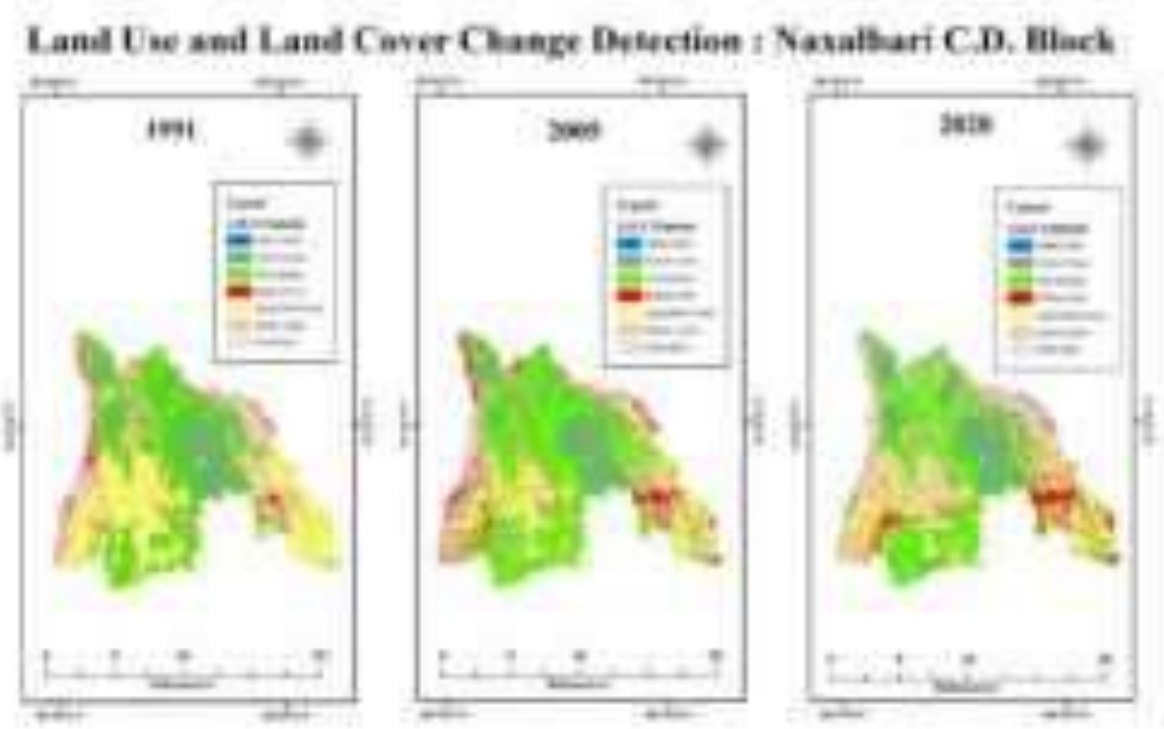
Source: Prepared by the Researcher.

Table No. 5.5 Land use & land cover change detection : Matigara								
LULC 1991			LULC 2005			LULC 2020		
LULC Class	Area in sq. km	% of total area	LULC Class	Area in sq. km	% of total area	LULC Class	Area in sq. km	% of total area
Agricultural Land	35.64	27	Agricultural Land	22.15	16.7	Agricultural Land	11.58	9
Barren Land	21.14	16	Barren Land	21.91	16.5	Barren Land	32.94	25
Built-up Area	9.19	7	Built-up Area	15.90	12	Built-up Area	18.32	14
Forest Cover	36.77	28	Forest Cover	39.87	30	Forest Cover	43.95	33
Sand Bars	5.85	4	Sand Bars	3.99	3	Sand Bars	3.24	2
Tea Garden	22.78	17	Tea Garden	27.26	21	Tea Garden	18.20	14
Water Body	1.24	1	Water Body	1.53	1	Water Body	4.38	3
Grand Total	132.61	100	Grand Total	132.61	100	Grand Total	132.61	100
Source: Calculated by the Researcher.								

Naxalbari Block - Naxalbari block also experienced significant changes in its land use dynamics owing to increase in the commercial activities. It can be observed from the above maps and tables that the spread of built-up area and the fragmentation of cropland have mainly taken place along the arterial road in the block. Agricultural land has showed a steady decline

with respect to the total area over the given time period. Nonetheless, there remains a complex land use transformation dynamic between the agricultural land, built-up area, forest cover and tea gardens. For instance, the total area under cropland decreased by 27 sq. km. between 1991 and 2005 and by 2 sq. km. between 2005 and 2020 and at time was transformed into built-up areas and tea gardens. Consequently, one can notice an increase in the built-up area from 7.15 sq. km. to 13.50 sq. km. during the given assessment period. Given a long duration of time, it has been observed that the change in area under tea plantation has remained inconsistent wherein the area under tea plantation increased to 35% from 27% between 1991 and 2005 which later on declined to 29% in the year 2020. In the context of barren land, the block has had experienced sharp increase in area especially in areas located near Balason and Mechi rivers. The areal extent of barren land was 30.31 sq. km. in 1991, 32.18 sq. km. in 2005 and 46.72 sq. km. in 2020 indicating increase in the areal extent of barren land at an increasing rate. However, it is worth mentioning that among all the classes, it is the forest cover that has the highest percentage of area i.e. 54.54% in Naxalbari block.

Map No. 5.17 Land use & land cover change detection : Naxalbari

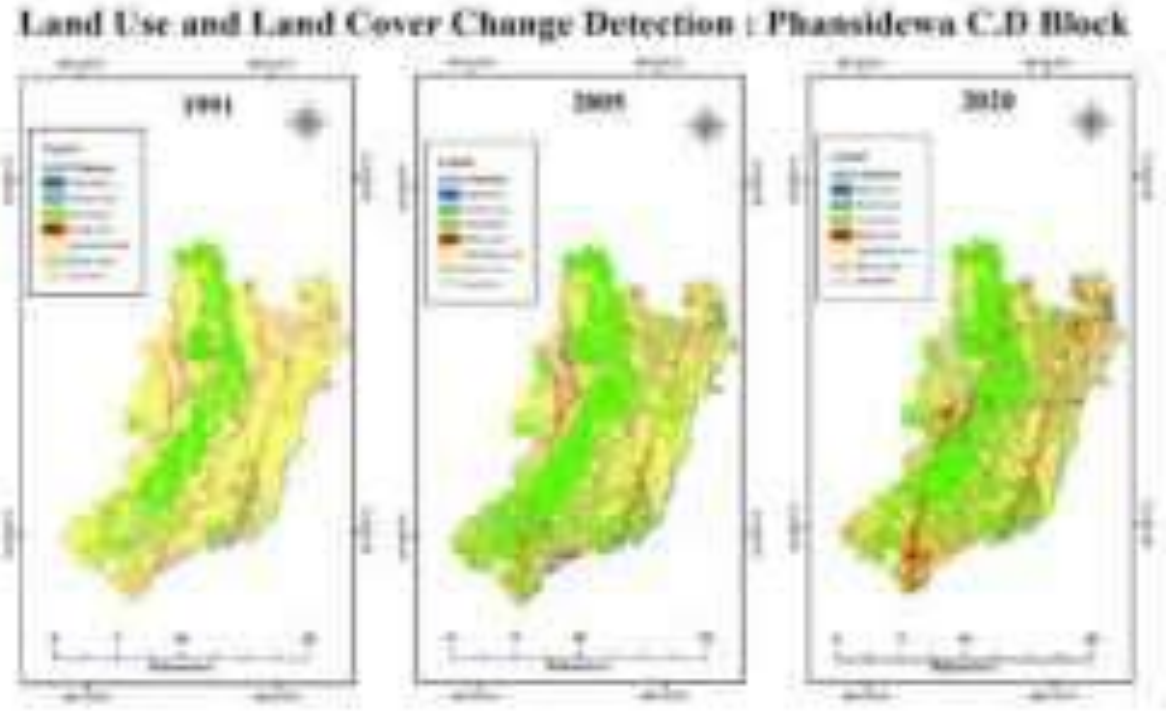


Source: Prepared by the Researcher.

Table No. 5.6 Land use & Land cover change detection : Naxalbari								
LULC 1991			LULC 2005			LULC 2020		
LULC Class	Area in sq. km	% of total area	LULC Class	Area in sq. km	% of total area	LULC Class	Area in sq. km	% of total area
Agricultural Land	62.03	33	Agricultural Land	35.63	19	Agricultural Land	32.87	17
Barren Land	30.31	16	Barren Land	32.18	17	Barren Land	46.72	25
Builtup Area	7.15	4	Builtup Area	16.40	9	Builtup Area	13.50	7
Forest Cover	29.20	16	Forest Cover	32.60	17	Forest Cover	34.24	18
Sand Bars	7.73	4	Sand Bars	4.13	2	Sand Bars	4.61	2
Tea Garden	51.57	27	Tea Garden	66.61	35	Tea Garden	54.54	29
Water Body	0.14	0	Water Body	0.58	0	Water Body	1.65	1
Grand Total	188.12	100	Grand Total	188.12	100	Grand Total	188.12	100
Source: Calculated by the Researcher.								

Phansidewa Block - Towards the southern part of Siliguri sub-division, along Teesta - Mahananda canal is the Phansidewa block. Following the suit, Phansidewa block also experienced sharp decline in the share of agricultural land from 59% in 1991 to 38.4% in 2005 and 31% in 2020. It is however noted that the percentage of agricultural area has been decreasing at a decreasing rate. Similarly, the forest cover has witnessed a decline from 12.92 sq. km. to 10.81 sq. km. area. Contrary to this, the block has witnessed a striking change in the built-up area as it saw an increase from 11.14 sq. km. in 1991 to 26.42 sq. km. in 2005 and 37.49 sq. km. in 2020. Interestingly, area under tea plantation also increased considerably from 61.41 sq. km in 1991 to 118.96 sq. km in 2005 and 124.40 sq. km area in 2020 considering the large scale conversion of agricultural land into tea gardens.

Map No. 5.18 Land use & land cover change detection : Phansidewa



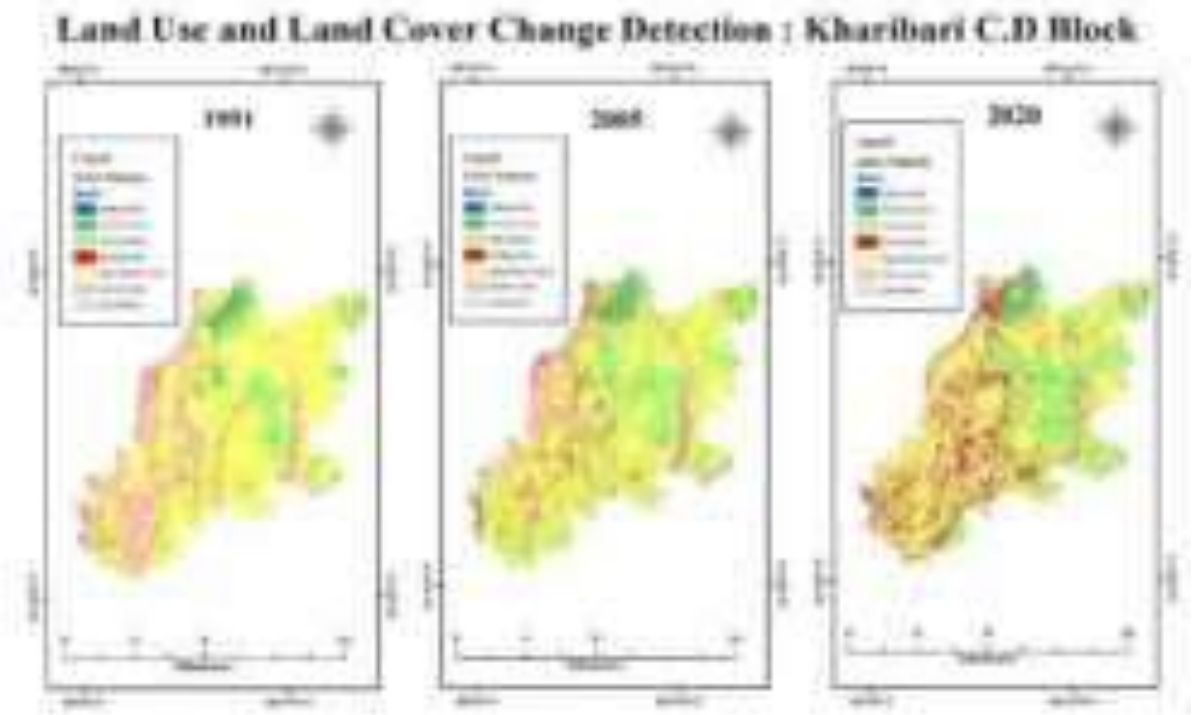
Source: Prepared by the Researcher.

Table No. 5.7 Land use & land cover change detection : Phansidewa								
LULC 1991			LULC 2005			LULC 2020		
LULC Class	Area in sq. km	% of total area	LULC Class	Area in sq. km	% of total area	LULC Class	Area in sq. km	% of total area
Agricultural Land	184.39	59	Agricultural Landa	118.84	38	Agricultural Land	98.18	31
Barren Land	35.51	11	Barren Land	30.44	10	Barren Land	32.66	10
Builtup Area	11.14	4	Builtup Area	26.42	8	Builtup Area	37.49	12
Forest Cover	12.92	4	Forest Cover	9.25	3	Forest Cover	10.81	3
Sand Bars	3.73	1	Sand Bars	0.78	0	Sand Bars	1.83	1
Tea Garden	61.41	20	Tea Garden	118.96	38	Tea Garden	124.40	40
Water Body	2.99	1	Water Body	7.41	2	Water Body	6.73	2
Grand Total	312.1	100	Grand Total	312.1	100	Grand Total	312.1	100
Source: Calculated by the Researcher.								

Kharibari Block - Kharibari block of Siliguri sub-division is the farthest located block from Siliguri Municipal Corporation. Being distantly located, the block exhibits dwindling urban characteristics while rurality gains prominence. Needless to say, Kharibari block has the highest percentage of agricultural land among all the four blocks in the study area despite a considering decline in the agricultural land from 62% in 1991 to almost 50% in 2020. Similarly,

barren land also decreased in the given period of time from 26.06% 1991 to 12% in 2020. Total urban area in Kharibari block is the lowest among the four blocks. Though the total urban area increased from 4.86 sq. km. in 1991 to 11.68 sq. km, the value is comparatively low when compared to other blocks. It is interesting to note that the forest cover saw an increase by only 1 percent during the assessment period mainly because of the conversion of agricultural land. Lastly a steady growth of tea gardens has been observed which could be an outcome of changes in the agricultural practise in the block.

Map No. 5.19 Land use & land cover change detection : Kharibari



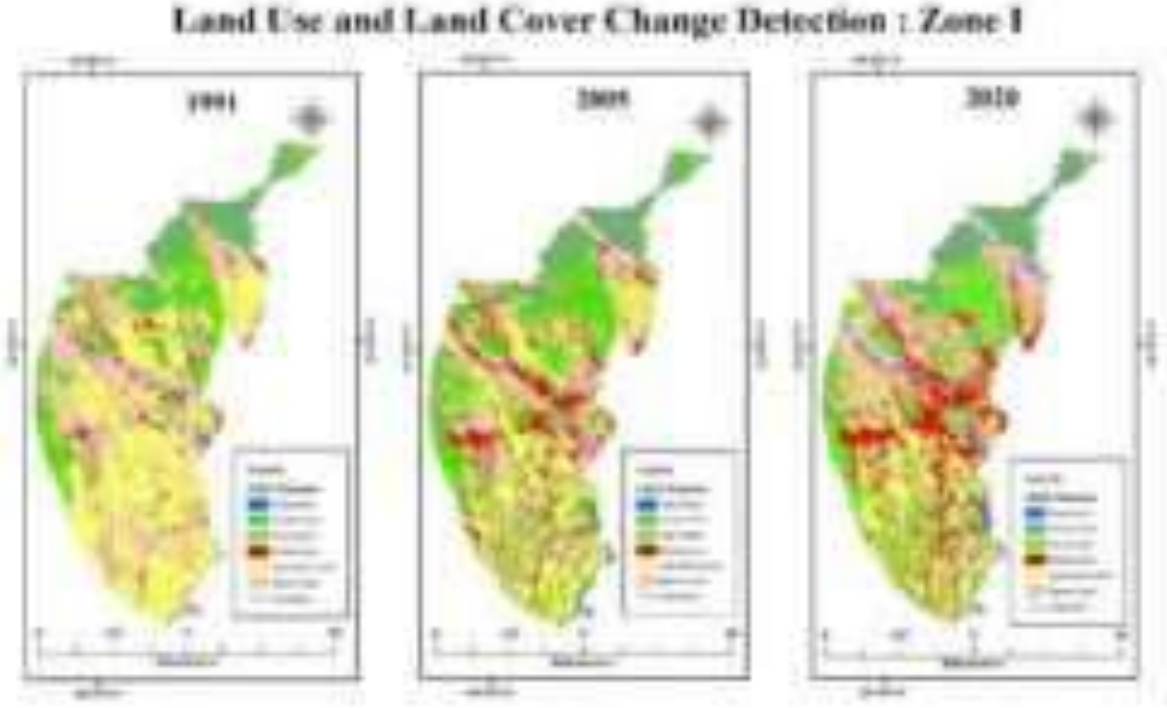
Source: Prepared by the Researcher.

Table No. 5.8 Land use & Land cover change detection : Kharibari								
LULC 1991			LULC 2005			LULC 2020		
LULC Class	Area in sq. km	% of total area	LULC Class	Area in sq. km	% of total area	LULC Class	Area in sq. km	% of total area
Agricultural Land	89.65	62%	Agricultural Land	73.01	50%	Agricultural Land	73.011	50%
Barren Land	26.06	18%	Barren Land	17.65	12%	Barren Land	17.650	12%
Builtup Area	4.86	3%	Builtup Area	11.69	8%	Builtup Area	11.689	8%
Forest Cover	4.73	3%	Forest Cover	5.39	4%	Forest Cover	5.393	4%
Sand Bars	2.62	2%	Sand Bars	1.08	1%	Sand Bars	1.083	1%
Tea Garden	16.56	11%	Tea Garden	35.37	24%	Tea Garden	35.373	24%
Water Body	0.40	0%	Water Body	0.68	0%	Water Body	0.681	0%
Grand Total	144.88	100%	Grand Total	144.88	100%	Grand Total	144.88	100%
Source: Calculated by the Researcher.								

In this section the LULC change has been analyzed for each of the three zones considered for this study.

Zone I - Zone I consists of 67 villages of Matigara block, 20 villages of Naxalbari block, 26 villages of Phansidewa block, and represents the most urbanized part of sub-division. Since 1991, continued growth of urban built-ups continued in this zone resulting in encroachment of scattered as well as tiny patches of agricultural lands, tea garden, barren lands etc. A reduction in agricultural land area had occurred approximately by 30.24 sq. km. between 1991 and 2005 and approximately by 17.21 sq. km. between 2005 and 2020. The built-up areas increased by approximately 6% between 1991 and 2005 and approximately by 5 % between 2005 and 2020. Spread of built-ups along the arterial roads and fragmentation of existing agricultural lands were prominent in this part during the entire assessment periods, thereby severely defragmenting the Chandmoni Tea Estate and its adjoining agricultural plots. Distinct growth of tea gardens especially in place of forest and barren land during 1991- 2005 and 2005–2020 has been observed.

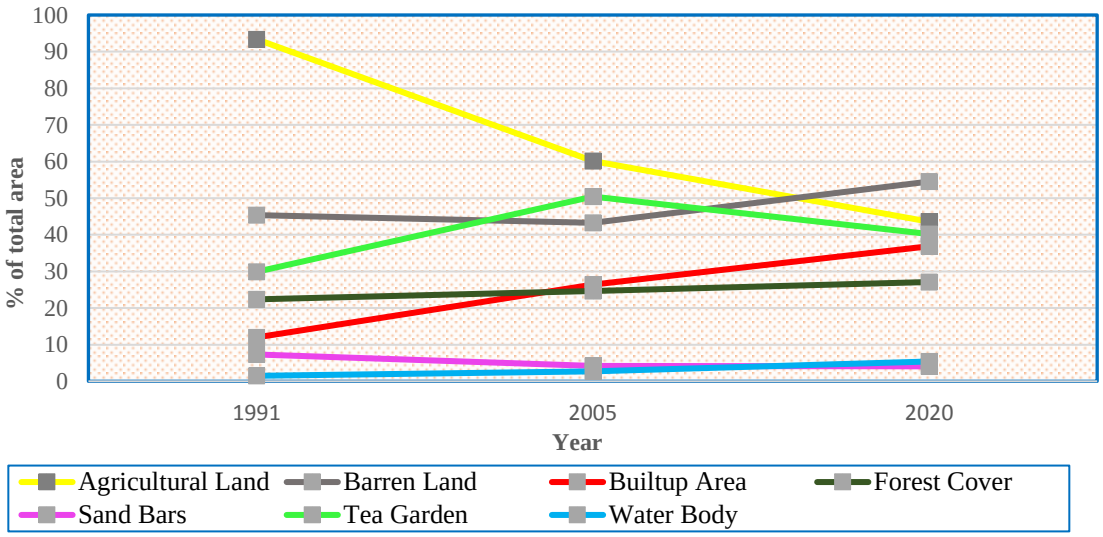
Map No. 5.20 Land use & land cover change detection : Zone I



Source: Prepared by the Researcher.

Table No. 5.9 Land use & Land cover change detection : Zone I								
LULC 1991			LULC 2005			LULC 2020		
LULC Class	Area in sq. km	% of total area	LULC Class	Area in sq. km	% of total area	LULC Class	Area in sq. km	% of total area
Agricultural Land	93.38	44	Agricultural Land	60.14	28	Agricultural Land	43.58	21
Barren Land	45.35	21	Barren Land	43.27	20	Barren Land	54.53	26
Builtup Area	11.99	6	Builtup Area	26.41	12	Builtup Area	36.87	17
Forest Cover	22.37	11	Forest Cover	24.69	12	Forest Cover	27.11	13
Sand Bars	7.33	3	Sand Bars	4.18	2	Sand Bars	4.10	2
Tea Garden	29.90	14	Tea Garden	50.43	24	Tea Garden	40.21	19
Water Body	1.50	1	Water Body	2.70	1	Water Body	5.42	3
Grand Total	211.82	100	Grand Total	211.82	100	Grand Total	211.82	100
Source: Calculated by the Researcher.								

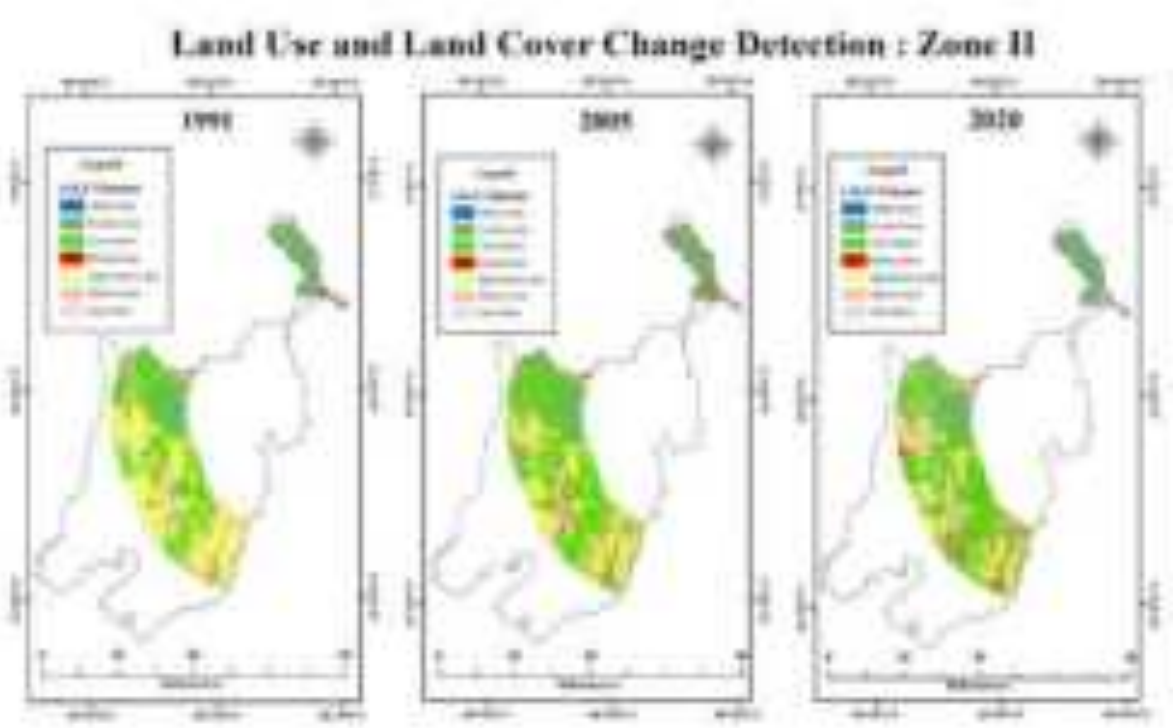
Fig. No. 5.8 Landuse & landcover change: Zone I



Zone II - Zone II consists of 5 villages of Matigara block, 62 villages of Naxalbari block, 72 villages of Phansidewa block and 7 villages of Kharibari block. With the continued outward spread of the urban built-up, it eventually engulfed the non-urban LULCs lying immediate to the Zone I. Thus, the buffer Zone II primarily represents an areas which experienced steady growth of residential sectors and commercial activities at the expense of agricultural lands, vegetation, and barren lands in the last few decades. Although, agricultural land showed a steady decline with respect to total area during the entire assessment period, a complex land use transformation dynamics existed between agricultural land, forest cover, and

built-up area. For instance, the total area under agricultural land had decreased by 45.49 sq. km. between1991and 2005 and had been transformed to built-up and other land use classes; considerable amount of forest cover had also been transformed into tea garden during the same period. The tea garden continued displaying an increasing trend in this zone as well during the given time period. Although forest cover remained more or less same between 1991 and 2005, it did increase a little during between 2005 and 2020 (17% in 1991 and 2005 and 19% in 2020).

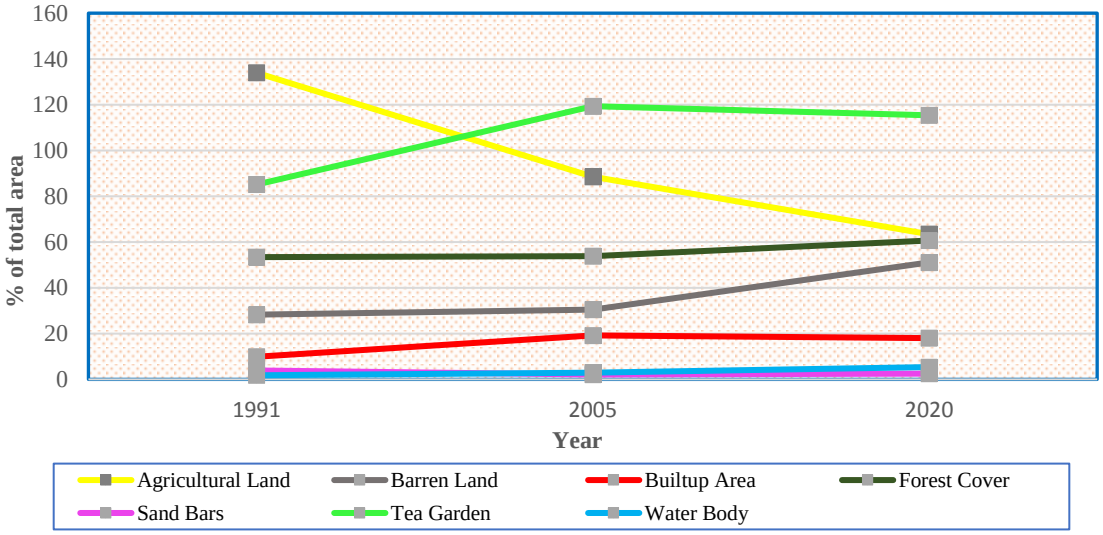
Map No. 5.21 Land use & land cover change detection : Zone II



Source: Prepared by the Researcher.

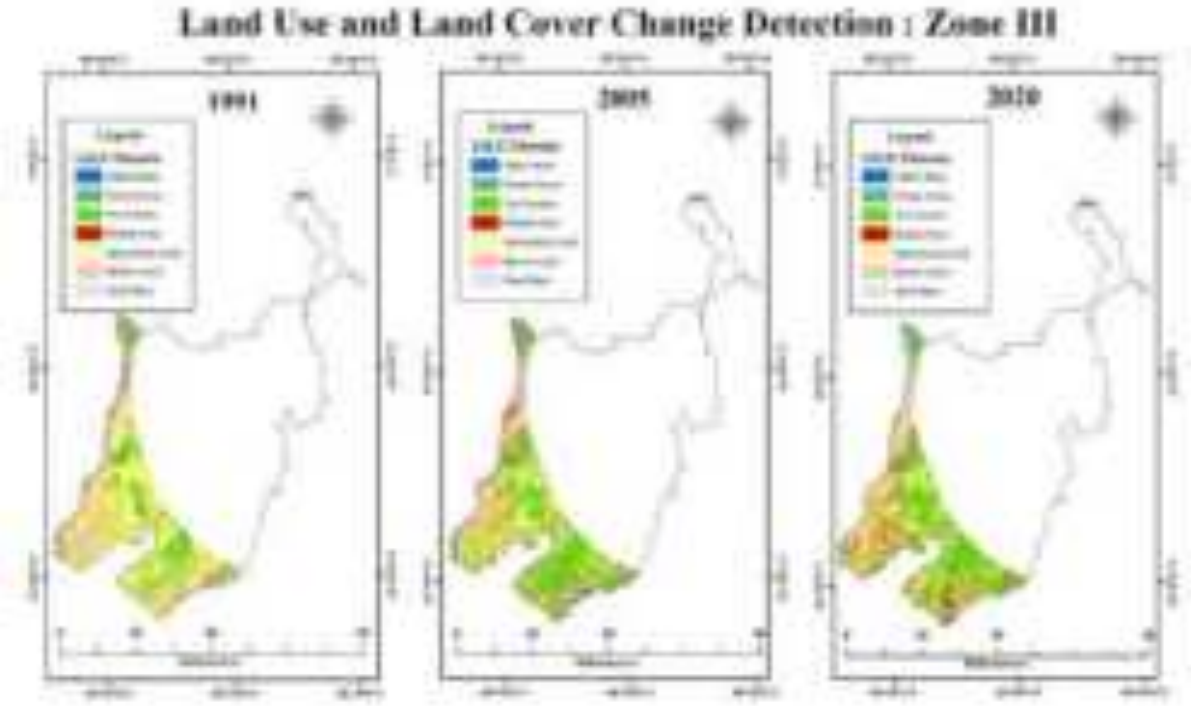
Table No. 5.10 Land use & Land cover change detection : Zone II								
LULC 1991			LULC 2005			LULC 2020		
LULC Class	Area in sq. km	% of total area	LULC Class	Area in sq. km	% of total area	LULC Class	Area in sq. km	% of total area
Agricultural Land	133.95	42	Agricultural Land	88.46	28	Agricultural Land	63.432	20
Barren Land	28.28	9	Barren Land	30.42	10	Barren Land	51.102	16
Built-up Area	9.90	3	Built-up Area	19.21	6	Built-up Area	18.019	6
Forest Cover	53.42	17	Forest Cover	53.89	17	Forest Cover	60.670	19
Sand Bars	3.89	1	Sand Bars	2.12	1	Sand Bars	2.454	1
Tea Garden	85.12	27	Tea Garden	119.35	38	Tea Garden	115.314	36
Water Body	1.80	1	Water Body	2.92	1	Water Body	5.370	2
Grand Total	316.36	100	Grand Total	316.36	100	Grand Total	316.36	100
Source: Calculated by the Researcher.								

Fig. No. 5.9 Landuse & landcover change: Zone II



Zone III - Zone III consists of 12 villages of Naxalbari block, 15 villages of Phansidewa block and 67 villages of Kharibari block, represents the farthest zone of the sub-division. Despite expansion in built-up areas, substantial amount of croplands also existed in these area as it lay comparatively far from the urban core. The amount of cropland reduced from 136.59 sq. km. (1991) to 98.63 sq. km. (2020) between total assessment periods owing to conversion to other classes of land. Subsequently, percentage growth of built-up (6%) was found to be slightly higher in this zone, especially between 1991 and 2005. In spite of relatively greater distance from the urban core, the growing demand of green-field sites for new commercial and industrial clusters had actually triggered the rampant acquisition of agricultural lands in the south-western parts of this zone. Shrinkage of agricultural lands continued during total assessment period mainly to accommodate built-ups and fallow lands. Barren land and water body also decreased in area from 1991 to 2005 and also from 2005 to 2020 to accommodate growth of built-up as well as tea garden.

Map No. 5.22 Land use & land cover change detection : Zone III



Source: Prepared by the Researcher.

Table No. 5.11 Land use & land cover change detection : Zone III								
LULC 1991			LULC 2005			LULC 2020		
LULC Class	Area in sq. km	% of total area	LULC Class	Area in sq. km	% of total area	LULC Class	Area in sq. km	% of total area
Agricultural Land	136.59	54	Agricultural Land	94.67	38	Agricultural Land	98.63	39
Barren Land	40.54	16	Barren Land	30.62	12	Barren Land	23.25	9
Builtup Area	11.22	4	Builtup Area	25.73	10	Builtup Area	34.06	14
Forest Cover	13.71	5	Forest Cover	15.26	6	Forest Cover	16.26	6
Sand Bars	9.55	4	Sand Bars	4.34	2	Sand Bars	4.78	2
Tea Garden	39.00	15	Tea Garden	77.12	31	Tea Garden	71.91	29
Water Body	1.46	1	Water Body	4.34	2	Water Body	3.18	1
Grand Total	252.07	100	Grand Total	252.07	100	Grand Total	252.07	100
Source: Calculated by the Researcher.								

Table 5.11 shows the percentage change in LULC under each of the seven landuse/landcover class for Zone III in the study area during 1991, 2005 and 2020 respectively. It is evident from the table that agricultural land and built-up area has undergone the major change in this zone.

Fig. No. 5.10 Landuse & landcover change: Zone III

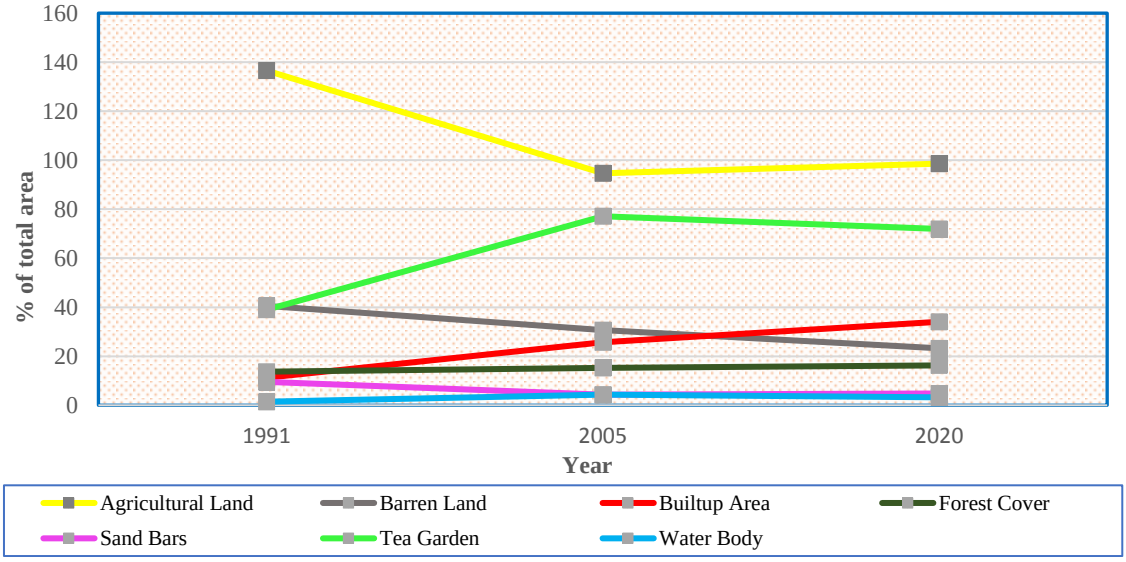


Table No. 5.12 Change in LULC in the study area

LULC Change Category	Zone I		Zone II		Zone III	
	Area In Sq.km.(1991-2005)	Area In Sq.Km.(2005-2020)	Area In Sq.Km.(1991-2005)	Area In Sq.Km.(2005-2020)	Area In Sq.Km.(1991-2005)	Area In Sq.Km.(2005-2020)
Agricultural land → Barren Land	14.42	19.37	11.54	18.18	8.09	6.96
Agricultural land → Builtup Area	8.98	9.00	6.90	4.95	5.26	5.94
Agricultural land → Forest Cover	1.76	0.30	1.67	0.98	3.05	0.99
Agricultural land → Sand Bars	0.24	0.09	0.06	0.10	0.03	0.03
Agricultural land → Tea Garden	18.93	5.21	32.90	15.46	19.19	6.73
Agricultural land →Water Body	0.49	0.46	0.43	0.43	1.10	0.20
Barren Land → Agricultural Land	6.36	9.51	3.72	6.16	5.60	7.43
Barren Land → Builtup Area	8.36	6.27	4.66	1.24	2.02	2.37
Barren Land → Forest Cover	1.17	0.60	1.17	1.07	0.97	0.48
Barren Land → Sand Bars	0.38	0.52	0.29	0.48	0.40	0.77
Barren Land → Tea Garden	6.98	5.63	6.22	6.98	5.32	4.95
Barren Land → Water Body	0.30	0.46	0.30	0.53	0.51	0.38

Builtup Area → Agricultural Land	2.06	3.54	1.35	3.42	2.95	2.92
Builtup Area → Barren Land	2.11	5.10	1.99	5.57	2.36	3.69
Builtup Area → Forest Cover	0.18	0.28	0.26	0.55	0.14	0.32
Builtup Area → Sand Bars	0.98	1.34	0.52	1.07	0.65	1.09
Builtup Area →Tea Garden	0.52	1.03	0.76	1.69	0.94	1.83
Builtup Area → Water Body	0.74	2.11	0.72	1.98	0.71	0.94
Forest cover →Agricultural Land	0.14	0.27	0.28	0.19	0.38	1.86
Forest cover →Barren Land	0.50	0.63	0.49	1.58	0.16	0.34
Forest cover → Builtup Area	0.55	1.51	0.70	1.05	0.52	1.59
Forest cover →Sand Bars	0.02	0.01	0.06	0.01	0.03	0.00
Forest cover → Tea Garden	3.35	2.10	11.31	7.39	5.51	3.64
Forest cover →Water Body	0.05	0.24	0.10	0.23	0.09	0.10
Sand Bars →Agricultural Land	0.37	0.25	0.11	0.09	0.22	0.43
Sand Bars → Barren Land	1.60	0.99	1.03	0.86	2.26	0.71
Sand Bars → Builtup Area	2.43	0.27	1.24	0.14	2.86	0.47
Sand Bars →Forest Cover	0.02	0.00	0.00	0.00	0.01	0.01
Sand Bars →Tea Garden	0.02	0.01	0.02	0.01	0.01	0.01
Sand Bars →Water Body	0.68	0.82	0.51	0.45	0.96	0.26
Tea Garden →Agricultural Land	0.94	4.10	2.31	4.93	2.33	4.89
Tea Garden → Barren Land	2.66	7.70	3.38	10.62	1.25	1.76
Tea Garden → Builtup Area	0.77	6.27	0.99	5.31	0.96	7.41
Tea Garden → Forest Cover	3.78	5.96	10.22	14.59	4.01	6.72
Tea Garden → Sand Bars	0.18	0.02	0.08	0.05	0.00	0.00
Tea Garden →Water Body	0.03	0.21	0.08	0.21	0.14	0.05
Water Body →Agricultural Land	0.15	0.20	0.22	0.25	0.05	1.20
Water Body → Barren Land	0.09	0.45	0.05	0.35	0.06	0.20

Water Body → Builtup Area	0.59	0.57	0.42	0.42	0.38	0.92
Water Body → Forest Cover	0.11	0.02	0.08	0.03	0.03	0.03
Water Body →Sand Bars	0.04	0.27	0.14	0.18	0.08	0.45
Water Body → Tea Garden	0.08	0.06	0.10	0.15	0.04	0.31
Grand Total	94.11	103.78	109.38	119.94	81.59	81.37
Source: Calculated by the Researcher.						

Table No. 5.12 shows the change in LULC from each class to rest of the six classes in the study area for the three zones during 1991-2005 and 2005-2020 respectively. It is evident from the table that major change in LULC has taken place from agricultural land to barren land, agricultural land to built-up area, agricultural land to tea garden, barren land to agricultural land, barren land to built-up area, barren land to tea garden, forest to tea garden and tea garden to forest respectively. For rest of the categories the change is negligible. Table No. 5.13 shows the total change in LULC across the seven classes for each zone along with their respective percentage to total area during 1991-2005 and 2005-2020. It is evident from the table that Zone I locted nearest to Siliguri Municipal Corporation recorded the maximum change for both the time period followed by Zone II and Zone III respectively. Thus it can be said that with increase in distance from Siliguri Municipal Corporation, LULC change has decreased in the study area. Therefore, the third hypothesis that there is a negative relationship between distance from Siliguri Municipal Corporation and land use and land cover change in the study area is validated and accepted.

Table No. 5.13 Percentage change in LULC in the study area

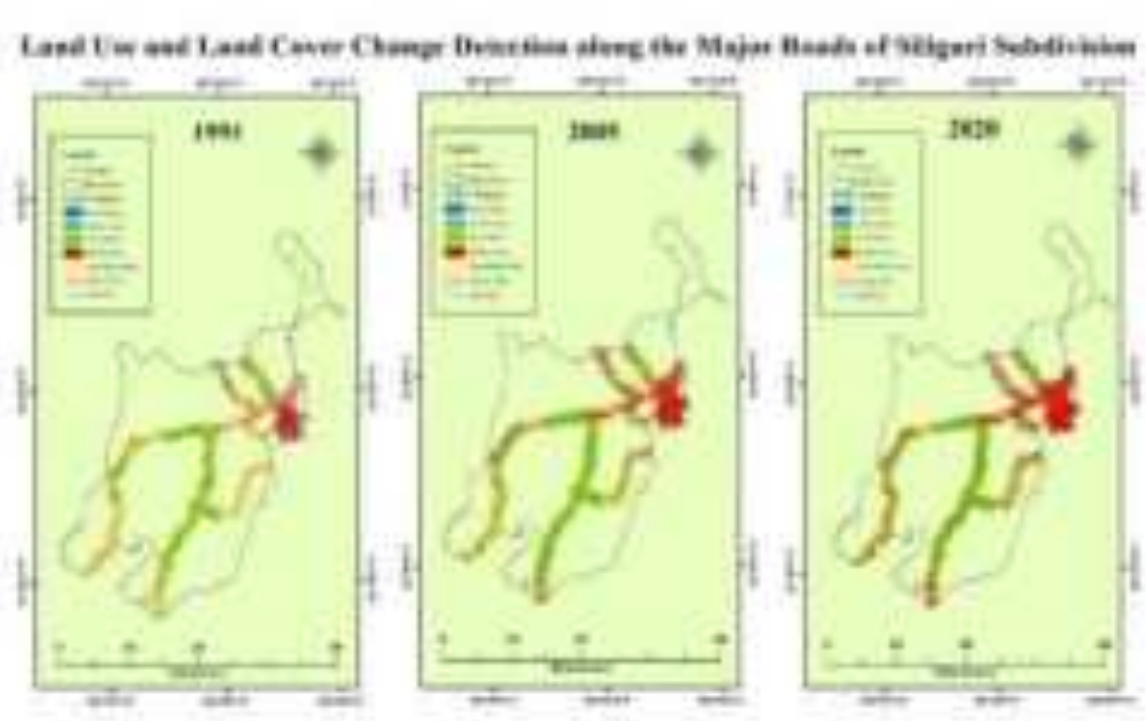
Zone	TotalArea (sq. km)	1991-2005		2005-2020	
		Actual Change (sq. km)	% Change	Actual Change (sq. km)	% Change
I	211.82	94.11	44.43	109.38	48.99
II	316.36	103.78	34.57	119.94	37.91
III	252.07	81.59	32.36	81.37	32.28
Source: Calculated by the Researcher.					

5.5.3 Landuse & land cover change of Siliguri sub-division through main transport lines

Along transportation lines the landuse and landcover change is maximum. In the study area the main transportation lines are Asian Highway 2, NH 31, NH 31A, NH 55 and SH 12. Therefore, in this section landuse and landcover change has been along these roads for 1991, 2005 and 2020 respectively. 1 km buffer has been taken along both side of these roads, and landuse and landcover change has been analyzed accordingly. The LULC change has been

done following the earlier process used for identifying the change both for the blocks as well as for the three zones. Map No 5.23 shows the change in LULC along the major roads in the study area and table 5.14 shows the actual area and percentage change under each category. The most important change in LULC is with respect to agricultural land. It was 45% in 1991, which decreased 28% in 2005 and 22% in 2020 respectively. Area under barren land has also gone down considerably from 1991 to 2020. Built-up area has seen a rapid increase along the main roads and its percentage went up from 10% in 1991 to 21% in 2005 and further went to 31% in 2020. Area under forest cover, sand bar and water body has remained more or less same from 1991 to 2020. However, area under tea garden went up from 19% in 1991 to 28% in 2020. Therefore, along the main roads in the study area, agricultural land has been mostly converted to built-up area and tea garden during 1991 to 2020.

Map No. 5.23 Land use & land cover change of Siliguri sub-division through main transport line,1991-2020



Source: Prepared by the Researcher.

Table No. 5.14 Land use & Land cover change of Siliguri sub-division through main transport line, 1991-2020

LULC 1991			LULC 2005			LULC 2020		
LULC Class	Area in sq. km	% of total area	LULC Class	Area in sq. km	% of total area	LULC Class	Area in sq. km	% of total area
Agricultural Land	111.96	45	Agricultural Landa	69.70	28	Agricultural Land	53.82	22

Barren Land	39.72	16	Barren Land	27.71	11	Barren Land	29.70	12
Builtup Area	25.24	10	Builtup Area	51.25	21	Builtup Area	75.26	31
Forest Cover	14.72	6	Forest Cover	13.11	5	Forest Cover	13.04	5
Sand Bars	3.67	1	Sand Bars	0.78	0	Sand Bars	1.38	1
Tea Garden	47.05	19	Tea Garden	80.57	33	Tea Garden	69.04	28
Water Body	4.30	2	Water Body	3.51	1	Water Body	4.41	2
Grand Total	246.69	100	Grand Total	246.66	100	Grand Total	246.67	100
Source: Calculated by the Researcher.								

5.6 Summary

The major objective of this chapter was to study the transport network and analyze the land use and land cover change within the study. The road and rail network of the study area shows that roadways are the most important mode of communication for the rural population in the study area to interact with Siliguri Municipal Corporation. Although, railway network is present but lack of suburban rail connectivity with Siliguri does not make it a popular mode of transportation for the rural population of Siliguri sub-division to connect with Siliguri. The transport network is most developed in Siliguri Municipal Corporation and its surrounding rural areas and as one moves away from the main urban centre the transport network also became less developed. The transport network analysis done for the study area shows that Siliguri Municipal Corporation and its surrounding areas around Bagdogra, Shivmandir and Matigara covering the east-central part of the study area have the highest network connectivity and as moves towards the north, west and south-western part of the sub division the transport network connectivity deteriorates considerably. The road density within the study area also varies with the highest road density observed around Siliguri Municipal Corporation and its surrounding area and the lowest road density observed along the border areas of the subdivision. Among the blocks, Matigara has the highest road density while Kharibari and Phansidewa has the lowest road density. Among the zones, Zone I has the highest road density and Zone III has the lowest road density.

The land use and land cover change in the study area has been analyzed for seven classes which are agricultural land, barren land, built-up area, forest cover, sand bars, tea garden and water bodies. For all the zones as well as the blocks from 1991 to 2020, the area under built-up area and tea garden has increased while the area under agricultural land has declined. For rest of the classes there has not been too much of a change from 1991 to 2020.

The built-up area has increased due to spread of urbanization and associated construction activities. The area under tea garden has gone up considerably by conversion of agricultural land to tea garden as the small farmers find tea plantation to be more profitable than conventional agricultural practices. Land use and land cover change along the main transportation lines in the study area has also undergone a lot of change with the agricultural land being converted to built-up area.

5.7 References

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CHAPTER 6:

RURAL-URBAN INTERACTION IN THE STUDY AREA

6.1 Introduction

Rural-urban interaction is an obvious process associated with rapid urbanization. With the growth of any large urban centre the demand for primary goods increase which is usually supplied by the surrounding rural areas. Moreover, as an urban centre grows, its importance increase which is associated with improvement in various facilities related to education, health, infrastructure, recreation, trade and commerce and employment opportunities. This in a way attract the rural population from the surrounding area to take benefits of these improved facilities by interacting with the urban centre. Any serious study on rural-urban interaction has tried to measure the volume of interaction using some quantitative techniques. Ellefsen (1962) studying the rural-urban interaction for Delhi, Madras, Hyderabad, Bombay, and Baroda used demographic, socioeconomic, and geographic characteristics to highlight the intricacy of the structure of the metropolitan region and relationships between cities and their surrounding areas. R.L. Singh (1964) used bus services and newspaper circulation along with the supply of milk, cereals and vegetables in his study on the "umland" of Banaras. M. Alam (1965) in his study on Hyderabad defined the boundary of its metropolitan district based on ‘primary’ and ‘reflective’ features which include some urban services offered to rural people and the socio-economic characteristics of the rural area. V.L.S.P. Rao & V.K. Tewari (1974) in their study on Bangalore used population variables, landuse characteristics and regularity of bus services to identify the hinterland of Bangalore. S. Nangia (1976) in her study on the Delhi Metropolitan Area used settlement pattern and population density to identify the zones of interaction for Delhi. R. Kaur (1995) used percentage of rural non-agricultural workers, percentage of villages connected by pucca roads, productivity of agriculture per worker, density of towns per 10,000 sq. km. and the proportion of intra-district migrants to analyze the pattern of rural-urban interaction.

The most common technique to quantify the rural-urban interaction has been by analyzing the frequency of visit to urban areas. The major objective of this chapter will be to study the pattern of rural-urban interaction and also to quantify the volume of interaction. Since rural-urban interaction takes place for various purpose so in this section, rural-urban interaction will be measured based on each theme of interaction which are as follows: economic interaction, agricultural interaction, educational interaction, health interaction, interaction for entertainment and administration or organizational interaction.

6.2 Rural-Urban interaction in the study area

For analyzing the level of interaction, frequency of visit to Siliguri Municipal Corporation for various purposes listed above will be measured. As mentioned earlier, for measuring the level of interaction between the villages of Siliguri sub-division with Siliguri Municipal Corporation, three villages were randomly selected from each size-class category of each zone (zones were delineated on the basis of distance from the outer boundary of Siliguri Municipal Corporation). By this process total 55 villages were selected to measure the rural-urban interaction in the study area. Out of these 55 villages, 18 villages were from Zone I, 18 villages were from Zone II and 19 villages were from Zone III respectively. 10 percent households from each of these 55 villages were randomly selected for analyzing the level of interaction. However, for villages from smaller size-class category where the total number of households were very less this percentage went up to 60 to 70 percent of the total number of households in the village. In this way a total of 2586 households were surveyed from the selected 55 villages. The households of each village were classified on the basis of their frequency of visit to Siliguri Municipal Corporation. The households were classified based on their percentage as follows:

1. Visits Siliguri Municipal Corporation daily.
2. Visits Siliguri Municipal Corporation 3-4 times per week.
3. Visits Siliguri Municipal Corporation 1-2 times per week.
4. Visits Siliguri Municipal Corporation 1-2 times per month.
5. Visits Siliguri Municipal Corporation 1-2 times per six months.
6. Visits Siliguri Municipal Corporation 1-2 times per year.
7. Never visit Siliguri Municipal Corporation.

Since, the households which vists Siliguri daily have higher interaction compared to the rest of the categories. Therefore, maximum weightage will be given to them and weightage will decrease subsequently with decline in the frequency of visit to Siliguri. Accordingly, the weightage for calculating the composite index of interaction will be as follows:

Table No. 6.1 Frequency of visit to Siliguri Municipal Corporation

Frequency of visit to Siliguri Municipal Corporation	Weightage
Visits Siliguri Municipal Corporation daily.	7
Visits Siliguri Municipal Corporation 3-4 times per week.	6
Visits Siliguri Municipal Corporation 1-2 times per week.	5
Visits Siliguri Municipal Corporation 1-2 times per month.	4
Visits Siliguri Municipal Corporation 1-2 times per six months.	3
Visits Siliguri Municipal Corporation 1-2 times per year.	2
Never visit Siliguri Municipal Corporation.	1

The composite index of interaction for a village will be calculated by multiplying the percentage of household in each category (based on frequency of visit) with their respective weightage and finally summing them up. For example,

The composite index of economic interaction for Champasari Chhat = 80*7 + 20*6 + 0*5 + 0*4 + 0*3 + 0*2 + 0*1 = 680.

In this way the composite index of interaction for the designated purposes has been calculated for the selected villgaes under each zone with Siliguri Municipal Corporation.

Map No. 6.1 Location of the surveyed villages

Source: Prepared by the Researcher.

Table No. 6.2 Economic Interaction between selected villages and Siliguri Municipal Corporation

Zone	Name of the Villages	Road Distance form SMC	Percentage of household							Composite Index of Interaction
			Daily	3- 4 times per week	1-2 times per week	1-2 times per month	1-2 times per six month	1-2 times per year	Never Visited	
I	Champasari Chhat	11.5	80.00	20.00	0.00	0.00	0.00	0.00	0.00	680.00
	Ruhini Chhat	14.3	70.00	20.00	10.00	0.00	0.00	0.00	0.00	660.00
	Salbari Chhat Pratham Khanda	8	70.00	30.00	0.00	0.00	0.00	0.00	0.00	670.00
	Fulbari Pataner Chhat	15.2	70.00	30.00	0.00	0.00	0.00	0.00	0.00	670.00
	Kamala barir Chhat	12.7	60.00	40.00	0.00	0.00	0.00	0.00	0.00	660.00
	Purba Karai Barir chhat	10.9	60.00	30.00	10.00	0.00	0.00	0.00	0.00	650.00
	Lalsara Chhat	18.5	45.45	54.55	0.00	0.00	0.00	0.00	0.00	645.45
	Ujanu	4.3	93.75	6.25	0.00	0.00	0.00	0.00	0.00	693.75
	Dumriguri Chhat	16	80.95	14.29	4.76	0.00	0.00	0.00	0.00	676.19
	Sisabari	9.8	76.19	23.81	0.00	0.00	0.00	0.00	0.00	676.19
	Karaibari	10.7	66.67	25.00	8.33	0.00	0.00	0.00	0.00	658.33
	Putimari	12.7	83.33	16.67	0.00	0.00	0.00	0.00	0.00	683.33
	Rajpairi	11.1	78.05	19.51	2.44	0.00	0.00	0.00	0.00	675.61
	Bhujia Banir Chhat	13	72.34	23.40	4.26	0.00	0.00	0.00	0.00	668.09
	Bara Pathuram	9.5	83.05	10.17	6.78	0.00	0.00	0.00	0.00	676.27
	Liusipukuri	16.5	73.58	20.75	5.66	0.00	0.00	0.00	0.00	667.92
	Mahishmari	9.4	62.50	31.25	6.25	0.00	0.00	0.00	0.00	656.25
	Kauakhali	5.4	94.77	5.23	0.00	0.00	0.00	0.00	0.00	694.77
II	Tharu Bhita	25.6	40.00	60.00	0.00	0.00	0.00	0.00	0.00	640.00
	Gangaram Maler Chhat	24.1	30.00	70.00	0.00	0.00	0.00	0.00	0.00	630.00
	Bairbhita	24.9	40.00	60.00	0.00	0.00	0.00	0.00	0.00	640.00
	Grammanir Chhat	24.3	30.00	70.00	0.00	0.00	0.00	0.00	0.00	630.00

	Sivok Hill Forest	23.2	20.00	50.00	30.00	0.00	0.00	0.00	0.00	590.00
	Grammani	24.1	40.00	40.00	20.00	0.00	0.00	0.00	0.00	620.00
	Dalkajhar Forest	21.8	40.00	50.00	10.00	0.00	0.00	0.00	0.00	630.00
	Bhelu	24.1	45.45	45.45	9.09	0.00	0.00	0.00	0.00	636.36
	Dhemaler Chhar	23.3	40.00	46.67	13.33	0.00	0.00	0.00	0.00	626.67
	Siubar	29.4	42.11	31.58	26.32	0.00	0.00	0.00	0.00	615.79
	Dandrajhar	33.3	36.36	31.82	31.82	0.00	0.00	0.00	0.00	604.55
	Chamtaguri Chhat	10.1	66.67	22.22	11.11	0.00	0.00	0.00	0.00	655.56
	Trihana Tea Garden	22.9	32.50	42.50	25.00	0.00	0.00	0.00	0.00	607.50
	Jogibhita	29.1	40.00	24.44	35.56	0.00	0.00	0.00	0.00	604.44
	Hetmuri	19.4	43.48	23.91	32.61	0.00	0.00	0.00	0.00	610.87
	Uttar Bansgaon Kismat	23	43.12	32.11	22.02	0.00	0.00	0.00	2.75	607.34
	Madhya Bansgaon	25.6	51.63	19.02	26.09	2.17	0.00	0.00	1.09	615.76
	Pashchim Madati	37.1	44.28	26.57	22.14	5.90	0.37	0.00	1.85	606.64
III	Tukriajhar Forest	34.3	20.00	50.00	10.00	0.00	0.00	0.00	20.00	510.00
	Dhakna Gachh	32.7	30.00	30.00	10.00	0.00	0.00	0.00	30.00	470.00
	Fulbarir Chhat	34.9	20.00	60.00	0.00	0.00	0.00	0.00	20.00	520.00
	Madan	32.2	30.00	20.00	20.00	0.00	0.00	0.00	30.00	460.00
	Nazir	38.2	20.00	50.00	10.00	0.00	0.00	0.00	20.00	510.00
	Dudha	34.3	20.00	20.00	30.00	0.00	0.00	0.00	30.00	440.00
	Jamatulla	38	18.18	27.27	27.27	0.00	0.00	0.00	27.27	454.55
	Singbhita	32.8	27.27	18.18	27.27	0.00	0.00	0.00	27.27	463.64
	Chhota Paikpara Arazi	40.7	28.57	21.43	28.57	0.00	0.00	0.00	21.43	492.86
	Chunilal	44.8	40.91	27.27	18.18	0.00	0.00	0.00	13.64	554.55
	Subalbhita	35.6	36.36	22.73	18.18	13.64	0.00	0.00	9.09	545.45
	Naksalbari	28.2	38.89	36.11	11.11	5.56	0.00	0.00	8.33	575.00
	Debiganja	47.1	33.33	30.95	19.05	7.14	0.00	0.00	9.52	552.38

	Chayansing	37.4	31.82	27.27	27.27	4.55	0.00	0.00	9.09	550.00
	Dayaram	29.3	28.57	41.43	17.14	5.71	0.00	0.00	7.14	564.29
	Mandila Jhar	44.5	30.53	32.06	20.61	9.16	0.00	0.00	7.63	553.44
	Bara Paikpara Arazi	41.2	31.54	22.15	28.86	10.74	0.00	0.00	6.71	547.65
	Uttar Ramdhan	32.3	29.80	23.18	22.52	13.91	0.00	0.00	10.60	526.49
	Lahugaon	44	28.06	23.32	21.74	15.02	0.00	0.00	11.86	517.00
Source: Computed by the Researcher.										

Interaction between rural and urban area for economic purpose is of paramount importance. Economic interaction includes interaction for financial purpose, employment purpose, trade and commerce purpose and daily shopping purpose. Table 6.2 shows the rural-urban interaction among the households of the selected 55 villages from three zones with Siliguri Municipal Corporation for economic purpose. According to the table, households of the villages under Zone I interact very frequently for economic purpose with Siliguri Municipal Corporation. From Zone I, the highest interaction for economic purpose was observed by the people living in Kauakhali village, while the lowest was from Lalsara Chhat village. Similarly from Zone II, the highest interaction for economic purpose was observed by people living in Chamtaguri Chhat, while the lowest was from Sivok Hill Forest. In general the interaction for economic purpose has declined considerably for villages located in Zone II compared to villages located in Zone I. Within Zone III, the highest interaction for economic purpose was observed by people living in Naksalbari village, while the lowest was by people living in Dudha village. A general observation from the table is that interaction for economic purpose is highest with Siliguri Municipal Corporation by the villages located in Zone I, which subsequently decrease for Zone II and Zone III respectively.

Simple bi-variate regression equation has been calculated among the 55 selected villages with their road distance from Siliguri Municipal Corporation and their composite index of interaction for economic purpose (Fig. 6.1). It is evident from the figure that there is a negative relationship between the road distance of any village from Siliguri Municipal Corporation and their composite index of interaction for economic purpose. This signifies that with increase in distance of a village from Siliguri Municipal Corporation, it's interaction with Siliguri Municipal Corporation for economic purposes decreases. The coefficient of determination calculated shows a value of 0.6823, which means that around 68% of variation

in composite index of interaction for economic purposes among the villages in the study area can be explained by their variation in distance from Siliguri Municipal Corporation.

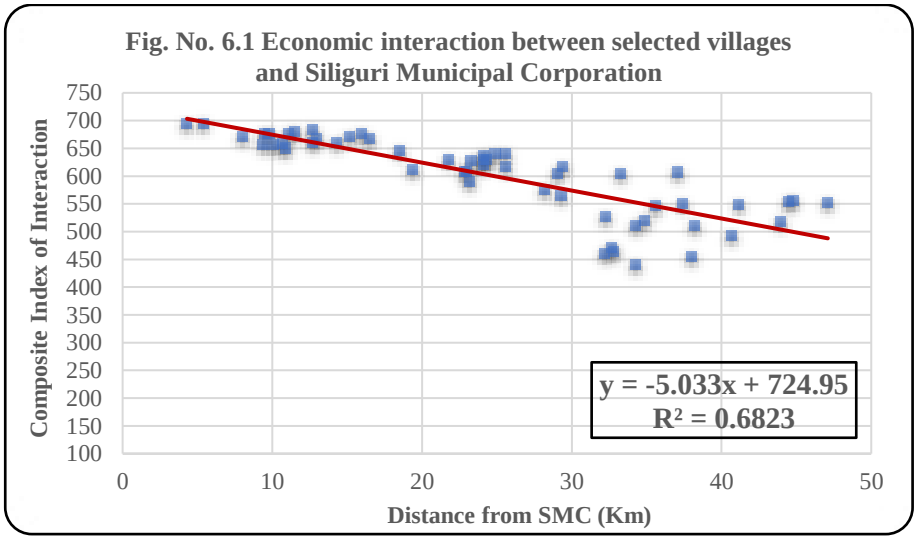


Table No. 6.3 Agricultural interaction between selected villages and Siliguri Municipal Corporation

Zone	Name of the Villages	Distance form SMC (Km)	Households Availing Agricultural Interaction							Composite Index of Interaction
			Daily	3- 4 times per week	1-2 times per week	1-2 times per month	1-2 times per six month	1-2 times per year	Never Visited	
I	Champasari Chhat	11.5	60.00	20.00	10.00	0.00	0.00	0.00	10.00	600.00
	Ruhini Chhat	14.3	40.00	40.00	20.00	0.00	0.00	0.00	0.00	620.00
	Salbari Chhat Pratham Khanda	8	40.00	50.00	0.00	0.00	0.00	0.00	10.00	590.00
	Fulbari Pataner Chhat	15.2	50.00	40.00	0.00	0.00	0.00	0.00	10.00	600.00
	Kamala barir Chhat	12.7	40.00	60.00	0.00	0.00	0.00	0.00	0.00	640.00
	Purba Karai Barir chhat	10.9	50.00	40.00	10.00	0.00	0.00	0.00	0.00	640.00
	Lalsara Chhat	18.5	45.45	36.36	9.09	0.00	0.00	0.00	9.09	590.91
	Ujanu	4.3	68.75	18.75	6.25	0.00	0.00	0.00	6.25	631.25
	Dumriguri Chhat	16	71.43	14.29	9.52	0.00	0.00	0.00	4.76	638.10
	Sisabari	9.8	57.14	33.33	4.76	0.00	0.00	0.00	4.76	628.57
	Karaibari	10.7	54.17	20.83	12.50	4.17	0.00	0.00	8.33	591.67

	Putimari	12.7	62.50	12.50	8.33	8.33	0.00	0.00	8.33	595.83
	Rajpairi	11.1	63.41	24.39	4.88	0.00	0.00	0.00	7.32	621.95
	Bhujia Banir Chhat	13	61.70	23.40	6.38	2.13	0.00	0.00	6.38	619.15
	Bara Pathuram	9.5	69.49	11.86	8.47	5.08	0.00	0.00	5.08	625.42
	Liusipukuri	16.5	59.43	22.64	6.60	5.66	0.00	0.00	5.66	613.21
	Mahishmari	9.4	54.69	25.78	10.16	1.56	0.00	0.00	7.81	602.34
	Kauakhali	5.4	66.67	13.73	11.11	3.92	0.00	0.00	4.58	624.84
II	Tharu Bhita	25.6	30.00	20.00	30.00	10.00	0.00	0.00	10.00	530.00
	Gangaram Maler Chhat	24.1	20.00	30.00	30.00	10.00	0.00	0.00	10.00	520.00
	Bairbhita	24.9	20.00	30.00	20.00	20.00	0.00	0.00	10.00	510.00
	Grammanir Chhat	24.3	0.00	40.00	50.00	10.00	0.00	0.00	0.00	530.00
	Sivok Hill Forest	23.2	10.00	20.00	40.00	20.00	0.00	0.00	10.00	480.00
	Grammani	24.1	20.00	40.00	30.00	0.00	0.00	0.00	10.00	540.00
	Dalkajhar Forest	21.8	10.00	40.00	30.00	10.00	0.00	0.00	0.00	500.00
	Bhelu	24.1	18.18	27.27	45.45	0.00	0.00	0.00	9.09	527.27
	Dhemaler Chhar	23.3	13.33	46.67	20.00	6.67	0.00	0.00	13.33	513.33
	Siubar	29.4	21.05	31.58	21.05	10.53	0.00	0.00	15.79	500.00
	Dandrajhar	33.3	18.18	22.73	31.82	9.09	4.55	0.00	13.64	486.36
	Chamtaguri Chhat	10.1	44.44	18.52	18.52	3.70	0.00	0.00	14.81	544.44
	Trihana Tea Garden	22.9	25.00	32.50	20.00	7.50	2.50	0.00	12.50	520.00
	Jogibhita	29.1	8.89	33.33	42.22	0.00	0.00	0.00	15.56	488.89
	Hetmuri	19.4	36.96	23.91	19.57	8.70	0.00	0.00	10.87	545.65
	Uttar Bansgaon Kismat	23	27.52	25.69	22.94	8.26	1.83	0.00	13.76	513.76
	Madhya Bansgaon	25.6	26.09	21.74	30.98	5.43	2.17	0.00	13.59	509.78

	Pashchim Madati	37.1	20.30	40.59	19.93	4.43	3.69	0.00	11.07	525.09
III	Tukriajhar Forest	34.3	0.00	10.00	60.00	20.00	0.00	0.00	10.00	450.00
	Dhakna Gachh	32.7	0.00	10.00	70.00	10.00	0.00	0.00	10.00	460.00
	Fulbarir Chhat	34.9	0.00	10.00	50.00	20.00	0.00	0.00	20.00	410.00
	Madan	32.2	0.00	20.00	60.00	0.00	0.00	0.00	20.00	440.00
	Nazir	38.2	0.00	10.00	70.00	0.00	0.00	0.00	20.00	430.00
	Dudha	34.3	0.00	20.00	40.00	10.00	0.00	0.00	30.00	390.00
	Jamatulla	38	0.00	9.09	63.64	9.09	0.00	0.00	18.18	427.27
	Singbhita	32.8	0.00	9.09	63.64	0.00	0.00	0.00	27.27	400.00
	Chhota Paikpara Arazi	40.7	0.00	14.29	57.14	0.00	0.00	0.00	28.57	400.00
	Chunilal	44.8	0.00	9.09	68.18	4.55	0.00	0.00	18.18	431.82
	Subalbhita	35.6	0.00	13.64	50.00	13.64	0.00	0.00	22.73	409.09
	Naksalbari	28.2	0.00	11.11	47.22	16.67	0.00	0.00	25.00	394.44
	Debiganja	47.1	0.00	14.29	45.24	16.67	0.00	0.00	23.81	402.38
	Chayansing	37.4	0.00	11.36	47.73	13.64	0.00	0.00	27.27	388.64
	Dayaram	29.3	0.00	8.57	62.86	11.43	0.00	0.00	17.14	428.57
	Mandila Jhar	44.5	0.00	19.08	45.80	15.27	0.00	0.00	19.85	424.43
	Bara Paikpara Arazi	41.2	0.00	16.78	48.32	14.77	0.00	0.00	20.13	421.48
	Uttar Ramdhan	32.3	0.00	26.49	49.67	3.97	0.00	0.00	19.87	443.05
	Lahugaon	44	0.00	11.86	55.34	17.79	0.00	0.00	15.02	433.99
Source: Computed by the Researcher										

Interaction between rural and urban area for agricultural purpose is also very important. Surplus agricultural commodities produced in the rural areas are sold in urban markets. Agricultural interaction includes interaction for agricultural commodities, fruits, vegetables, dairy products and agricultural inputs. Table 6.3 shows the rural-urban interaction among the

households of the selected 55 villages from three zones with Siliguri Municipal Corporation for agricultural purpose. According to the table, households of the villages under Zone I interact very frequently for agricultural purpose with Siliguri Municipal Corporation. From Zone I, the highest interaction for agricultural purpose was observed by the people living in Dumriguri Chhat village, while the lowest was from Salbari Chhat Pratham Khanda village. Similarly, from Zone II, the highest interaction for agricultural purpose was observed by people living in Hetmuri, while the lowest was from Sivok Hill Forest. Like economic interaction, the interaction for agricultural purpose has declined considerably for villages located in Zone II compared to villages located in Zone I. Within Zone III, the highest interaction for agricultural purpose was observed by people living in Dhakna Gachh village, while the lowest was by people living in Chayansing village. A general observation from the table is that interaction for agricultural purpose is highest with Siliguri Municipal Corporation by the villages located in Zone I, which subsequently decrease for Zone II and Zone III respectively. This trend is quite similar to the one observed for interaction due to economic purpose. However, interaction for agricultural purpose with the villages in the study area and Siliguri Municipal Corporation is relatively less compared to that of interaction for economic purpose.

Simple bi-variate regression equation has been calculated among the 55 selected villages with their road distance from Siliguri Municipal Corporation and their composite index of interaction for agricultural purpose (Fig. 6.2). It is evident from the figure that there is a negative relationship between the road distance of any village from Siliguri Municipal Corporation and their composite index of interaction for agricultural purpose. This signifies that with increase in distance of a village from Siliguri Municipal Corporation, it's interaction with Siliguri Municipal Corporation for agricultural purposes decreases. The coefficient of determination calculated shows a value of 0.8159, which means that around 81% of variation in composite index of interaction for agricultural purposes among the villages in the study area can be explained by their variation in distance from Siliguri Municipal Corporation.

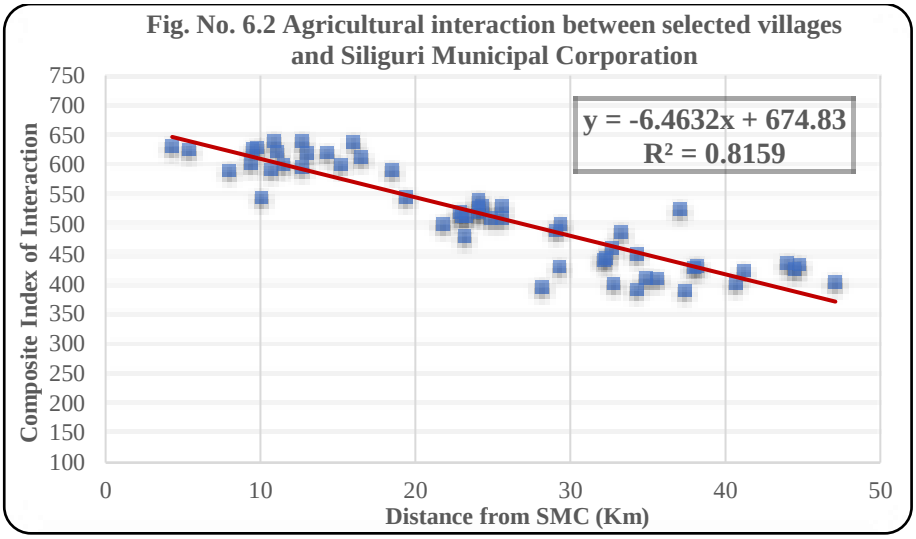


Table No. 6.4 Educational interaction between selected villages and Siliguri Municipal Corporation

Zone	Name of the Villages	Distance form SMC (Km)	Households Availing Educational Interaction							Composite Index of Interaction
			Daily	3- 4 times per week	1-2 times per week	1-2 times per month	1-2 times per six month	1-2 times per year	Never Visited	
I	Champasari Chhat	11.5	50.00	40.00	0.00	0.00	0.00	0.00	10.00	600.00
	Ruhini Chhat	14.3	40.00	40.00	0.00	0.00	0.00	0.00	20.00	540.00
	Salbari Chhat Pratham Khanda	8	60.00	30.00	10.00	0.00	0.00	0.00	0.00	650.00
	Fulbari Pataner Chhat	15.2	60.00	20.00	20.00	0.00	0.00	0.00	0.00	640.00
	Kamala barir Chhat	12.7	40.00	50.00	0.00	0.00	0.00	0.00	10.00	590.00
	Purba Karai Barir chhat	10.9	50.00	20.00	20.00	0.00	0.00	0.00	10.00	580.00
	Lalsara Chhat	18.5	36.36	27.27	0.00	0.00	0.00	0.00	27.27	445.45
	Ujanu	4.3	75.00	12.50	0.00	0.00	0.00	0.00	12.50	612.50
	Dumriguri Chhat	16	71.43	0.00	23.81	0.00	0.00	0.00	4.76	623.81
	Sisabari	9.8	71.43	23.81	0.00	0.00	0.00	0.00	4.76	647.62
	Karaibari	10.7	58.33	25.00	12.50	0.00	0.00	0.00	4.17	625.00
	Putimari	12.7	75.00	0.00	16.67	0.00	0.00	0.00	8.33	616.67
	Rajpairi	11.1	68.29	24.39	2.44	0.00	0.00	0.00	4.88	641.46
	Bhujia Banir Chhat	13	63.83	21.28	2.13	0.00	0.00	0.00	12.77	597.87

	Bara Pathuram	9.5	67.80	16.95	6.78	1.69	0.00	0.00	6.78	623.73
	Liusipukuri	16.5	66.04	18.87	9.43	0.00	0.00	0.00	5.66	628.30
	Mahishmari	9.4	58.59	19.53	14.06	0.00	0.00	0.00	7.81	605.47
	Kauakhali	5.4	81.70	6.54	1.31	0.00	0.00	0.00	11.76	629.41
II	Tharu Bhita	25.6	20.00	10.00	0.00	0.00	0.00	0.00	70.00	270.00
	Gangaram Maler Chhat	24.1	10.00	30.00	0.00	0.00	0.00	0.00	60.00	310.00
	Bairbhita	24.9	20.00	20.00	0.00	0.00	0.00	0.00	60.00	320.00
	Grammanir Chhat	24.3	0.00	30.00	0.00	0.00	0.00	0.00	70.00	250.00
	Sivok Hill Forest	23.2	20.00	10.00	10.00	0.00	0.00	0.00	60.00	310.00
	Grammani	24.1	10.00	20.00	0.00	0.00	0.00	0.00	70.00	260.00
	Dalkajhar Forest	21.8	10.00	20.00	0.00	0.00	0.00	0.00	70.00	260.00
	Bhelu	24.1	18.18	9.09	0.00	0.00	0.00	0.00	63.64	245.45
	Dhemaler Chhar	23.3	20.00	13.33	6.67	0.00	0.00	0.00	60.00	313.33
	Siubar	29.4	26.32	10.53	0.00	0.00	0.00	0.00	63.16	310.53
	Dandrajhar	33.3	13.64	4.55	9.09	0.00	0.00	0.00	72.73	240.91
	Chamtaguri Chhat	10.1	51.85	33.33	3.70	0.00	0.00	0.00	11.11	592.59
	Trihana Tea Garden	22.9	7.50	10.00	35.00	0.00	0.00	0.00	47.50	335.00
	Jogibhita	29.1	2.22	15.56	26.67	0.00	0.00	0.00	55.56	297.78
	Hetmuri	19.4	8.70	13.04	21.74	0.00	0.00	0.00	56.52	304.35
	Uttar Bansgaon Kismat	23	0.00	9.17	27.52	4.59	3.67	0.00	55.05	277.06
	Madhya Bansgaon	25.6	3.80	2.72	10.87	5.43	8.15	2.72	66.30	215.22
	Pashchim Madati	37.1	3.32	11.07	4.06	9.23	7.38	1.85	63.10	235.79
III	Tukriajhar Forest	34.3	0.00	20.00	0.00	0.00	0.00	0.00	80.00	200.00
	Dhakna Gachh	32.7	0.00	10.00	10.00	0.00	0.00	0.00	80.00	190.00
	Fulbarir Chhat	34.9	0.00	10.00	10.00	0.00	0.00	0.00	80.00	190.00
	Madan	32.2	0.00	0.00	20.00	0.00	0.00	0.00	80.00	180.00
	Nazir	38.2	0.00	0.00	10.00	20.00	0.00	0.00	70.00	200.00

	Dudha	34.3	0.00	0.00	20.00	10.00	0.00	0.00	70.00	210.00
	Jamatulla	38	0.00	0.00	18.18	9.09	9.09	0.00	63.64	218.18
	Singbhita	32.8	0.00	0.00	9.09	18.18	9.09	0.00	63.64	209.09
	Chhota Paikpara Arazi	40.7	0.00	0.00	14.29	7.14	0.00	0.00	78.57	178.57
	Chunilal	44.8	0.00	0.00	9.09	9.09	0.00	0.00	81.82	163.64
	Subalbhita	35.6	0.00	0.00	0.00	18.18	0.00	0.00	81.82	154.55
	Naksalbari	28.2	0.00	0.00	5.56	11.11	8.33	0.00	75.00	172.22
	Debiganja	47.1	0.00	0.00	4.76	7.14	9.52	2.38	66.67	152.38
	Chayansing	37.4	0.00	0.00	9.09	6.82	0.00	0.00	84.09	156.82
	Dayaram	29.3	0.00	0.00	0.00	18.57	5.71	4.29	71.43	171.43
	Mandila Jhar	44.5	0.00	0.00	3.82	8.40	6.11	2.29	79.39	154.96
	Bara Paikpara Arazi	41.2	0.00	0.00	2.68	8.05	6.04	5.37	77.85	152.35
	Uttar Ramdhan	32.3	0.00	0.00	2.65	10.60	6.62	6.62	73.51	162.25
	Lahugaon	44	0.00	0.00	1.98	5.93	11.46	5.93	74.70	154.55
Source: Computed by the Researcher.										

Interaction between rural and urban areas for educational purpose is also very important for the students living in rural area but want to get the best of educational opportunities available in the nearby urban centre. Educational interaction includes interaction for primary education, secondary education, higher secondary education, higher education, technical education and for private tuition and coaching classes. Table 6.4 shows the rural-urban interaction among the households of the selected 55 villages from three zones with Siliguri Municipal Corporation for educational purpose. According to the table, households of the villages under Zone I interact quite frequently for educational purpose with Siliguri Municipal Corporation. From Zone I, the highest interaction for educational purpose was observed by the people living in Salbari Chhat Pratham Khanda village, while the lowest was from Lalsara Chhat village. Similarly, from Zone II, the highest interaction for educational purpose was observed by people living in Chamtaguri Chhat, while the lowest was from Madhya Bansgaon. Like economic interaction and agricultural interaction, the interaction for educational purpose has declined considerably for villages located in Zone II compared to villages located in Zone I. Within Zone III, the highest interaction for educational purpose was observed by people

living in Jamatulla village, while the lowest was by people living in Bara Paikpara Arazi village. A general observation from the table is that interaction for educational purpose is highest with Siliguri Municipal Corporation by the villages located in Zone I, which subsequently decrease for Zone II and Zone III respectively. This trend is quite similar to the one observed for interaction due to economic purpose and agricultural purpose. However, comparing the composite index of interaction for educational, economic and agricultural purpose it can be said that interaction for educational purpose between the villages of the study area with Siliguri Municipal Corporation is relatively less than that of agricultural and economic interaction.

Simple bi-variate regression equation has been calculated among the 55 selected villages with their road distance from Siliguri Municipal Corporation and their composite index of interaction for educational purpose (Fig. 6.3). It is evident from the figure that there is a negative relationship between the road distance of any village from Siliguri Municipal Corporation and their composite index of interaction for educational purpose. This signifies that with increase in distance of a village from Siliguri Municipal Corporation, it's interaction with Siliguri Municipal Corporation for educational purposes decreases. Infact, interaction for educational purpose decrease very rapidly with increase in road distance from Siliguri Municipal Corporation. The coefficient of determination calculated shows a value of 0.8302, which means that around 83% of variation in composite index of interaction for educational purposes among the villages in the study area can be explained by their variation in distance from Siliguri Municipal Corporation.

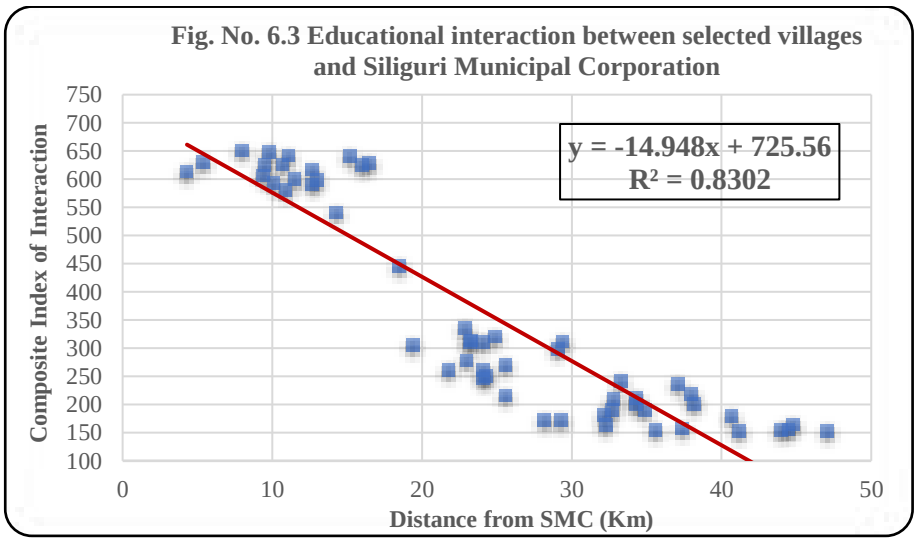


Table No. 6.5 Health interaction between selected villages and Siliguri Municipal Corporation

Zone	Name of the Villages	Distance form SMC (Km)	Households Availing Health Interaction							Composite Index of Interaction
			Daily	3- 4 times per week	1-2 times per week	1-2 times per month	1-2 times per six month	1-2 times per year	Never Visited	
I	Champasari Chhat	11.5	0.00	0.00	20.00	50.00	30.00	0.00	0.00	390.00
	Ruhini Chhat	14.3	0.00	0.00	20.00	30.00	40.00	10.00	0.00	360.00
	Salbari Chhat Pratham Khanda	8	0.00	0.00	30.00	30.00	40.00	0.00	0.00	390.00
	Fulbari Pataner Chhat	15.2	0.00	0.00	20.00	40.00	30.00	10.00	0.00	370.00
	Kamala barir Chhat	12.7	0.00	0.00	20.00	40.00	40.00	0.00	0.00	380.00
	Purba Karai Barir chhat	10.9	0.00	0.00	30.00	30.00	40.00	0.00	0.00	390.00
	Lalsara Chhat	18.5	0.00	0.00	27.27	36.36	36.36	0.00	0.00	390.91
	Ujanu	4.3	0.00	0.00	37.50	37.50	25.00	0.00	0.00	412.50
	Dumriguri Chhat	16	0.00	0.00	23.81	38.10	33.33	4.76	0.00	380.95
	Sisabari	9.8	0.00	0.00	19.05	38.10	28.57	14.29	0.00	361.90
	Karaibari	10.7	0.00	0.00	16.67	41.67	33.33	8.33	0.00	366.67
	Putimari	12.7	0.00	0.00	20.83	41.67	25.00	12.50	0.00	370.83
	Rajpairi	11.1	0.00	0.00	9.76	39.02	36.59	14.63	0.00	343.90
	Bhujia Banir Chhat	13	0.00	0.00	10.64	42.55	36.17	10.64	0.00	353.19
	Bara Pathuram	9.5	0.00	0.00	15.25	42.37	33.90	16.95	0.00	381.36
	Liusipukuri	16.5	0.00	0.00	15.09	42.45	31.13	11.32	0.00	361.32
	Mahishmari	9.4	0.00	0.00	15.63	35.16	27.34	21.88	0.00	344.53
	Kauakhali	5.4	0.00	0.00	29.41	37.25	23.53	9.80	0.00	386.27
II	Tharu Bhita	25.6	0.00	0.00	0.00	20.00	30.00	40.00	10.00	260.00
	Gangaram Maler Chhat	24.1	0.00	0.00	0.00	20.00	40.00	40.00	0.00	280.00
	Bairbhita	24.9	0.00	0.00	0.00	10.00	60.00	30.00	0.00	280.00
	Grammanir Chhat	24.3	0.00	0.00	0.00	10.00	50.00	30.00	10.00	260.00
	Sivok Hill Forest	23.2	0.00	0.00	0.00	20.00	50.00	30.00	0.00	290.00
	Grammani	24.1	0.00	0.00	0.00	20.00	40.00	40.00	0.00	280.00
	Dalkajhar Forest	21.8	0.00	0.00	0.00	10.00	60.00	20.00	10.00	270.00
	Bhelu	24.1	0.00	0.00	0.00	0.00	63.64	36.36	0.00	263.64
	Dhemaler Chhar	23.3	0.00	0.00	0.00	13.33	53.33	33.33	0.00	280.00
	Siubar	29.4	0.00	0.00	0.00	10.53	47.37	42.11	0.00	268.42
	Dandrajhar	33.3	0.00	0.00	0.00	9.09	54.55	36.36	0.00	272.73
	Chamtaguri Chhat	10.1	0.00	0.00	0.00	51.85	33.33	14.81	0.00	337.04

	Trihana Tea Garden	22.9	0.00	0.00	0.00	10.00	65.00	25.00	0.00	285.00
	Jogibhita	29.1	0.00	0.00	0.00	11.11	33.33	55.56	0.00	255.56
	Hetmuri	19.4	0.00	0.00	0.00	13.04	54.35	32.61	0.00	280.43
	Uttar Bansgaon Kismat	23	0.00	0.00	0.00	17.43	55.05	27.52	0.00	289.91
	Madhya Bansgaon	25.6	0.00	0.00	0.00	13.04	59.78	27.17	0.00	285.87
	Pashchim Madati	37.1	0.00	0.00	0.00	15.13	55.35	29.52	0.00	285.61
III	Tukriajhar Forest	34.3	0.00	0.00	0.00	10.00	30.00	40.00	20.00	230.00
	Dhakna Gachh	32.7	0.00	0.00	0.00	10.00	20.00	50.00	20.00	220.00
	Fulbarir Chhat	34.9	0.00	0.00	0.00	10.00	20.00	60.00	10.00	230.00
	Madan	32.2	0.00	0.00	0.00	20.00	20.00	40.00	20.00	240.00
	Nazir	38.2	0.00	0.00	0.00	10.00	30.00	50.00	10.00	240.00
	Dudha	34.3	0.00	0.00	0.00	10.00	20.00	60.00	10.00	230.00
	Jamatulla	38	0.00	0.00	0.00	9.09	18.18	72.73	0.00	236.36
	Singbhita	32.8	0.00	0.00	0.00	9.09	18.18	63.64	9.09	227.27
	Chhota Paikpara Arazi	40.7	0.00	0.00	0.00	14.29	14.29	64.29	7.14	235.71
	Chunilal	44.8	0.00	0.00	0.00	9.09	13.64	68.18	9.09	222.73
	Subalbhita	35.6	0.00	0.00	0.00	4.55	18.18	72.73	4.55	222.73
	Naksalbari	28.2	0.00	0.00	0.00	5.56	19.44	69.44	5.56	225.00
	Debiganja	47.1	0.00	0.00	0.00	4.76	30.95	59.52	4.76	235.71
	Chayansing	37.4	0.00	0.00	0.00	4.55	22.73	68.18	4.55	227.27
	Dayaram	29.3	0.00	0.00	0.00	5.71	30.00	34.29	1.43	182.86
	Mandila Jhar	44.5	0.00	0.00	0.00	6.11	25.19	61.07	7.63	229.77
	Bara Paikpara Arazi	41.2	0.00	0.00	0.00	6.04	23.49	63.76	6.71	228.86
	Uttar Ramdhan	32.3	0.00	0.00	0.00	6.62	19.87	66.89	6.62	226.49
	Lahugaon	44	0.00	0.00	0.00	8.30	27.67	59.29	4.74	239.53

Source: Computed by the Researcher.

Interaction between rural and urban areas for health purpose is also very important given the fact that most of the hospitals in rural areas does not have specialized medical facilities required during emergency and critical illness. Health interaction includes interaction for OPD service, diagnostic service, hospitalization, vaccination and medicine service. Table 6.5 shows the rural-urban interaction among the households of the selected 55 villages from three zones with Siliguri Municipal Corporation for health purpose. According to the table, households of the villages under Zone I interact quite frequently for health purpose with Siliguri Municipal Corporation. From Zone I, the highest interaction for health purpose was observed by the people living in Ujanu village, while the lowest was from Rajpairi village. Similarly, from Zone II, the highest interaction for health purpose was observed by people living in Chamtaguri Chhat, while the lowest was from Jogibhita. Like economic interaction,

agricultural interaction and educational interaction, interaction for health purpose has declined considerably for villages located in Zone II compared to villages located in Zone I. Within Zone III, the highest interaction for health purpose was observed by people living in Madan and Nazir village, while the lowest was by people living in Chayansing village. A general observation from the table is that interaction for health purpose is highest with Siliguri Municipal Corporation by the villages located in Zone I, which subsequently decrease for Zone II and Zone III respectively. This trend is quite similar to the one observed for interaction due to economic purpose, agricultural purpose and educational purpose. However, comparing the composite index of interaction for educational, economic, agricultural and health purpose it can be said that interaction for health purpose between the villages of the study area with Siliguri Municipal Corporation is relatively less than that of the earlier discussed interaction.

Simple bi-variate regression equation has been calculated among the 55 selected villages with their road distance from Siliguri Municipal Corporation and their composite index of interaction for health purpose (Fig. 6.4). It is evident from the figure that there is a negative relationship between the road distance of any village from Siliguri Municipal Corporation and their composite index of interaction for health purpose. This signifies that with increase in distance of a village from Siliguri Municipal Corporation, it's interaction with Siliguri Municipal Corporation for health purposes decreases. The coefficient of determination calculated shows a value of 0.7843, which means that around 78% of variation in composite index of interaction for health purposes among the villages in the study area can be explained by their variation in distance from Siliguri Municipal Corporation.

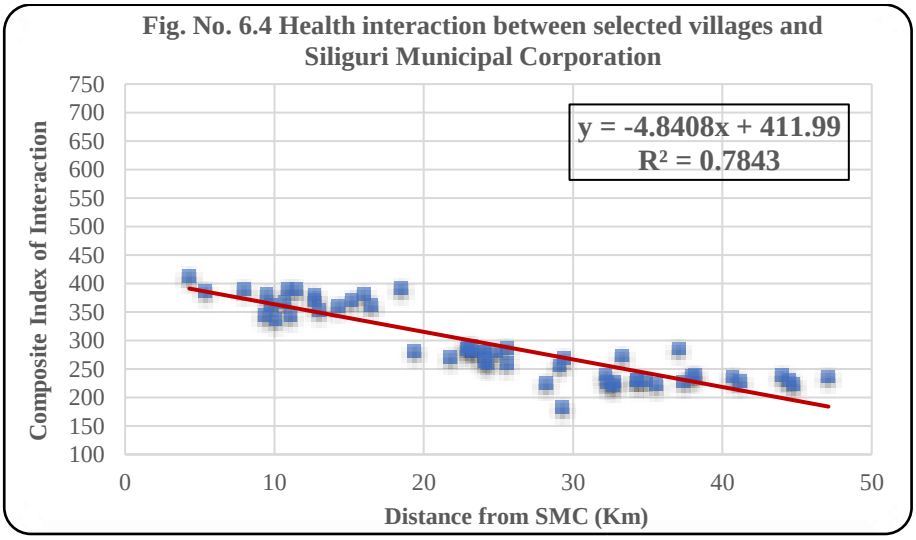


Table No. 6.6 Entertainment interaction between selected villages and Siliguri Municipal Corporation

Zone	Name of the Villages	Distance orm SMC (Km)	Households Availing Entertainment Interaction							Composite Index of Interaction
			Daily	3- 4 times per week	1-2 times per week	1-2 times per month	1-2 times per six month	1-2 times per year	Never Visited	
I	Champasari Chhat	11.5	0.00	10.00	50.00	40.00	0.00	0.00	0.00	470.00
	Ruhini Chhat	14.3	0.00	0.00	60.00	40.00	0.00	0.00	0.00	460.00
	Salbari Chhat Pratham Khanda	8	0.00	10.00	70.00	20.00	0.00	0.00	0.00	490.00
	Fulbari Pataner Chhat	15.2	0.00	10.00	60.00	30.00	0.00	0.00	0.00	480.00
	Kamala barir Chhat	12.7	0.00	0.00	60.00	40.00	0.00	0.00	0.00	460.00
	Purba Karai Barir chhat	10.9	0.00	10.00	50.00	40.00	0.00	0.00	0.00	470.00
	Lalsara Chhat	18.5	0.00	18.18	45.45	36.36	0.00	0.00	0.00	481.82
	Ujanu	4.3	0.00	62.50	31.25	6.25	0.00	0.00	0.00	556.25
	Dumriguri Chhat	16	0.00	14.29	47.62	38.10	0.00	0.00	0.00	476.19
	Sisabari	9.8	0.00	14.29	47.62	33.33	4.76	0.00	0.00	471.43
	Karaibari	10.7	0.00	12.50	50.00	37.50	0.00	0.00	0.00	475.00
	Putimari	12.7	0.00	12.50	45.83	33.33	8.33	0.00	0.00	462.50
	Rajpairi	11.1	0.00	12.20	51.22	36.59	0.00	0.00	0.00	475.61
	Bhujia Banir Chhat	13	0.00	10.64	53.19	36.17	0.00	0.00	0.00	474.47
	Bara Pathuram	9.5	0.00	11.86	50.85	37.29	0.00	0.00	0.00	474.58
	Liusipukuri	16.5	0.00	9.43	56.60	33.96	0.00	0.00	0.00	475.47
	Mahishmari	9.4	0.00	10.94	54.69	34.38	0.00	0.00	0.00	476.56
	Kauakhali	5.4	0.00	38.56	41.83	19.61	0.00	0.00	0.00	518.95
II	Tharu Bhita	25.6	0.00	0.00	20.00	50.00	30.00	0.00	0.00	390.00
	Gangaram Maler Chhat	24.1	0.00	0.00	30.00	50.00	20.00	0.00	0.00	410.00
	Bairbhita	24.9	0.00	0.00	20.00	60.00	20.00	0.00	0.00	400.00
	Grammanir Chhat	24.3	0.00	0.00	30.00	40.00	30.00	0.00	0.00	400.00
	Sivok Hill Forest	23.2	0.00	0.00	20.00	50.00	30.00	0.00	0.00	390.00

	Grammani	24.1	0.00	0.00	30.00	50.00	20.00	0.00	0.00	410.00
	Dalkajhar Forest	21.8	0.00	0.00	20.00	40.00	40.00	0.00	0.00	380.00
	Bhelu	24.1	0.00	0.00	27.27	45.45	27.27	0.00	0.00	400.00
	Dhemaler Chhar	23.3	0.00	0.00	20.00	60.00	20.00	0.00	0.00	400.00
	Siubar	29.4	0.00	0.00	15.79	63.16	21.05	0.00	0.00	394.74
	Dandrajhar	33.3	0.00	0.00	18.18	59.09	22.73	0.00	0.00	395.45
	Chamtaguri Chhat	10.1	0.00	0.00	40.74	48.15	11.11	0.00	0.00	429.63
	Trihana Tea Garden	22.9	0.00	0.00	12.50	47.50	37.50	2.50	0.00	370.00
	Jogibhita	29.1	0.00	0.00	11.11	51.11	33.33	4.44	0.00	368.89
	Hetmuri	19.4	0.00	0.00	15.22	43.48	41.30	0.00	0.00	373.91
	Uttar Bansgaon Kismat	23	0.00	0.00	9.17	45.87	44.95	0.00	0.00	364.22
	Madhya Bansgaon	25.6	0.00	0.00	16.30	57.07	26.63	0.00	0.00	389.67
	Pashchim Madati	37.1	0.00	0.00	12.55	63.10	24.35	0.00	0.00	388.19
III	Tukriajhar Forest	34.3	0.00	0.00	0.00	30.00	50.00	20.00	0.00	310.00
	Dhakna Gachh	32.7	0.00	0.00	0.00	20.00	40.00	40.00	0.00	280.00
	Fulbarir Chhat	34.9	0.00	0.00	20.00	20.00	40.00	20.00	0.00	340.00
	Madan	32.2	0.00	0.00	10.00	30.00	30.00	30.00	0.00	320.00
	Nazir	38.2	0.00	0.00	0.00	20.00	60.00	20.00	0.00	300.00
	Dudha	34.3	0.00	0.00	0.00	30.00	50.00	20.00	0.00	310.00
	Jamatulla	38	0.00	0.00	0.00	27.27	54.55	18.18	0.00	309.09
	Singbhita	32.8	0.00	0.00	0.00	27.27	45.45	27.27	0.00	300.00
	Chhota Paikpara Arazi	40.7	0.00	0.00	0.00	28.57	57.14	14.29	0.00	314.29
	Chunilal	44.8	0.00	0.00	0.00	36.36	54.55	9.09	0.00	327.27
	Subalbhita	35.6	0.00	0.00	0.00	27.27	59.09	13.64	0.00	313.64
	Naksalbari	28.2	0.00	0.00	0.00	27.78	58.33	13.89	0.00	313.89
	Debiganja	47.1	0.00	0.00	0.00	23.81	59.52	16.67	0.00	307.14
	Chayansing	37.4	0.00	0.00	0.00	25.00	56.82	18.18	0.00	306.82

	Dayaram	29.3	0.00	0.00	0.00	18.57	64.29	17.14	0.00	301.43
	Mandila Jhar	44.5	0.00	0.00	0.00	15.27	68.70	16.03	0.00	299.24
	Bara Paikpara Arazi	41.2	0.00	0.00	0.00	20.13	61.74	18.12	0.00	302.01
	Uttar Ramdhan	32.3	0.00	0.00	0.00	22.52	62.91	14.57	0.00	307.95
	Lahugaon	44	0.00	0.00	0.00	19.76	55.34	24.90	0.00	294.86
Source: Computed by the Researcher.										

Interaction between rural and urban areas for entertainment purpose is to some extent optional. However, with the waves of globalization hitting the nook and corner of India, rural areas have also witnessed a lot of change in recent times. For young generation living in rural areas also, visiting multiplex, wearing branded cloths and eating in branded eateries have become a status symbol. To fulfil this aspirations people from the rural areas frequently visit nearby large urban centre. Interaction for entertainment purpose includes interaction related to shopping, eating out, movies, hangouts, festivals, fairs and shopping for luxury and high value goods. Table 6.6 shows the rural-urban interaction among the households of the selected 55 villages from three zones with Siliguri Municipal Corporation for entertainment purpose. According to the table, households of the villages under Zone I interact quite frequently for entertainment purpose with Siliguri Municipal Corporation. From Zone I, the highest interaction for entertainment purpose was observed by the people living in Ujanu village, while the lowest was from Ruhini Chhat and Kamala Barir Chhat village. Similarly, from Zone II, the highest interaction for entertainment purpose was observed by people living in Chamtaguri Chhat, while the lowest was from Uttar Bansgaon Kismat. Like economic interaction and agricultural interaction, the interaction for entertainment purpose has declined considerably for villages located in Zone II compared to villages located in Zone I. Within Zone III, the highest interaction for entertainment purpose was observed by people living in Fulbarir Chhat village, while the lowest was by people living in Dhakna Gachh village. A general observation from the table is that interaction for entertainment purpose is highest with Siliguri Municipal Corporation by the villages located in Zone I, which subsequently decrease for Zone II and Zone III respectively. This trend is quite similar to the one observed for interaction due to economic purpose and agricultural purpose. However, given the fact that although interaction for entertainment purpose is purely optional, comparing the composite index of interaction for entertainment, education and health purpose it can be said that entertainment has emerged as a big motivational factor for people from the rural area to interact with the nearby urban centre.

Simple bi-variate regression equation has been calculated among the 55 selected villages with their road distance from Siliguri Municipal Corporation and their composite index of interaction for entertainment purpose (Fig. 6.5). It is evident from the figure that there is a negative relationship between the road distance of any village from Siliguri Municipal Corporation and their composite index of interaction for entertainment purpose. This signifies that with increase in distance of a village from Siliguri Municipal Corporation, it's interaction with Siliguri Municipal Corporation for entertainment purposes decreases. Interaction for entertainment purpose decrease gradually with increase in road distance from Siliguri Municipal Corporation. The coefficient of determination calculated shows a value of 0.8279, which means that around 82% of variation in composite index of interaction for entertainment purposes among the villages in the study area can be explained by their variation in distance from Siliguri Municipal Corporation.

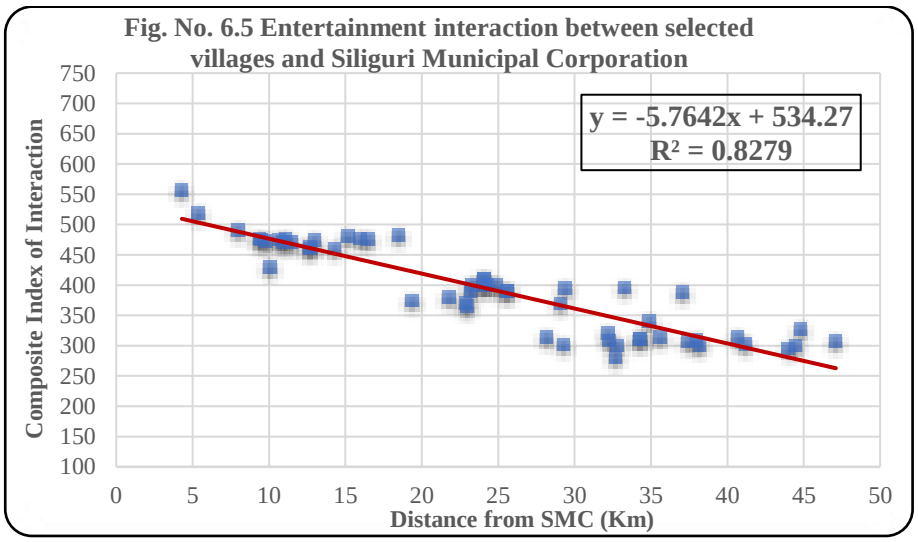


Table No. 6.7 Administration and organizational interaction between selected villages and Siliguri Municipal Corporation

Zone	Name of the Villages	Distance orm SMC (Km)	Households Availing Administration or Organizational Interaction							Composite Index of Interaction
			Daily	3- 4 times per week	1-2 times per week	1-2 times per month	1-2 times per six month	1-2 times per year	Never Visited	
I	Champasari Chhat	11.5	0.00	0.00	0.00	30.00	40.00	30.00	0.00	300.00
	Ruhini Chhat	14.3	0.00	0.00	0.00	20.00	50.00	30.00	0.00	290.00
	Salbari Chhat Pratham Khanda	8	0.00	0.00	0.00	30.00	50.00	20.00	0.00	310.00

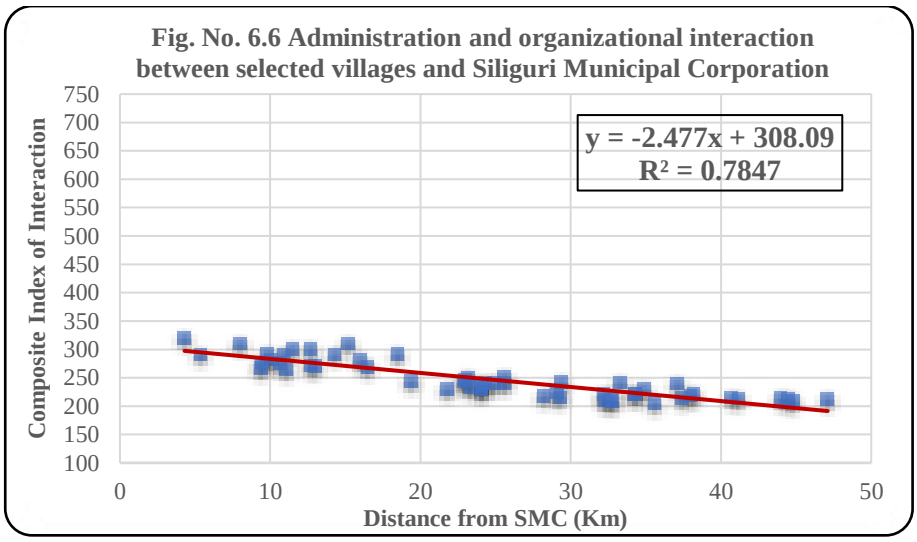
	Fulbari Pataner Chhat	15.2	0.00	0.00	0.00	40.00	30.00	30.00	0.00	310.00
	Kamala barir Chhat	12.7	0.00	0.00	0.00	30.00	40.00	30.00	0.00	300.00
	Purba Karai Barir chhat	10.9	0.00	0.00	0.00	30.00	30.00	40.00	0.00	290.00
	Lalsara Chhat	18.5	0.00	0.00	0.00	27.27	36.36	36.36	0.00	290.91
	Ujanu	4.3	0.00	0.00	0.00	37.50	43.75	18.75	0.00	318.75
	Dumriguri Chhat	16	0.00	0.00	0.00	19.05	42.86	38.10	0.00	280.95
	Sisabari	9.8	0.00	0.00	0.00	23.81	42.86	33.33	0.00	290.48
	Karaibari	10.7	0.00	0.00	0.00	16.67	41.67	41.67	0.00	275.00
	Putimari	12.7	0.00	0.00	0.00	12.50	45.83	41.67	0.00	270.83
	Rajpairi	11.1	0.00	0.00	0.00	7.32	48.78	43.90	0.00	263.41
	Bhujia Banir Chhat	13	0.00	0.00	0.00	12.77	44.68	42.55	0.00	270.21
	Bara Pathuram	9.5	0.00	0.00	0.00	16.95	42.37	40.68	0.00	276.27
	Liusipukuri	16.5	0.00	0.00	0.00	10.38	47.17	42.45	0.00	267.92
	Mahishmari	9.4	0.00	0.00	0.00	10.16	46.88	42.97	0.00	267.19
	Kauakhali	5.4	0.00	0.00	0.00	18.30	53.59	28.10	0.00	290.20
II	Tharu Bhita	25.6	0.00	0.00	0.00	0.00	40.00	60.00	0.00	240.00
	Gangaram Maler Chhat	24.1	0.00	0.00	0.00	0.00	30.00	70.00	0.00	230.00
	Bairbhita	24.9	0.00	0.00	0.00	0.00	40.00	60.00	0.00	240.00
	Grammanir Chhat	24.3	0.00	0.00	0.00	0.00	40.00	60.00	0.00	240.00
	Sivok Hill Forest	23.2	0.00	0.00	0.00	0.00	50.00	50.00	0.00	250.00
	Grammani	24.1	0.00	0.00	0.00	0.00	30.00	70.00	0.00	230.00
	Dalkajhar Forest	21.8	0.00	0.00	0.00	0.00	30.00	70.00	0.00	230.00
	Bhelu	24.1	0.00	0.00	0.00	0.00	36.36	63.64	0.00	236.36
	Dhemaler Chhar	23.3	0.00	0.00	0.00	0.00	33.33	66.67	0.00	233.33
	Siubar	29.4	0.00	0.00	0.00	0.00	42.11	57.89	0.00	242.11
	Dandrajhar	33.3	0.00	0.00	0.00	0.00	40.91	59.09	0.00	240.91
	Chamtaguri Chhat	10.1	0.00	0.00	0.00	18.52	44.44	37.04	0.00	281.48

	Trihana Tea Garden	22.9	0.00	0.00	0.00	0.00	42.50	57.50	0.00	242.50
	Jogibhita	29.1	0.00	0.00	0.00	0.00	37.78	48.89	13.33	224.44
	Hetmuri	19.4	0.00	0.00	0.00	0.00	43.48	56.52	0.00	243.48
	Uttar Bansgaon Kismat	23	0.00	0.00	0.00	0.00	45.87	54.13	0.00	245.87
	Madhya Bansgaon	25.6	0.00	0.00	0.00	2.17	46.20	51.63	0.00	250.54
	Pashchim Madati	37.1	0.00	0.00	0.00	0.37	45.76	50.18	0.00	239.11
III	Tukriajhar Forest	34.3	0.00	0.00	0.00	0.00	20.00	80.00	0.00	220.00
	Dhakna Gachh	32.7	0.00	0.00	0.00	0.00	20.00	70.00	10.00	210.00
	Fulbarir Chhat	34.9	0.00	0.00	0.00	0.00	30.00	70.00	0.00	230.00
	Madan	32.2	0.00	0.00	0.00	0.00	20.00	80.00	0.00	220.00
	Nazir	38.2	0.00	0.00	0.00	0.00	20.00	80.00	0.00	220.00
	Dudha	34.3	0.00	0.00	0.00	0.00	20.00	80.00	0.00	220.00
	Jamatulla	38	0.00	0.00	0.00	0.00	18.18	81.82	0.00	218.18
	Singbhita	32.8	0.00	0.00	0.00	0.00	18.18	72.73	9.09	209.09
	Chhota Paikpara Arazi	40.7	0.00	0.00	0.00	0.00	14.29	85.71	0.00	214.29
	Chunilal	44.8	0.00	0.00	0.00	0.00	13.64	81.82	4.55	209.09
	Subalbhita	35.6	0.00	0.00	0.00	0.00	13.64	77.27	9.09	204.55
	Naksalbari	28.2	0.00	0.00	0.00	0.00	16.67	83.33	0.00	216.67
	Debiganja	47.1	0.00	0.00	0.00	0.00	16.67	78.57	4.76	211.90
	Chayansing	37.4	0.00	0.00	0.00	0.00	18.18	77.27	4.55	213.64
	Dayaram	29.3	0.00	0.00	0.00	0.00	14.29	85.71	0.00	214.29
	Mandila Jhar	44.5	0.00	0.00	0.00	0.00	16.03	80.15	3.82	212.21
	Bara Paikpara Arazi	41.2	0.00	0.00	0.00	0.00	16.11	80.54	3.36	212.75
	Uttar Ramdhan	32.3	0.00	0.00	0.00	0.00	13.91	82.78	3.31	210.60
	Lahugaon	44	0.00	0.00	0.00	0.00	17.79	77.87	4.35	213.44

Source: Computed by the Researcher.

Interaction between rural and urban areas for administration and organizational purpose is the least frequent one among the reasons of interaction. Interaction for administrative and organizational purpose includes interaction related to office visit and court visit. Table 6.7 shows the rural-urban interaction among the households of the selected 55 villages from three zones with Siliguri Municipal Corporation for administration and organizational purpose. As mentioned earlier interaction for administration and organizational purpose is comparatively less as it is not a part of the daily requirement of people living in the rural areas. From Zone I, the highest interaction for administration and organizational purpose was observed by the people living in Ujanu village, while the lowest was from Rajpairi village. Similarly, from Zone II, the highest interaction for administration and organizational purpose was observed by people living in Chamtaguri Chhat, while the lowest was from Jogibhita. Unlike the other interactions, there is less variation among the villages under three zones with respect to interaction for administration and organizational purpose. Within Zone III, the highest interaction for administration and organizational purpose was observed by people living in Fulbarir Chhat village, while the lowest was by people living in Subalbhita village. A general observation from the table is that interaction for administrative and organizational purpose is highest with Siliguri Municipal Corporation by the villages located in Zone I, which subsequently decrease for Zone II and Zone III respectively. This trend is quite similar to the one observed for interaction due to economic purpose and agricultural purpose, however variation among the different zones is comparatively less.

Simple bi-variate regression equation has been calculated among the 55 selected villages with their road distance from Siliguri Municipal Corporation and their composite index of interaction for administration and organizational purpose (Fig. 6.6). It is evident from the figure that there is a negative relationship between the road distance of any village from Siliguri Municipal Corporation and their composite index of interaction for administration and organizational purpose. This signifies that with increase in distance of a village from Siliguri Municipal Corporation, it's interaction with Siliguri Municipal Corporation for administration and organizational purposes decreases. The coefficient of determination calculated shows a value of 0.7847, which means that around 78% of variation in composite index of interaction for administration and organizational purposes among the villages in the study area can be explained by their variation in distance from Siliguri Municipal Corporation.



In the above section rural-urban interaction between the selected 55 villages of Siliguri sub-division with Siliguri Municipal Corporation has been analyzed for economic, agricultural, educational, health, entertainment and administration and organizational purpose. From the tables and figures it can be said that there is a negative relationship in the study area with respect to distance of any village from Siliguri Municipal Corporation and their level of interaction with Siliguri Municipal Corporation for various purpose. The coefficient of determination calculated also validates this point. Therefore, the fourth hypothesis i.e. rural-urban interaction decrease with an increase in distance from Siliguri Municipal Corporation remains is accepted and is valid for all the selected purposes of interaction in the study area.

Income of any household plays a significant role in determining the rural-urban interaction. Usually, households with higher income tends to put them in a better position to explore the outside world. In rural areas households with very low income, living below the poverty line or just above the poverty line remain confined to their own village. Although, in many cases because of poverty these people are forced to migrate to large metropolitan cities in search of employment and to change their economic fortune. However, households having better economic condition tends to visit the nearby urban centre frequently for economic, educational, health and entertainment purpose. Moreover, relatively well-off farmers will also interact more with the nearby urban centre to market their agricultural products and also to buy agricultural inputs. In this section an attempt has been made to analyze the relationship between the average income of households in a village and their composite index of interaction with Siliguri Municipal Corporation for various purpose within the study area. Table 6.8 shows the composite index of interaction for 55 selected villages of the study area for various purpose with Siliguri Municipal Corporation and the average household income of each village. Based

on this table simple bivariate regression equation has been calculated by taking average income of household of each village and their composite index of interaction for each purpose. It shows that although, there is a positive relationship between the average income of households of any village and their composite index of interaction with Siliguri Municipal Corporation for various purposes but the coefficient of determination calculated are as follows: 0.2310 for average household income with composite index of interaction for economic purpose, 0.2525 for average household income with composite index of interaction for agricultural purpose, 0.3149 for average household income with composite index of interaction for educational purpose, 0.2623 for average household income with composite index of interaction for health purpose, 0.2907 for average household income with composite index of interaction for entertainment purpose and 0.2558 for average household income with composite index of interaction for administration and organizational purpose respectively. Hence, although the relationship is positive but it is not significant because only about 25% to 30% of variation in composite index of interaction for each purpose can be explained by variation in average household income. This signifies that for rural-urban interaction among the villages of the study area with Siliguri Municipal Corporation, income of the household is not the primary factor but other factor like distance of the village from Siliguri Municipal Corporation plays a dominant role in controlling the level of interaction.

Table No. 6.8 Relationship between Income of household and rural-urban interaction

Zone	Name of the Villages	Average Household Income (Rs./month)	Composite Index of Interaction					
			Economic Purpose	Agricultural Purpose	Educational Purpose	Health Purpose	Entertainment Purpose	Administration and Organizational Purpose
I	Champasari Chhat	8960	680.00	600.00	600.00	390.00	470.00	300.00
	Ruhini Chhat	7590	660.00	620.00	540.00	360.00	460.00	290.00
	Salbari Chhat Pratham Khanda	8340	670.00	590.00	650.00	390.00	490.00	310.00
	Fulbari Pataner Chhat	7650	670.00	600.00	640.00	370.00	480.00	310.00
	Kamala barir Chhat	9240	660.00	640.00	590.00	380.00	460.00	300.00
	Purba Karai Barir chhat	7600	650.00	640.00	580.00	390.00	470.00	290.00
	Lalsara Chhat	9800	645.45	590.91	445.45	390.91	481.82	290.91
	Ujanu	12550	693.75	631.25	612.50	412.50	556.25	318.75
	Dumriguri Chhat	13600	676.19	638.10	623.81	380.95	476.19	280.95

	Sisabari	12800	676.19	628.57	647.62	361.90	471.43	290.48
	Karaibari	13450	658.33	591.67	625.00	366.67	475.00	275.00
	Putimari	9820	683.33	595.83	616.67	370.83	462.50	270.83
	Rajpairi	8350	675.61	621.95	641.46	343.90	475.61	263.41
	Bhujia Banir Chhat	10560	668.09	619.15	597.87	353.19	474.47	270.21
	Bara Pathuram	8775	676.27	625.42	623.73	381.36	474.58	276.27
	Liusipukuri	7650	667.92	613.21	628.30	361.32	475.47	267.92
	Mahishmari	10250	656.25	602.34	605.47	344.53	476.56	267.19
	Kauakhali	13800	694.77	624.84	629.41	386.27	518.95	290.20
II	Tharu Bhita	11000	640.00	530.00	270.00	260.00	390.00	240.00
	Gangaram Maler Chhat	7690	630.00	520.00	310.00	280.00	410.00	230.00
	Bairbhita	7700	640.00	510.00	320.00	280.00	400.00	240.00
	Grammanir Chhat	8500	630.00	530.00	250.00	260.00	400.00	240.00
	Sivok Hill Forest	8600	590.00	480.00	310.00	290.00	390.00	250.00
	Grammani	9650	620.00	540.00	260.00	280.00	410.00	230.00
	Dalkajhar Forest	7650	630.00	500.00	260.00	270.00	380.00	230.00
	Bhelu	8500	636.36	527.27	245.45	263.64	400.00	236.36
	Dhemaler Chhar	8700	626.67	513.33	313.33	280.00	400.00	233.33
	Siubar	8350	615.79	500.00	310.53	268.42	394.74	242.11
	Dandrajhar	7350	604.55	486.36	240.91	272.73	395.45	240.91
	Chamtaguri Chhat	14250	655.56	574.07	592.59	337.04	429.63	281.48
	Trihana Tea Garden	10000	607.50	520.00	335.00	285.00	370.00	242.50
	Jogibhita	9425	604.44	488.89	297.78	255.56	368.89	224.44
	Hetmuri	7435	610.87	506.52	304.35	280.43	373.91	243.48
	Uttar Bansgaon Kismat	7980	607.34	513.76	277.06	289.91	364.22	245.87
	Madhya Bansgaon	7650	615.76	509.78	215.22	285.87	389.67	250.54
	Pashchim Madati	8250	606.64	525.09	235.79	285.61	388.19	239.11
III	Tukriajhar Forest	7450	510.00	450.00	200.00	230.00	310.00	220.00
	Dhakna Gachh	7680	470.00	460.00	190.00	220.00	280.00	210.00
	Fulbarir Chhat	8775	520.00	410.00	190.00	230.00	340.00	230.00
	Madan	7500	460.00	440.00	180.00	240.00	320.00	220.00
	Nazir	7600	510.00	430.00	200.00	240.00	300.00	220.00
	Dudha	8500	440.00	390.00	210.00	230.00	310.00	220.00
	Jamatulla	8250	454.55	427.27	218.18	236.36	309.09	218.18

	Singbhita	8375	463.64	400.00	209.09	227.27	300.00	209.09
	Chhota Paikpara Arazi	7886	492.86	400.00	178.57	235.71	314.29	214.29
	Chunilal	7355	554.55	431.82	163.64	222.73	327.27	209.09
	Subalbhita	7560	545.45	409.09	154.55	222.73	313.64	204.55
	Naksalbari	10245	575.00	394.44	172.22	225.00	313.89	216.67
	Debiganja	7345	552.38	402.38	152.38	235.71	307.14	211.90
	Chayansing	8215	550.00	388.64	156.82	227.27	306.82	213.64
	Dayaram	7995	564.29	428.57	171.43	182.86	301.43	214.29
	Mandila Jhar	7690	553.44	424.43	154.96	229.77	299.24	212.21
	Bara Paikpara Arazi	8015	547.65	421.48	152.35	228.86	302.01	212.75
	Uttar Ramdhan	7554	526.49	443.05	162.25	226.49	307.95	210.60
	Lahugaon	7650	517.00	433.99	154.55	239.53	294.86	213.44
Source: computed by the Researcher.								

Fig. No. 6.7 Relationship between household income and rural-urban interaction for economic purpose

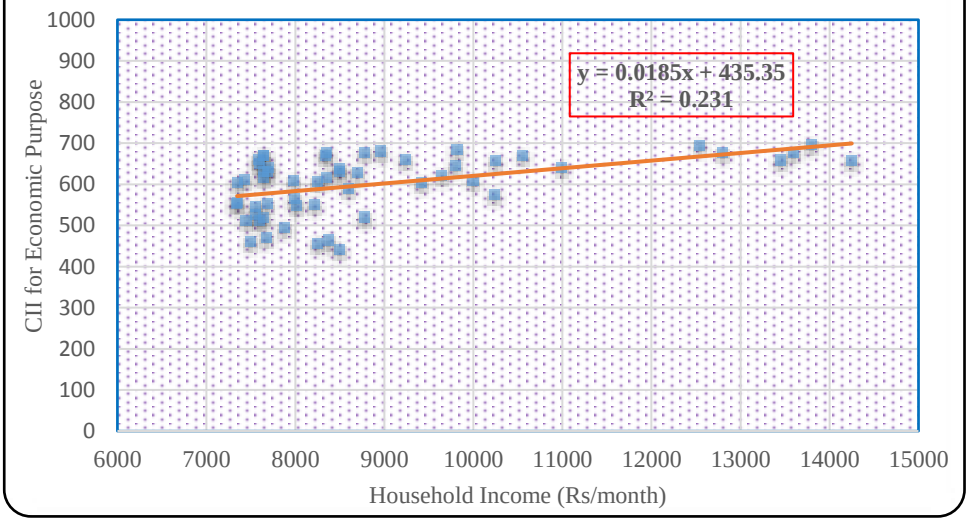


Fig. No. 6.8 Relationship between household income and rural-urban interaction for agricultural purpose

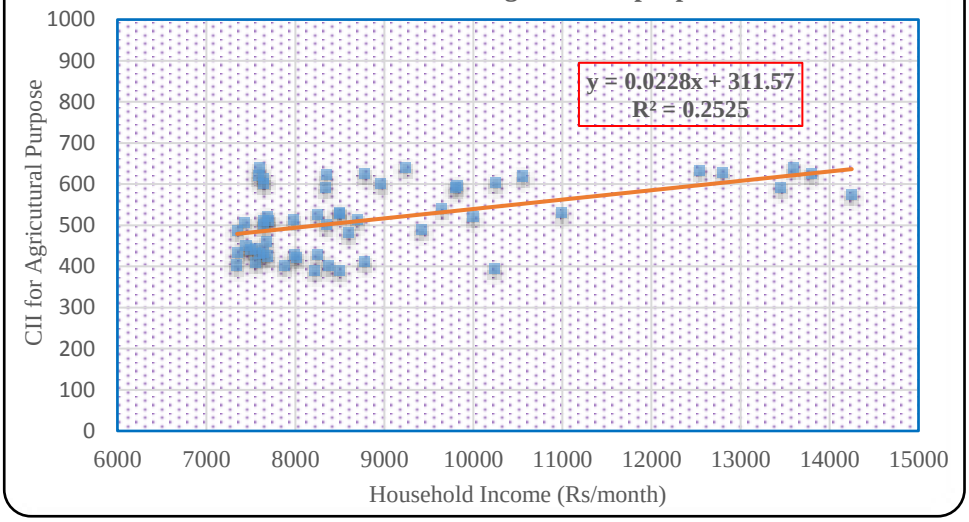


Fig. No. 6.9 Relationship between household income and rural-urban interaction for educational purpose

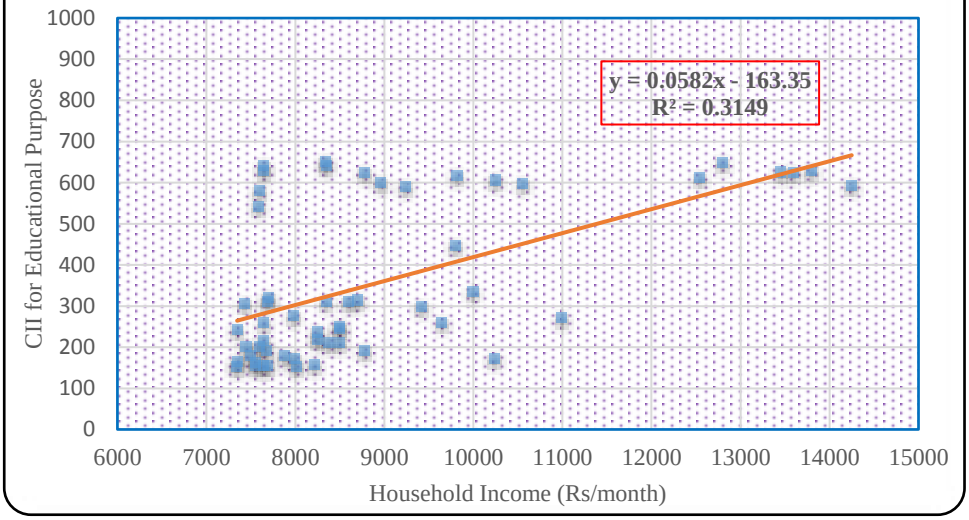


Fig. No. 6.10 Relationship between household income and rural-urban interaction for health purpose

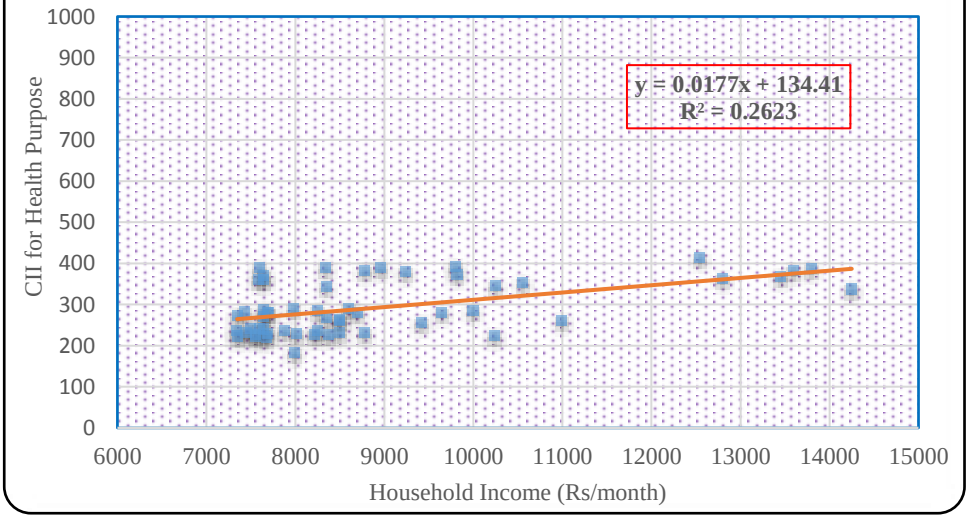


Fig. No. 6.11 Relationship between household income and rural-urban interaction for entertainment purpose

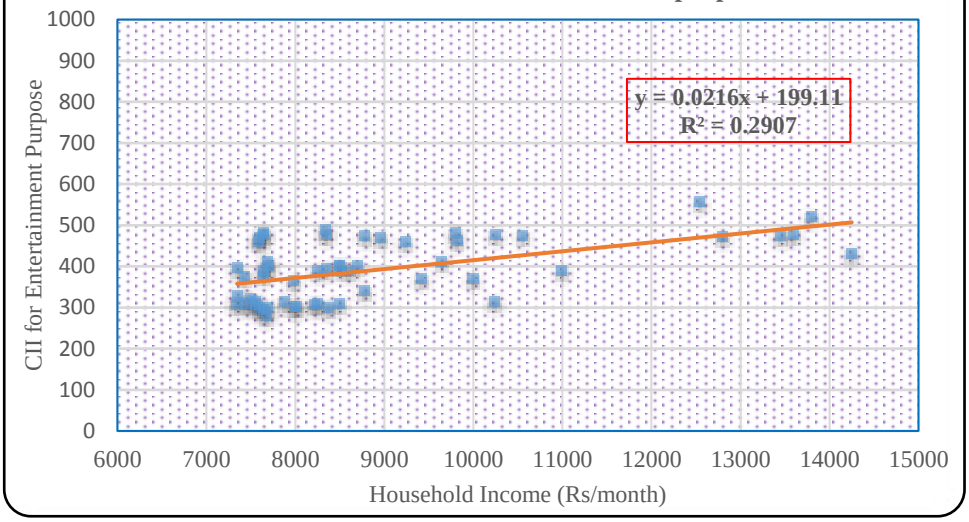
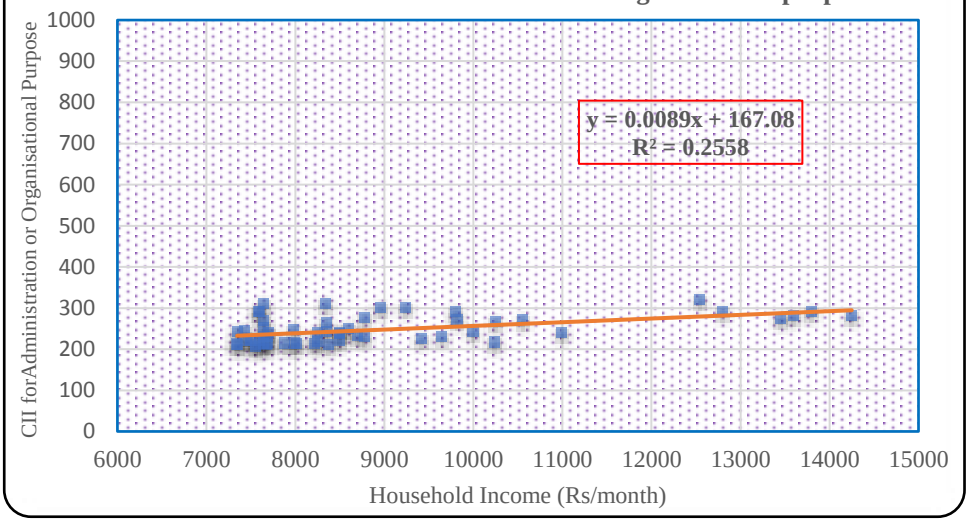


Fig. No. 6.12 Relationship between household income and rural-urban interaction for administration and organizational purpose



Literacy rate plays a significant role in determining the rural-urban interaction. Usually, villages with higher literacy rate tends to interact more with outside world. Education plays a pivotal role for rural population to venture into new fields of economic opportunities. In this section an attempt has been made to analyze the relationship between the literacy rate of a village and their composite index of interaction with Siliguri Municipal Corporation for various purpose within the study area. Table 6.9 shows the composite index of interaction for 55 selected villages of the study area for various purpose with Siliguri Municipal Corporation and their literacy rate. Based on this table simple bivariate regression equation has been calculated by taking literacy rate of each village and their composite index of interaction for each purpose. It shows that although, there is a positive relationship between the literacy rate of any village and their composite index of interaction with Siliguri Municipal Corporation for various

purposes but except interaction for educational purpose, the literacy rate of the villages does not have any significant effect on rural-urban interaction in the study area. The coefficient of determination calculated are as follows: 0.0363 for literacy rate of a village with composite index of interaction for economic purpose, 0.0346 for literacy rate of a village with composite index of interaction for agricultural purpose, 0.0634 for literacy rate of a village with composite index of interaction for educational purpose, 0.0771 for literacy rate of a village with composite index of interaction for health purpose, 0.0618 for literacy rate of a village with composite index of interaction for entertainment purpose and 0.0671 for literacy rate of a village with composite index of interaction for administration and organizational purpose. Hence, although the relationship is positive but it is not significant because only about 3% to 7% of variation in composite index of interaction for each purpose can be explained by variation in literacy rate. This signifies that for rural-urban interaction among the villages of the study area with Siliguri Municipal Corporation, literacy rate is not the primary factor but other factor like distance of the village from Siliguri Municipal Corporation plays a dominant role in controlling the level of interaction.

Table No. 6.9 Relationship between literacy rate and rural-urban interaction

Zone	Name of the Villages	Literacy Rate	Composite Index of Interaction					
			Economic Purpose	Agricultural Purpose	Educational Purpose	Health Purpose	Entertainment Purpose	Administration and Organizational Purpose
I	Champasari Chhat	90.23	680.00	600.00	600.00	390.00	470.00	300.00
	Ruhini Chhat	72.15	660.00	620.00	540.00	360.00	460.00	290.00
	Salbari Chhat Pratham Khanda	70.85	670.00	590.00	650.00	390.00	490.00	310.00
	Fulbari Pataner Chhat	62.54	670.00	600.00	640.00	370.00	480.00	310.00
	Kamala barir Chhat	73.21	660.00	640.00	590.00	380.00	460.00	300.00
	Purba Karai Barir chhat	83.52	650.00	640.00	580.00	390.00	470.00	290.00
	Lalsara Chhat	86.47	645.45	590.91	445.45	390.91	481.82	290.91
	Ujanu	95.68	693.75	631.25	612.50	412.50	556.25	318.75
	Dumriguri Chhat	69.25	676.19	638.10	623.81	380.95	476.19	280.95
	Sisabari	79.58	676.19	628.57	647.62	361.90	471.43	290.48

	Karaibari	86.52	658.33	591.67	625.00	366.67	475.00	275.00
	Putimari	89.14	683.33	595.83	616.67	370.83	462.50	270.83
	Rajpairi	65.34	675.61	621.95	641.46	343.90	475.61	263.41
	Bhujia Banir Chhat	89.68	668.09	619.15	597.87	353.19	474.47	270.21
	Bara Pathuram	76.24	676.27	625.42	623.73	381.36	474.58	276.27
	Liusipukuri	77.39	667.92	613.21	628.30	361.32	475.47	267.92
	Mahishmari	76.54	656.25	602.34	605.47	344.53	476.56	267.19
	Kauakhali	88.59	694.77	624.84	629.41	386.27	518.95	290.20
II	Tharu Bhita	40.68	640.00	530.00	270.00	260.00	390.00	240.00
	Gangaram Maler Chhat	59.2	630.00	520.00	310.00	280.00	410.00	230.00
	Bairbhita	60	640.00	510.00	320.00	280.00	400.00	240.00
	Grammanir Chhat	72.57	630.00	530.00	250.00	260.00	400.00	240.00
	Sivok Hill Forest	93.68	590.00	480.00	310.00	290.00	390.00	250.00
	Grammani	86.47	620.00	540.00	260.00	280.00	410.00	230.00
	Dalkajhar Forest	91.9	630.00	500.00	260.00	270.00	380.00	230.00
	Bhelu	65.49	636.36	527.27	245.45	263.64	400.00	236.36
	Dhemaler Chhar	64.37	626.67	513.33	313.33	280.00	400.00	233.33
	Siubar	82.29	615.79	500.00	310.53	268.42	394.74	242.11
	Dandrajhar	68.1	604.55	486.36	240.91	272.73	395.45	240.91
	Chamtaguri Chhat	76.97	655.56	574.07	592.59	337.04	429.63	281.48
	Trihana Tea Garden	69.3	607.50	520.00	335.00	285.00	370.00	242.50
	Jogibhita	79.25	604.44	488.89	297.78	255.56	368.89	224.44
	Hetmuri	76.31	610.87	506.52	304.35	280.43	373.91	243.48
	Uttar Bansgaon Kismat	69.42	607.34	513.76	277.06	289.91	364.22	245.87
	Madhya Bansgaon	67.83	615.76	509.78	215.22	285.87	389.67	250.54
	Pashchim Madati	70.47	606.64	525.09	235.79	285.61	388.19	239.11
III	Tukriajhar Forest	82.39	510.00	450.00	200.00	230.00	310.00	220.00
	Dhakna Gachh	58.4	470.00	460.00	190.00	220.00	280.00	210.00
	Fulbarir Chhat	59.67	520.00	410.00	190.00	230.00	340.00	230.00
	Madan	72.58	460.00	440.00	180.00	240.00	320.00	220.00
	Nazir	83.9	510.00	430.00	200.00	240.00	300.00	220.00
	Dudha	84.67	440.00	390.00	210.00	230.00	310.00	220.00

	Jamatulla	69.5	454.55	427.27	218.18	236.36	309.09	218.18
	Singbhita	58.7	463.64	400.00	209.09	227.27	300.00	209.09
	Chhota Paikpara Arazi	72.85	492.86	400.00	178.57	235.71	314.29	214.29
	Chunilal	76.13	554.55	431.82	163.64	222.73	327.27	209.09
	Subalbhita	60.49	545.45	409.09	154.55	222.73	313.64	204.55
	Naksalbari	94.6	575.00	394.44	172.22	225.00	313.89	216.67
	Debiganja	67.83	552.38	402.38	152.38	235.71	307.14	211.90
	Chayansing	73.49	550.00	388.64	156.82	227.27	306.82	213.64
	Dayaram	90.3	564.29	428.57	171.43	182.86	301.43	214.29
	Mandila Jhar	63.48	553.44	424.43	154.96	229.77	299.24	212.21
	Bara Paikpara Arazi	73.96	547.65	421.48	152.35	228.86	302.01	212.75
	Uttar Ramdhan	78	526.49	443.05	162.25	226.49	307.95	210.60
	Lahugaon	74.69	517.00	433.99	154.55	239.53	294.86	213.44
Source: Computed by the Researcher.								

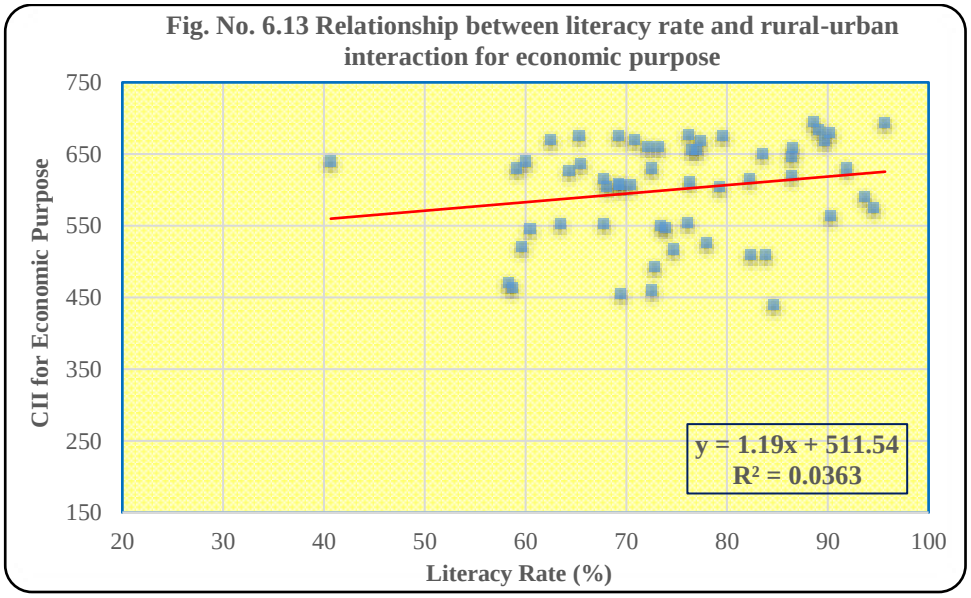


Fig. No. 6.13 Relationship between literacy rate and rural-urban interaction for economic purpose

Fig. No. 6.14 Relationship between literacy rate and rural-urban interaction for agricultural purpose

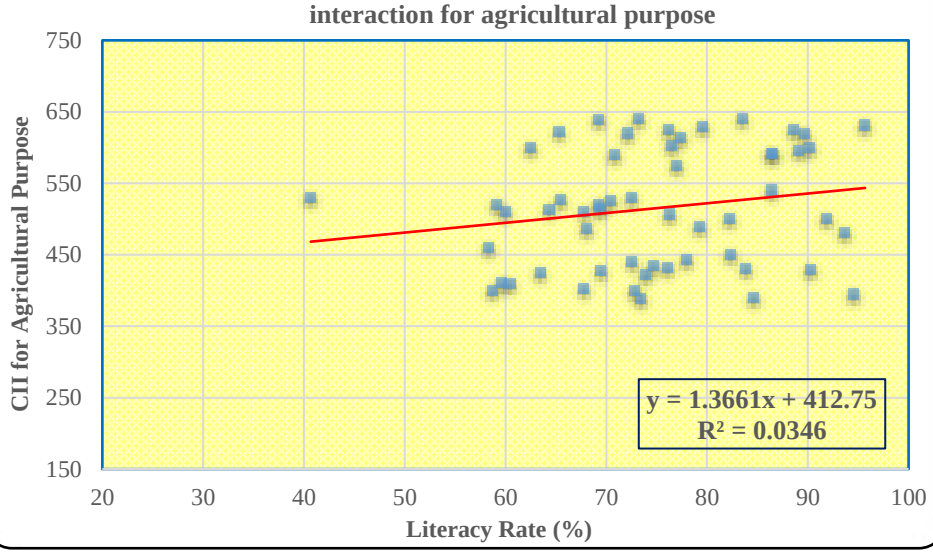


Fig. No. 6.15 Relationship between literacy rate and rural-urban interaction for educational purpose

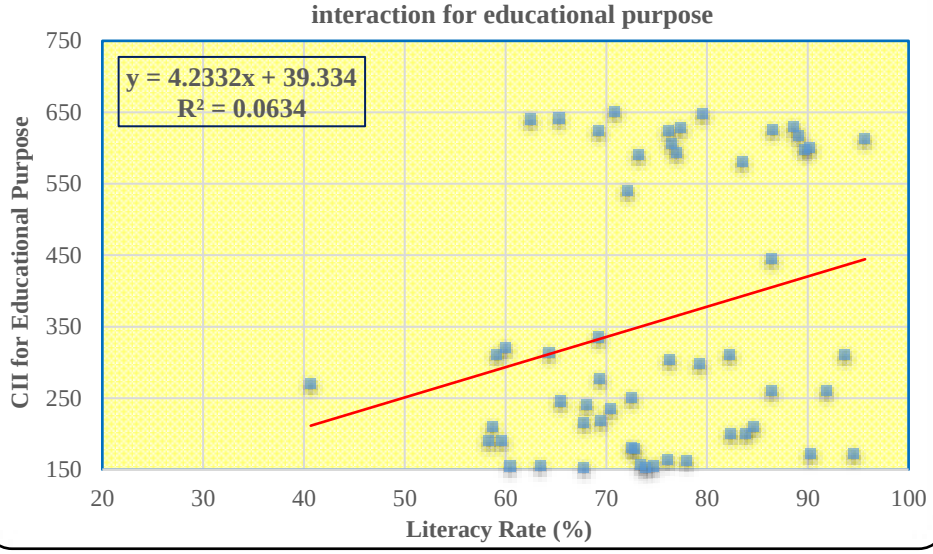
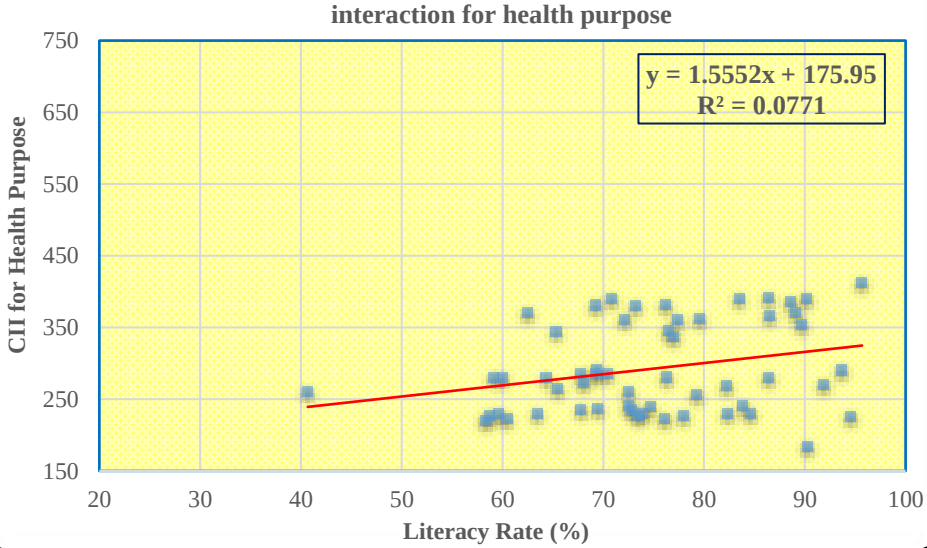


Fig. No. 6.16 Relationship between literacy rate and rural-urban interaction for health purpose



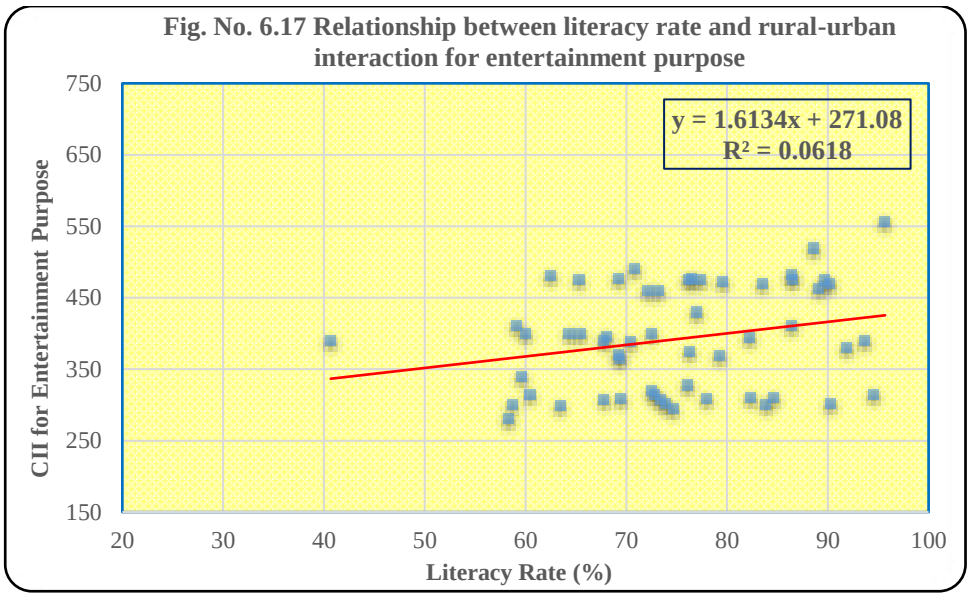


Fig. No. 6.17 Relationship between literacy rate and rural-urban interaction for entertainment purpose

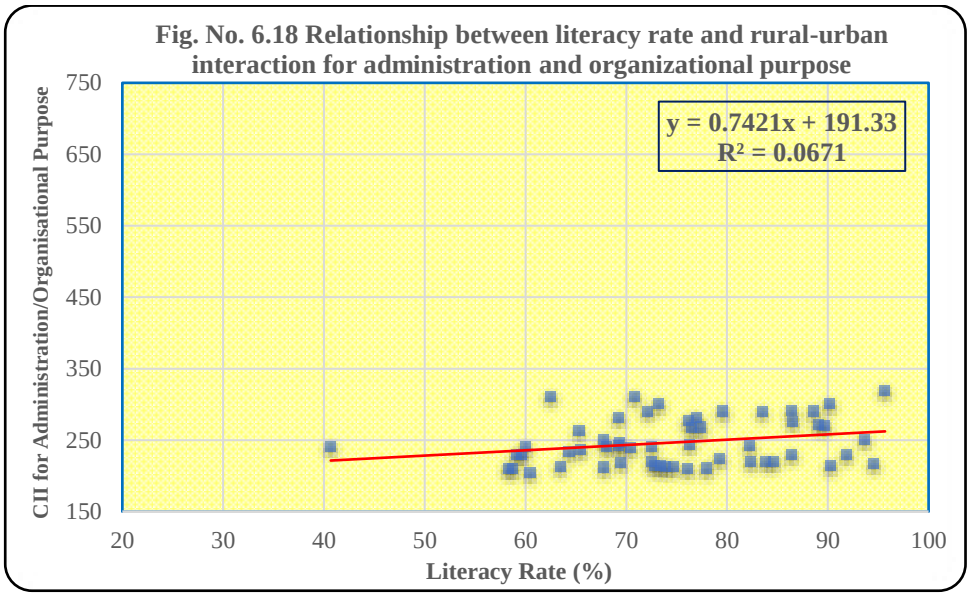


Fig. No. 6.18 Relationship between literacy rate and rural-urban interaction for administration and organizational purpose

6.3 Summary

The major objective of this chapter was to study the pattern of rural-urban interaction within the study area. For analyzing the rural-urban interaction in the study area 55 villages were selected based on their size-class category from Zone I, II and III respectively. Since rural-urban interaction takes place for a variety of reasons so in this study, rural-urban interaction was analyzed for the following purposes viz. economic, agricultural, educational, health, entertainment and administration and organizational. Then from each of the 55 selected villages, the households were classified on the basis of frequency of visit to Siliguri Municipal Corporation for each of the above mentioned purposes. The unequal weightage method was used, with the highest weightage given to those households who visit Siliguri Municipal Corporation daily and the lowest weightage to those households who never visit Siliguri

Municipal Corporation. This gave a composite index of interaction for each of the 55 villages with respect to different purpose of the rural-urban interaction individually. While analyzing the rural-urban interaction, it was seen that interaction for economic, agricultural and educational purposes were in general higher compared to interaction for health, entertainment and administration and organizational purpose between the villages of the study area with Siliguri Municipal Corporation. However, a dominant trend with respect to all the purposes of rural-urban interaction in the study area is the frequency and volume of interaction decrease with an increase in distance from Siliguri Municipal Corporation. Infact, while analyzing the relationship with average income of households and the literacy rate of 55 selected villages with their composite index of interaction, no significant relationship was established. Therefore, it can be said that for rural-urban interaction between the villages of the study area with Siliguri Municipal Corporation, distance of a village from Siliguri Municipal Corporation plays the dominant role in determining the level of interaction.

6.4 References

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CHAPTER 7
CONCLUSION

7.1 Introduction

This has been an indepth study on rural-urban interaction taking place among the villages of Siliguri sub-division with Siliguri Municipal Corporation. The study shows rural-urban interaction has been very prominent in the study area with interactions taking taking place for economic, agricultural, educational, health, entertainment and administration and organizational purpose. The the study area of Siliguri Municipal Corporation and 4 C.D block of Siliguri sub-division viz. Matigara, Naxalbari, Khoribari and Phansidewa have a total area of 819.61 sq.km.

7.2 Summary

It was in the year 1867 when J.D. Hooller first used the term 'siligoree'. Siliguri went on to become sub-divisional head quarter under Darjeeling district for the first time in 1907. With the introduction of modern motorized transportation system post First World War in 1919 in Siliguri, movement of people from Siliguri to Darjeeling and back became relatively more convenient and frequent. With time public bus also started running from Siliguri to Naxalbari in the year 1925, commuting people from Siliguri to Naxalbari and back. Gradually the population of Siliguri reached 7000 in 1931 and got recognized as a census town. Siliguri witnessed a huge influx of refugees from East Pakistan during the period of partition and social unrest which led to subsequent increase in the population of Siliguri. It would not be completely wrong to state that Siliguri, in its initial stages developed rather sporadically along with inconsistent growth of population.

Siliguri got the status of a municipality in 1949 after independence. However, it was only after the Chinese invasion in 1962, that the roads in and around Siliguri developed rapidly for strategic purpose. Gradually a large number of military, air force and army base were established in and around Siliguri making this town a very important cotterpin in Indian defence system. With the development of NJP railway station in 1964 on the outskirts of the city, Siliguri emerged as a railway transportation hub in the mainline connecting north-east India with the mainland. The construction of Farakka Barrage in 1974 led to uninterrupted rail and road connectivity between Siliguri and South Bengal making people's movement more convenient resulting in further growth of Siliguri. Post the creation of Bangladesh in 1971,

another wave of refugees entered Siliguri resulting in rapid increase in population. Finally, in 1994, Siliguri got the status of a Municipal Corporation following which Siliguri as well as the entire sub-division went ahead in the path of growth and development. Presently, according to the census report of 2011, the total population of the study area is 1189838 persons consisting of 65417 urban population and 535221 rural population.

Physiographically, the study area is part of outlying hills of the lower Himalayas and a stretch of land along the base known as terai. The elevation of the study area ranges from 48 m to 1299 m above the mean sea level. Teesta, Mahananda, Balasan and Mechi are the major rivers flowing through the study. The annual average rainfall in the study area is above 2000 mm with mean maximum and minimum temperature lying between 13.8° C to 28.6° C. Forests are present in abundance in the study area with a number of reserved and protected one.

Siliguri sub-division is agriculturally diverse with crops like paddy, jute, potato and different seasonal vegetables cultivated in abundance. Besides agriculture, tea plantation is very common in the study area. Tea gardens are important contributors to the local economy as a lot of it depends on the processing of the tea leaves. Throughout the present study area, Siliguri flourished to become the most important urban centre as a result of development in trade and commerce. Located close to Sikkim and the north-eastern states, Darjeeling hills, Bhutan and Nepal, Siliguri went on to become the main distribution hub of industrial and household goods moving to the aforesaid states and countries. Siliguri also gained more prominence owing to development of tourism not just in North Bengal but also in Sikkim and north-east India giving it the title of "gateway to the north east" as it literally acted as the gateway to different tourist spots located in Sikkim, Darjeeling and the forests of North Bengal.

In the present study an attempt has therefore been made to study the growth of rural and urban settlements. The population growth was analyzed from 1991 to 2001 based on the census data. The analysis was done for all the four blocks, i.e. Matigara, Naxalbari, Phansidewa, Kharibari as well as Siliguri Municipal Corporation. It was observed from the analysis that population growth in the study area was very rapid from 1991 to 2011. However, the decadal growth of population was not uniform for all the blocks. Matigara block located closest to Siliguri Municipal Corporation witnessed very high population growth both during 1991- 2001 and 2001 -2011 as a direct impact of rapid population spill out from SMC to its surrounding areas that took place from 1991 onwards. On the other hand, Phansidewa and Kharibari block located farthest from Siliguri Municipal Corporation have recorded relatively less population growth. Siliguri Municipal Corporation during 1991- 2001 more than doubled

it's population due to addition of adjoining area within its boundary but during the next decade it witnessed a very moderate population growth.

The size class classification of rural settlements within the study area was also done for each block. It was observed that the conversion of villages in to census towns in Matigara and Naxalbari block saw a decrease in their total number of villages from 1991 to 2011. However, the same cannot be said for Phansidewa and Kharibari as the total number of villages from 1991 to 2011 remained almost the same. Another interesting fact which requires attention is that the numbers of villages in the lowest four size classes have declined considerably in the study area in 2011 compared to 1991, while an opposite trend was visible for the largest three size classes.

At the village level a lot of variation in decadal population growth was revealed. Therefore, to analyze the growth of population for villages in the study area, decadal population growth of individual villages was computed for 1991-2001 and 2001-2011. While calculating the decadal population growth of villages, there was problem with some villages which existed in one or two of the three census years under consideration. The village level population data reveals that some villages in the study area experienced very high decadal growth (over 1000%). Nonetheless, negative population growth in villages of the study area is not uncommon. Some villages with very less population size witnessed nearly 100% negative population growth probably because of a combination of factors like out migration and natural calamity. Interestingly, there is no significant relation between the distance of any village from Siliguri Municipal Corporation and their decadal population growth.

The study area portrays diverse socio-economic characteristics. In general, the literacy rate of villages decreases with increasing distance from Siliguri Municipal Corporation. The literacy rate for most of the villages has seen improvement in 2011 compared to 1991. Moreover, the villages with very low literacy rate in 1991 witnessed the highest improvement in 2011, with a few exceptions. Similarly, the sex ratio also varies among the villages and there are many villages in the study area where high sex ratio were recorded. Most of the villages with low sex ratio in 1991 witnessed a significant improvement in sex ratio in 2001 and 2011. In terms of distribution of population according to worker's category, an increase in the share of marginal workers in the villages has been observed. Most of the villages reported a very low share of marginal worker in 1991 (Zero in nearly 50 % of villages) but in subsequent years this share increased to about 5 to 15% of the total population in the villages. This increase in the share of marginal workers for most of the villages in the study area has taken place at the cost of main workers. Continued increase of marginal workers at the cost of main workers will

definitely have severe repercussions which will eventually have catastrophic effect on the rural economy of the study area.

In the present study an attempt has also been made to analyze the rural-urban interaction. Chapter 4 has solely been devoted to study and analyze the nature of rural-urban interaction in the study area as it is an integral part of urbanization process and its associated development of the surrounding rural areas. It is very famously said that India lives in her villages and the same can be applied to West Bengal as well with majority of their population residing in rural areas. However, the interaction between the rural and urban areas continues to increase at rapid rate due to mutual benefit of both the communities. Infact, in an increasingly globalized world, it is misleading to view the rural and urban areas as distinct spheres as both are interconnected and depended on one another. As has been strongly advocated, the solution to urban problems lays in rural areas, therefore in this given context this study on rural urban interaction gains greater significance. Economic, social and factors related to infrastructure are some of the factors that govern the nature of rural-urban interaction. The most important factor which controls the volume of rural-urban interaction is the population size. This includes both the population of the urban centre as well as population of the surrounding rural area. In the study area the total population of Siliguri Municipal Corporation in 2011 was 513265 while the population of the four blocks viz, Matigara, Naxalbari, Phansidewa and Kharibari was 676574 persons. Siliguri, being the second most important urban centre of West Bengal after Kolkata depends a lot on rural population of its sub-division for supplies related to food grains, vegetables, fruits and dairy products. On the other hand, people living in rural settlements also depend a lot on Siliguri to fulfill their requirements related to services like education, health, trade and commerce, business etc.

Development of transport and communication facilities plays an important role in governing the degree of rural-urban interaction. Since railway connectivity is very limited with fewer local trains, most of the people in the study area depend on roadways for interaction. The major roads which connect the rural area of Siliguri sub-division with Siliguri Municipal Corporation are Asian Highway 2, National Highway 31, 31A and 55 and State Highway 12. There is access to both public and private buses as well as autos from Siliguri Municipal Corporation to various parts of the study area. The high frequency of bus and auto services allows free movement of people leading to high volume of rural-urban interaction along the major routes connecting important parts of the study area with Siliguri Municipal Corporation. Moreover, Siliguri being the major hub of employment opportunities, health care services, educational institutes, trade and commerce and recreational facilities, people from its

surrounding areas come to Siliguri by availing the cheap modes of transportation facilities available to them.

The number and size of settlements also play a significant role in rural-urban interaction. There is a mutual beneficial relationship between rural and urban settlement in the area. In 2011, there were 353 villages and 14 census towns in Siliguri sub-division. Out of these 353 villages, 313 villages were inhabited and 40 villages were uninhabited. Out of these villages the highest number was in the size-class of 1000-1999. However, it was also found that with the passage of time smaller size-class villages in the study area declined and bigger size-class villages increased in number. This is the result of natural increase in rural population within the study area. The growth of urban population took place at a higher rate within the study area. The total number of villages in the study area has not changed by much but an increase in the number of villages in the higher size-class category also points towards a higher rural-urban interaction in the study area.

The dynamics of rural-urban interaction have also been affected to a large extent by trade and commerce operational in the study area. It is but obvious for rural population to trade with urban population with respect to primary goods like food grains, vegetables, fruits, and dairy products. On the other hand, they depend on the urban centre for fulfilling their requirements related to agricultural inputs, agricultural machineries and for other rural non-farm activities. Increasing incidence of trade and commerce between urban areas and the surrounding rural areas will have a greater influence in shaping the rural-urban interaction. With well developed trade and commerce in the urban centers, employment opportunities will be generated which will further attract the rural population to urban areas thereby increasing the intensity of rural-urban interaction and resulting into increase in the number and frequency of daily commuters to the nearby urban areas.

The rural-urban interaction is not just dependent on the development of trade and commerce in the cities and towns; rather it is also influenced by the level of development of agricultural activities in rural. A highly developed agricultural sector not only bring economic prosperity in the rural area but also lead to increase in the demand of more sophisticated farm inputs and machineries for which they have to depend on the nearby urban centre. A healthy rural economy further results in increasing demand for better healthcare facilities, educational facilities and consumer durable commodities among the rural population which in turn increases their dependency on nearby large urban centre. Moreover, if the rural population is engaged in commercial agriculture, they will have to bring their products to the nearby urban centre to sell their products. However, if the villages practice subsistence type of agriculture,

very little rural-urban interaction is possible as subsistence agriculture is usually associated with confinement of rural population within the village boundary. Availability of transport and communication services along with rather rapid development of Siliguri as the main centre of trade and commerce and allied developmental activities along with agricultural practices in the rural areas throughout the Siliguri sub-division results in robust rural-urban interaction in the study area.

Various socio-economic factors like the level of urbanization, distribution of working population, educational level, industrial development and power development are deciding factors in shaping the rural-urban interaction. In general, a high level of urbanization means more people living in urban areas, which lead to higher demand for primary goods from the surrounding rural settlements. The process of urbanization also results in increase in the construction activities thereby increasing the demand for cheap labour. This demand for labour force is met by supply of labour force from the surrounding rural settlements. Likewise, share of the population in the working age-group is also important here. A higher share of population in the working age-group means more people are in demand of employment. Rural areas fail to provide enough employment opportunities in non-farm sectors which make the local population more attracted towards nearby urban centre to get absorbed in urban informal sector. In Siliguri, there is an increased demand for labour in informal sectors which attract huge number of people from its surrounding rural areas to Siliguri where they work as hawkers, domestic help, construction workers, and daily wage labourers, workers in hotels, restaurants and malls. These workers commute daily for their village to Siliguri. Similarly, the level of education also plays a vital role in the process of rural-urban interaction. It is obvious that an educated person will have access to number of economic opportunities in comparison to an uneducated person. In the study area, the literacy rate of the villages decreases with increasing distance from Siliguri Municipal Corporation which will have its own impact on the access that rural population have to different employment opportunities present in the city. At the same time higher level of industrial development will lead to better rural-urban interaction. Any kind of industry, be it either large scale, small scale or medium enterprises depend on the rural areas for their supply of raw materials. Though the study area doesn't possess any big industrial unit, tourism, food processing, tea and timber industry have traditionally prospered in and around Siliguri and have remained to be major contributors of local economy. Primarily being labour intensive industries, they attract a lot of people from the surrounding rural areas for employment purpose in the study area.

In the fifth chapter an attempt has been made to study the transport network and analyze the land use and land cover change within the study area. It was observed that although, Siliguri sub-division is connected by roadway as well as railway, it is the roadways that are the most popular mode of communication for the rural population in the study area. Although, railway network is present but lack of suburban rail connectivity with Siliguri does not make it a popular mode of transportation for the rural population of Siliguri sub-division to connect with Siliguri. The transport network is most developed in Siliguri Municipal Corporation and its surrounding rural areas and as one moves away from the main urban centre the transport network also became less developed. The transport network analysis done for the study area shows that Siliguri Municipal Corporation and its surrounding areas around Bagdogra, Shivmandir and Matigara covering the east-central part of the study area have the highest network connectivity and as one moves towards the north, west and south-western part of the sub division the transport network connectivity deteriorates considerably. It has also been observed that the road density within the study area isn't consistent and varies. The highest road density was observed around Siliguri Municipal Corporation and its surrounding area and the lowest road density observed along the border areas of the sub-division, Matigara has the highest road density while Kharibari and Phansidewa has the lowest road density among the four blocks. While among the zones, Zone I has the highest road density and Zone III has the lowest road density.

The land use and land cover change in the study area has been analyzed for seven classes which are agricultural land, barren land, built-up area, forest cover, sand bars, tea garden and water bodies. The area under built-up area and tea garden has increased while the area under agricultural land has declined for all the zones as well as the blocks from 1991 to 2020. As far as the rest of the classes were concerned, not much change has been recorded from 1991 to 2020. It is also seen that the built-up area increased as result of rapid urbanization and increase in associated construction activities. The area under tea garden has also gone up considerably due to the conversion of agricultural land into tea garden. This shift from agricultural practices to tea plantation by small farmers was because of the relatively more profitable nature of tea plantation than conventional agricultural practices. It is worth mentioning that land use and land cover change along the main transportation lines in the study area has also undergone a lot of change which is a direct result of agricultural land being converted to built-up area.

The present study would remain incomplete without analyzing the pattern of rural-urban interaction within the study area. To fulfill this objective of studying the pattern of rural-

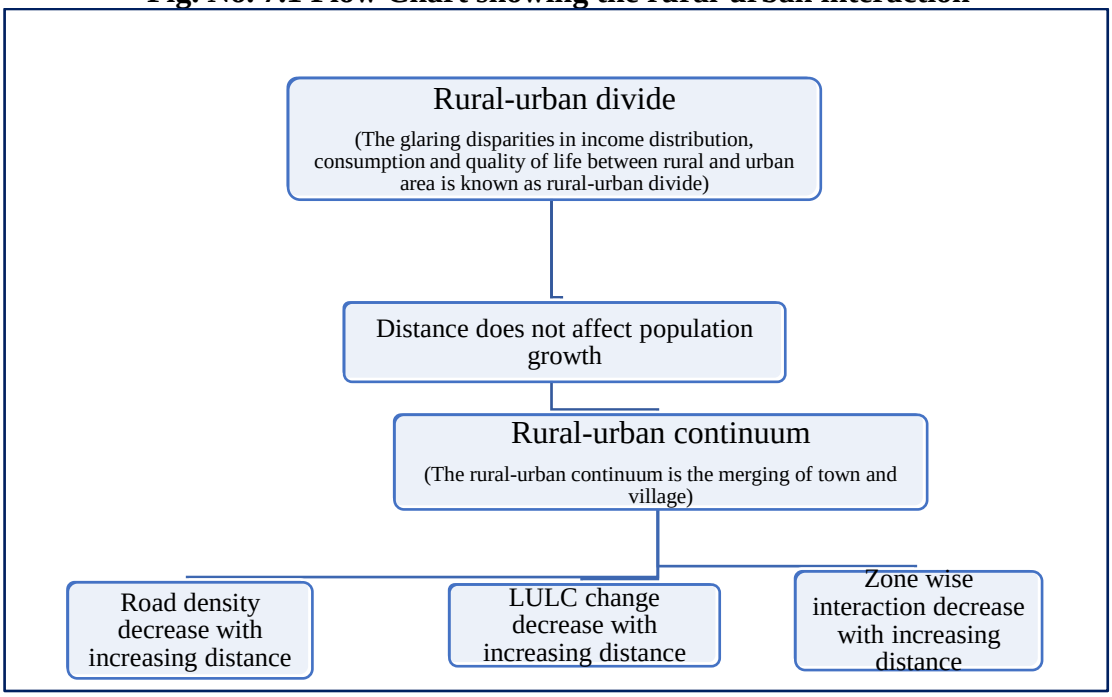
urban interaction within the study area, 55 villages were selected based on their size-class category from Zone I, II and III respectively. Since rural-urban interaction takes place for a variety of reasons so in this study, rural-urban interaction was analyzed for the following purposes viz. economic, agricultural and educational, health, entertainment, administrative and organizational. From each of the 55 selected villages, the households were classified on the basis of frequency of visit to Siliguri Municipal Corporation for each of the above mentioned purposes. The unequal weightage method was used, with the highest weightage given to those households who visit Siliguri Municipal Corporation daily and the lowest weightage to those households who never visit Siliguri Municipal Corporation. This gave a composite index of interaction for each of the 55 villages with respect to different purpose of the rural-urban interaction individually. While analyzing the rural-urban interaction, it was seen that interaction for economic, agricultural and educational purposes were in general higher compared to interaction for health, entertainment and administration and organizational purpose between the villages of the study area with Siliguri Municipal Corporation. However, a dominant trend with respect to all the purposes of rural-urban interaction in the study area is that the frequency and volume of interaction decrease with an increase in distance from Siliguri Municipal Corporation. Infact, while analyzing the relationship with average income of households and the literacy rate of 55 selected villages with their composite index of interaction, no significant relationship was established. Therefore, it can be said that for rural-urban interaction between the villages of the study area with Siliguri Municipal Corporation, distance of a village from Siliguri Municipal Corporation plays the dominant role in determining the level of interaction.

7.3 Suggestions

In this work an in depth analysis of the rural-urban interaction of Siliguri sub-division with Siliguri Municipal Corporation has been done. The study area consist of 4 C.D. blocks viz. Matigara, Naxalbari, Phansidewa and Kharibari of Siliguri sub-division and Siliguri Municipal Corporation with a total area of 819.61 sq. km. In this study, an attempt has been made to not only analyze the level of rural-urban interaction but also to analyze the factors which controls this interaction. Moreover, an in depth analysis of transport network of the study area has also been done because transport system along with distance plays the most important controlling factors in determining the rural-urban interaction. Land use and land cover change in the study area has also been analyzed because these changes has been very rapid in and around Siliguri Municipal Corporation in recent times due to spill out of urban population in

the surrounding rural areas. An analysis has also be done to measure interaction of villages of the study area with Siliguri Muncipal Corporation for various purposes like economic, agricultural, education, health, entertainment and administrative and organizational. The flow chart below shows how with the passage of time the concept of rural-urban divide is replaced by rural-urban continuum when interactions between these two fields are high.

Fig. No. 7.1 Flow Chart showing the rural-urban interaction



Source: Compiled by the Researcher.

Rural-urban interaction is beneficial for both the urban areas and the surrounding rural areas. It helps in integration of the rural economy with the nearly urban centre. However rural-urban interaction in the study area is not uniform with the presence of a number of villages whose interaction with Siliguri is minimum. Therefore, in this section some suggestions and recommendations has been given to further increase the rural-urban interaction in the study area.

1. The linkages across space such as flows of people, goods, money and information between rural and urban communities should be strengthened. This can be done by encouraging people from the rural areas to visit Siliguri regularly.
2. The linkages between sectors especially between agriculture and manufacturing needs to be strengthened. In the study area tea plantation and pineapple cultivation is very prominent. Therefore efforts must be made to create sectoral linkages with this primary goods with the manufacturing sectors for processing and export.

3. Although, within the study area there is the presence of 14 census towns which have urban by classification but in reality they perform very limited urban functions. Therefore, efforts must be made to improve the governance and local economy in these census towns which will help to improve the rural-urban interaction at the micro level to a new height.
4. Rural-urban interaction has the potential to become a successful policy measure to reduce poverty in rural areas. The gap between the livelihood status of rural and urban areas can be reduced to a great extent with increasing rural-urban interaction.
5. Rural-urban interaction depends a lot on the availability of proper transportation facilities. For people from the villages to interact with urban centre the primary requirement is the availability of all-weather roads connecting the village with the nearly urban centre. In this regard the central government scheme to connect all villages of the country with all-weather roads i.e. PMGSY can play a very vital role to increase the rural-urban interaction in the study area. Special emphasis will have to be given to connect the remote villages in the study area with the main transport lines connected with Siliguri.
6. A strong rural-urban interaction can help the rural population to cope during environmental and economic shocks in the rural areas. During the time of flood, drought or other economic crisis, people from the rural areas can depend on the surrounding urban areas for providing alternative livelihood opportunities.
7. Establishment of small scale industry within the study area will also foster a greater rural-urban interaction. This will not only help to improve the health of the rural economy but will also cater to the needs of unemployed youths in the rural area.

All these measures will help to increase the rural-urban interaction in the study area. This will finally lead a harmonious development of both Siliguri Municipal Corporation and the rural areas of Siliguri sub-division in the future.

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Photographs captured during field survey

Plate No.1

Plate No. 2

Plate No. 3

Plate No. 4

Appendix I

PH. D FIELD SURVEY

Tuhin Dey Roy
Under the supervision
of
Dr. Arindam Basak (Associate Professor)
University of North Bengal

Name of the Village	
Name of the head of the household	
Religion	
Caste	
Total number of family members	

Household Data

Name	Age	Sex	Education	Occupation	Income	Marital Status
1						
2						
3						
4						
5						
6						
7						
8						

Total number of working members	Main workers	Marginal workers	Non-workers

Monthly Household Expenditure

Food	Clothing	Fuel	Education	Health	Electricity	Transportation	Recreation

Type of house	kutcha	pucca	Semi pucca
Building materials used	Floor:	Roof:	Wall:
Type of toilet	Indian	English	
Number of rooms			
Availability of separate kitchen			
Source of drinking water			
Distance from drinking water facility			

Drainage facility								
Electricity facility								
Fuel used for cooking								
Access to public distribution system								
Possession of government health card and banking facility.								
Possession of household assets	Radio	Television	Room heater	Geyser	Mobile / telephone	Computer	Two wheeler	Four wheeler

Interactions								
Economic Interaction								
Type	Member of the household							
Financial								
Employment								
Trade & Commerce								
Daily Shopping								
Agricultural Interaction								
Type	Member of the household							
Grains								
Fruits								
Dairy Products								
Agricultural Inputs								
Machinery								
Educational Interaction								
Type	Member of the household							
Primary Education								
Secondary Education								
H.S Education								
Higher & Technical Education								
Tution and Coaching								
Educational Stationery								
Health Interaction								
Type	Member of the household							
OPD Service								
Diagnostic Service								
Hospitalization								
Vaccination								
Medicine Procurement								
Interaction for Entertainment								
Type	Member of the household							
Shopping								

Eating out								
Movies								
Festival and Fairs								
Shopping for high value goods								
Administrative and Organizational Interaction								
Type	Member of the household							
Office visit								
Court Visit								

Frequency of visit
1. Daily
2. 3-4 times per week
3. 1-2 times per week
4. 1-2 times per month
5.1-2 times per 6 months
6. 1-2 times per year
7. Never visited.

Appendix II

Zone I

Size class classification	Name	Population	No. of household	10 % household	Household surveyed
<200	Champasari Chhat	96	15	1.5= 1	10
	Ruhini Chhat	98	17	1.7=2	10
	Salbari Chhat Pratham Khanda	107	21	2.1=2	10
200-499	Fulbari Pataner Chhat	234	50	5	10
	Kamala barir Chhat	264	57	5.7=6	10
	Purba Karai Barir chhat	314	68	6.8=7	10
500-999	Lalsara Chhat	551	108	10.8=11	11
	Ujanu	660	164	16.4=16	16
	Dumriguri Chhat	950	207	20.7=21	21
1000-1999	Sisabari	1085	214	21.4=21	21
	Karaibari	1183	237	23.7=24	24
	Putimari	1217	244	24.4=24	24
2000-4999	Rajpairi	2018	414	41.4=41	41
	Bhujia Banir Chhat	2248	473	47.3=47	47
	Bara Pathuram	2728	591	59.1=59	59
5000-9999	Liusipukuri	5185	1063	106.3=106	106
	Mahishmari	6010	1275	127.5=128	128
	Kauakhali	6615	1526	152.6=153	153
10000>	-				

Zone II

Size class classification	Name	Population	No. of household	10 % household	Household surveyed
<200	Tharu Bhita	89	20	2.0=2	10
	Gangaram Maler Chhat	109	24	2.4=2	10
	Bairbhita	111	26	2.6=3	10
200-499	Grammanir Chhat	340	69	6.9=7	10
	Sivok Hill Forest	321	76	7.6=8	10
	Grammani	476	96	9.6=10	10
500-999	Dalkajhar Forest	512	102	10.2=10	10
	Bhelu	564	108	10.8=11	11

	Dhemaler Chhar	644	145	14.5=15	15
1000-1999	Siubar	1052	193	19.3=19	19
	Dandrajhar	1050	217	21.7=22	22
	Chamtaguri Chhat	1267	266	26.6=27	27
2000-4999	Trihana Tea Garden	2016	404	40.4=40	40
	Jogibhita	2221	452	45.2=45	45
	Hetmuri	2124	464	46.4=46	46
5000-9999	Uttar Bansgaon Kismat	5064	1086	108.6=109	109
	Madhya Bansgaon	9132	1843	184.3=184	184
	-				
10000>	Pashchim Madati	13523	2705	270.5=271	271

Zone III

Size class classification	Name	Population	No. of household	10 % household	Household surveyed
<200	Tukriajhar Forest	89	20	2.0=2	10
	Dhakna Gachh	184	34	3.4=3	10
	Fulbarir Chhat	171	35	3.5=4	10
200-499	Madan	236	53	5.3=5	10
	Nazir	313	64	6.4=6	10
	Dudha	379	75	7.5=8	10
500-999	Jamatulla	506	110	11.0=11	11
	Singbhita	536	114	11.4=11	11
	Chhota Paikpara Arazi	763	144	14.4=14	14
1000-1999	Chunilal	1192	217	21.7=22	22
	Subalbhita	1022	218	21.8=22	22
	Naksalbari	1618	357	35.7=36	36
2000-4999	Debiganja	2042	423	42.3=42	42
	Chayansing	2158	444	44.4=44	44
	Dayaram	3182	696	69.6=70	70
5000-9999	Mandila Jhar	6642	1313	131.3=131	131
	Bara Paikpara Arazi	6899	1492	149.2=149	149
	Uttar Ramdhan	6892	1505	150.5=151	151
10000>	Lahugaon	12710	2534	253.4=253	253

Appendix III

Transport network analysis

Vertices (v)	50
Edges (e)	68
Total Route length (M) in km	266.46

	Formula	Value	in %
Alpha Index	(e-v+p)/(2v-5)	0.2	20
Beta Index	e/v	1.36	
Gamma Index	e/3(v-2)	0.47222222	47.2222222
Cyclomatic Number	e-v+p	19	
Spatial Structure of Network	(e-v+p)/(√v-1)²		
	e-v+p	19	
	√v	7.07106781	
	(√v-1)	6.07106781	
	(√v-1)²	36.8578644	
	(e-v+p)/(√v-1)²	0.51549378	
	Grid Pattern or Structure		
Diameter	14		
Eta Index	M/e	3.91852941	
Theta Index	M/v	5.3292	
Pi Index	M/Diameter	19.0328571	

Nodes	Connectivity Index	Shimble Index	Associated Number	OID
1	1	452	14	1
2	2	404	13	2
3	2	358	12	3
4	3	314	11	4
5	3	280	10	5
6	3	298	11	6
7	3	261	10	7
8	3	290	11	8
9	3	238	9	9
10	3	298	12	10
11	4	293	11	11
12	3	317	12	12
13	4	271	11	13
14	2	273	10	14
15	4	239	9	15

16	3	218	10	16
17	3	224	9	17
18	2	227	8	18
19	3	220	8	19
20	2	272	10	20
21	2	265	10	21
22	3	209	9	22
23	3	203	9	23
24	4	199	8	24
25	2	364	13	25
26	3	338	12	26
27	2	283	10	27
28	2	252	13	28
29	3	224	9	29
30	4	259	10	30
31	3	272	11	31
32	3	280	11	32
33	3	244	10	33
34	3	242	9	34
35	2	273	12	35
36	3	269	12	36
37	3	297	13	37
38	1	335	13	38
39	2	297	13	39
40	3	306	13	40
41	2	306	13	41
42	2	279	11	42
43	2	239	10	43
44	3	265	11	44
45	3	295	12	45
46	4	284	12	46
47	2	328	13	47
48	2	372	14	48
49	2	383	14	49
50	2	339	13	50

Calculation for transport network analysis

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36
1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4	0	0	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5	0	0	0	1	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6	0	0	0	1	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7	0	0	0	0	0	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8	0	0	0	0	0	0	1	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
9	0	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
10	0	0	0	0	0	0	0	1	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
11	0	0	0	0	0	0	0	0	0	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
12	0	0	0	0	0	0	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
13	0	0	0	0	0	0	0	0	0	1	1	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
14	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
15	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	1	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
16	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0

17	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
18	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
19	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
21	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
22	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0
23	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	1	0
24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1	0	0	0	0	1	1	0	0	0	0	0	0
25	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
26	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0	0	0	0	0
27	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
28	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1	0	0	0	0	0
29	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1	0	0	1	0	0
30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	1	1	0	0
31	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0
32	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	1	0	0
33	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	0	1	0	0
34	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	1

35	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1	0	0
36	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0
37	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1
38	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
39	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
40	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
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43	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
44	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
46	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
47	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
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50	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Calculation for transport network analysis

Nodes	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	Shimble Index	Associated Number
1	0	1	2	3	4	4	5	6	5	7	8	7	8	9	9	10	6	7	8	9	10	9	9	8	8	9	10	13	9	10	11	11	10	9	12	12	13	13	13	13	12	11	10	11	12	12	13	14	14	13	452	14
2	1	0	1	2	3	3	4	5	4	6	7	6	7	8	8	9	5	6	7	8	9	8	8	7	7	8	9	12	8	9	10	10	9	8	11	11	12	12	12	12	11	10	9	10	11	11	12	13	13	12	404	13
3	2	1	0	1	2	2	3	4	3	5	6	5	6	7	7	8	4	5	6	7	8	7	7	6	6	7	8	11	7	8	9	9	8	7	10	10	11	11	11	11	10	9	8	9	10	10	11	12	12	11	358	12
4	3	2	1	0	1	1	2	3	2	4	5	4	5	6	6	7	3	4	5	6	7	6	6	5	5	6	7	10	6	7	8	8	7	6	9	9	10	10	10	10	9	8	7	8	9	9	10	11	11	10	314	11
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7	5	4	3	2	2	1	0	1	1	2	3	2	3	4	4	3	2	3	4	5	6	5	5	4	3	4	5	5	5	6	7	7	6	7	6	8	9	9	9	9	8	7	6	7	8	8	9	10	10	9	261	10
8	6	5	4	3	3	2	1	0	2	1	2	1	2	3	3	4	3	4	5	6	7	6	6	5	2	3	4	6	6	7	8	8	7	8	7	9	9	10	10	10	9	8	7	8	9	9	10	11	11	10	290	11
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12	7	6	5	4	4	3	2	1	4	2	1	0	2	3	3	4	5	5	6	7	9	7	6	5	1	2	3	6	6	7	8	8	7	8	9	9	9	10	10	11	10	9	8	9	10	10	11	12	12	11	317	12
13	8	7	6	5	5	4	3	2	4	1	1	2	0	1	1	3	3	4	5	6	7	5	4	3	3	2	2	4	4	5	6	6	5	6	7	7	7	8	8	9	9	8	7	8	9	9	10	11	11	10	271	11
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48	14	13	12	11	10	11	10	11	9	12	11	12	11	10	9	8	9	7	6	7	6	5	6	7	13	12	10	8	8	9	7	8	7	6	7	5	6	7	4	3	4	5	4	3	3	2	1	0	1	2	372	14
49	14	13	12	11	10	11	10	11	9	12	11	12	11	10	9	8	9	7	6	7	6	5	6	7	13	12	10	8	8	9	8	9	8	7	7	6	7	8	5	4	5	6	4	3	2	3	2	1	0	1	383	14
50	13	12	11	10	9	10	9	10	8	11	10	11	10	9	8	7	8	6	5	6	5	4	5	6	12	11	9	7	7	8	7	8	7	6	6	5	6	7	4	3	4	5	3	2	1	2	3	2	1	0	339	13
	452	404	358	314	280	298	261	290	238	298	293	317	271	273	239	218	224	227	220	272	265	209	203	199	364	338	283	252	224	259	272	280	244	242	273	269	297	335	297	306	306	279	239	265	295	284	328	372	383	339		
																																																			Diameter	14

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A Brief Discussion about history and geographical Background of the Siliguri Subdivision

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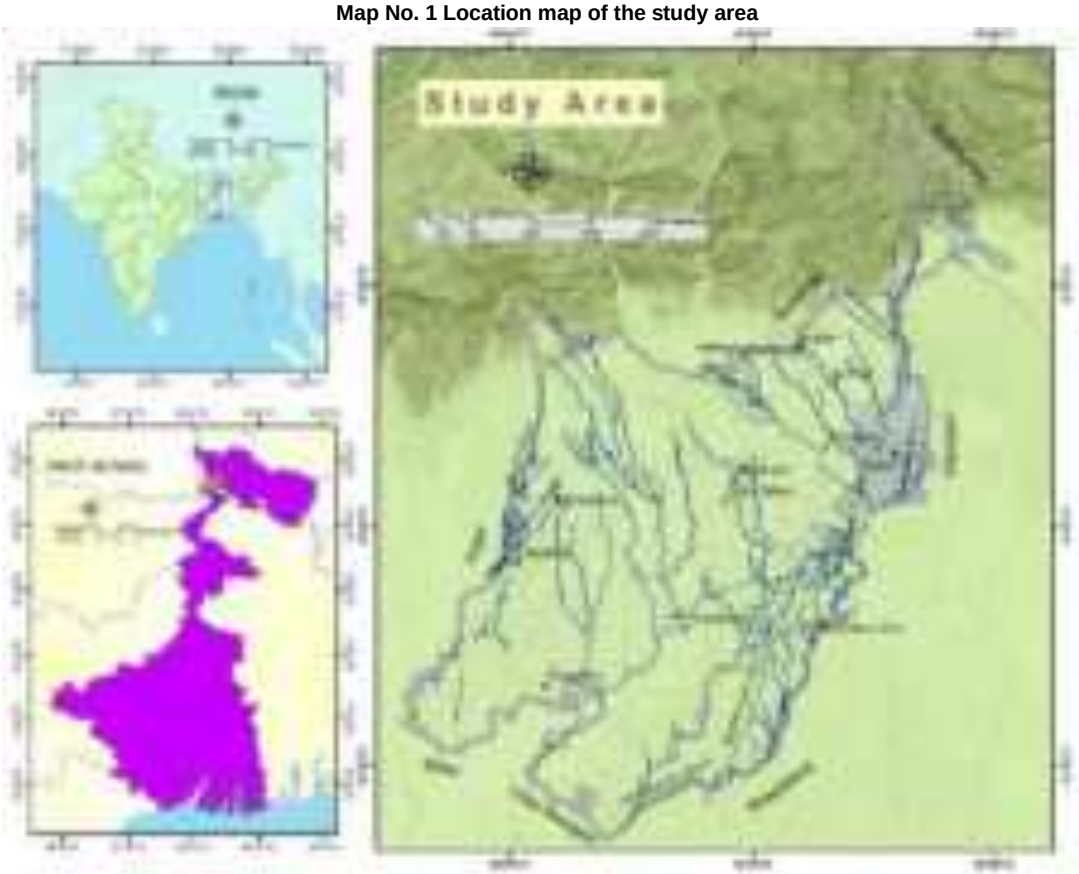
ABSTRACT

A geographical background of a region is very much an integral part of research. It helps to get an idea about the physiography, climate, geology, soil, drainage and natural vegetation which forms the mosaic of the physical background of the study area. In addition to these, brief history of this subdivision has also been dealt here in details. This will give a broad understanding of the geographical elements of Siliguri sub-division. Given this content each of these parameters has been discussed individually in the subsequent part.

Introduction

Siliguri sub-division, the study area is located at the base of Himalaya Mountain in the plain of the Darjeeling district. This subdivision is popularly known as 'Terai Land.' This region is also consider as 'Chicken neck corridor', a 'cartographic imprints of the British decolonization process is a terrifyingly vulnerable artery in India's Geography'. The latitudinal and longitudinal extension of the study area is $26^0 26' 50''$ N to $26^0 58' 00''$ N and $88^0 06' 13''$ E to $88^0 31' 03''$ E respectively. This area is represented by parts of the Survey of India (SOI) toposheet no. 78 B/1, 78 B/2, 78 B/3, 78 B/5. 78 B/6 and 78 B/9 on the scale of 1: 50,000. The geographical area is 819.61 sq. km consisting 4 C. D. Blocks, 22 Gram Panchayats, 14 Census Towns, 353 Villages and 1 Municipal Corporation under its administrative jurisdiction. This sub-division is bounded on the north by Kurseong sub-division and Kalimpong district, on south by Bihar, Uttar Dinajpur and Bangladesh, on east by Jalpaiguri district and on west by Nepal. In 2011 census, the total population of this region is 1189838 consisting 654617 urban population and 535221 rural population.

Map No. 1 Location map of the study area



Source: Prepared by the researcher

Brief history of Siliguri Subdivision

Documentation of the history of the study area is very limited. Siliguri's other name in Hunter's *Statistical Account of Bengal* was 'Sannyasikata'. In his books, Hunter made no mention of the term Siliguri. J.D. Hooker in his travelogue said that "Siligoree stands on the verge of the Terai, that low malarious belt which skirts the base of the Himalaya." The Baikunthapur Raikats were a subsidiary branch of the Cooch Behar royal family. A step brother of Maharaja Viswa Singha built a house adjacent to Siliguri during the reign of the region's first two kings, Viswa Singha and Naranarayan Raikat Siswasinhga. That region of the kingdom was given to him as "pet bhata" (appanage) in the middle of the sixteenth century. Accordingly, "His (Siswasinhga) capital was first built at Siliacguri (Siliguri) in the village of Debgram…..The capital was called 'Niz- Baikunthapur'. (Sanyal, 2002)" Darjeeling's history was first revealed in the 19th century, possibly as a result of the British Indian government's efforts to identify a Himalayan neighbouring region. The location was first mentioned in the Treaty of Titliya of 1816, which was signed by the kingdom of Sikkim and the British East India Company.

As a part of this agreement British government have to protect the frontier of Sikkim from invasion. In this regard two officers of British East India Company try to solve the frontier problem between Sikkim and Nepal in 1828. One of these officers, General Lloyd spent six days in Darjeeling and was attracted by its scenic beauty. Given the cold weather of Darjeeling, later he planned it as a location of health resort. After the approval of the court of directors, he was successful in obtaining the execution of a grant deed by the Raja of Sikkim on the 1st day of 1835. Thereafter the territory of Darjeeling was further expanded with the annexation of the terai. Thus, 1866 represents a turning point in the district's chronology. After Kalimpong was placed under British control, the district was divided into two subdivisions: the Terai sub-division, with a land area of 274 square miles, which included the entire country at the foot of the hills, and the headquarter sub-division, with a land area of 960 square miles, which included all the hills on both sides of the Teesta.

It was difficult to travel between the Darjeeling district and the plains prior to 1866 because there was only a small route, which still remains today and was constructed in 1841 and passes via Pankhabari. In order to facilitate wheeled travel from the hills to the plains, the current Hill Cart Road was built in 1861 (Hunter, 1876). Simultaneously, a different road connecting Siliguri to the northern part of the Ganga was built, which helped Siliguri gain notoriety. (O'Malley, 1907). From 1864 until 1880, the Terai sub-division's headquarters were located in Hanskhawa close to Phansidewa before being moved to Siliguri. The Eastern Bengal State Railway Company subsequently built the railway line connecting Sealdah (Calcutta) and Damukia Ghat, which is currently located in Bangladesh close to the bank of the river Padma. In 1878, it was extended farther from the other bank of the Padma River at a location known as Saraghat to Siliguri via Nator, Santahar, Parbatipur, and Jalpaiguri (all of which are now in Bangladesh except Jalpaiguri). As a result, this allowed for continuous rail service between Siliguri and Calcutta. Then, in 1926, this metre gauge line was converted to a broad gauge line. Darjeeling Himalayan Railways, a different railway line was built in 1881, connecting Siliguri to Darjeeling and increased the latter's significance.

In the Gazetteer of Darjeeling 1907, this place was declared by the authority as unhealthy and unhygienic and it was considered as a 'depot of malaria, typhoid' etc. In spite of these demerits, Siliguri was declared as a sub-divisional headquarters under Darjeeling district in 1907, thus re-establishing the Terai sub-division which had in 1891 been absorbed into the Kurseong sub-division. The population between 1907 and 1930 increased gradually but its overall development was not noteworthy, because till that time there was only one two-storied pukka (brick-built) building, which proves that 'Siliguri' though had by then a larger population, there had been little improvement in its performance. The establishment of schools and libraries between 1910 and 1930 was followed by the establishment of a club named the "Sporting Union" in 1920. Additionally, Siliguri has a strong history of the Swadeshi (Independence) movement, and Mahatma Gandhi addressed the people of Siliguri during his visit in 1925. After World War I, in 1919, transportation by modern vehicle began in Siliguri. Mr. Stephen, who had four motor cars and transported passengers to Darjeeling, utilized it for the first time. Each traveller paid Rs. 19 to get to Darjeeling. However, the Siliguri-Naxalbari route saw the beginning of the bus service for the Terai regions of Darjeeling in 1925. The first passenger bus was known as "Siliguri Motor Service." The bus's proprietor was Ganeshram Prasad and the first driver of the said bus was Md. Faridh.

When Siliguri's population reached about 7,000 people in 1931, it was officially recognized as a town for the first time by the Census of India. After that, this town's cultural life started to thrive, and in 1935 a movie was screened for the first time in the Mitra Sammilani Hall, which had originally opened in 1909 as the Bijalee Talkies and later changed its name to the Tripti Talkies. This town's cultural progress was further reflected in 1937 by the staging of a sizable number of traditional plays. Siliguri's population grew more quickly between 1931 and 1941, primarily as a result of the influx of immigrants from neighbouring districts in the south and nearby hills in the north.

According to the West Bengal Government's 29 April 1949 Gazette Notification, the Siliguri Municipality was created on May 24th, 1949, in accordance with the Bengal Municipal Act of 1932. It was first situated in a decrepit, one-story, little home with a tin roof owned by Mohammad Khudabox on the Hill Cart Road, directly across from the current Meghdoot Cinema Hall. The government appointed the first Chairman of the Municipality. By virtue of his position at the time, the S.D.O. served as the municipality's chairman. As a result, Sachindra Mohan Guha, the then S.D.O. of Siliguri, served as the first Chairman and Briendra Nath Roy Sarkar served as Vice-Chairman. Along with the aforementioned names, the State Government also nominated the following commissioners: Abanindranath Bhattacharjee, Pradut Kumar Basu, Bimal Kumar Mukhopadhay, Digendranath Roy Sarkar, Manturam Agarwala, Bindheawari Misra, Rampada Chattopadhaya, Dr. Khirodh Nath Chattopadhay, Dr. Gopal Chandra Ghosh and George Mahbert. The Chairman was formerly employed by the government, but this practise was ended in 1956. The "Poura Bhawan" was built near the Siliguri court in its current position

on October 26, 1952, with the foundation stone placed by the West Bengal governor in office at the time, Harendra Kumar Mukhopadhaya. Bireswas Majumdar gave the building its official opening on January 26, 1960. Jagadish Chandra Bhattacharya served as the new amendment act's first elected chairman. Thereafter, with the exception on a few occasions when an administrator served as chairman, the Siliguri Municipality's subsequent chairmen included Jiban Krishna Dutta, Krishnendra Narayan Choudhury, Swapan Kumar Sarkar, Asok Narayan Bhattacharya, and Bikash Ghosh. Though Siliguri was officially recognized as a town in 1931, but the local transportation was terrible. The municipality began licencing rickshaw pullers in 1952 and issued licences for 450 rickshaws. In 1951, the common people was first given access to power in this town through the Kurseong Hydro-Electric Power supply.

In the same year 1951, a college called "Siliguri College" was also established; up until 1971, it was the only college available to the people of Siliguri. After that, the Siliguri College of Commerce (1971) and the Siliguri Mahila Mahabidyalaya (1981) were established. After 1947, slum communities began to grow in and around Siliguri as a result of the massive influx of migrants from East Bengal (East Pakistan). During this time, the local market also began to expand as the flow of necessities expanded. The construction of the Siliguri railway junction in 1949 created a new pathway for direct communication with Bihar and the surrounding areas. The Siliguri Town Station is now connected via the pre-existing narrow gauge railway that ran along the Hill Cart Road thanks to the construction of Siliguri Junction station.

Due to the importance of the transport system during the war, the highways in and surrounding Siliguri were heavily utilized for the transportation of tanks and army vehicles during the 1962 Chinese invasion. For instance, the removal of the different stalls that were located on both sides of the Hill Cart Road significantly enlarged its width. Since then, there has been significant progress in roads, making Siliguri the main nodal point of the area. The Chinese incursion in 1962 brought the strategic importance of roads into the proper focus.

In the field of communication, the construction of the New Jalpaiguri Railway station in 1964 was a significant accomplishment. New Jalpaiguri railway station was connected to Siliguri Junction and Siliguri Town stations. The main reason for constructing the New Jalpaiguri Railway station was to establish a broad-gauge railroad line that would connect Siliguri and the surrounding areas with Calcutta. However, because the Farakka Barrage with road-cum-rai1 carriageways had not yet been built, the railway link between Siliguri and Calcutta was still going via Khejuria Ghat on the Ganga, which required using a boat to cross. Train communication between Siliguri and Calcutta became uninterrupted after the construction of Farakka Barrage in 1974. Notably, New Jalpaiguri became India's first railway station to feature all three gauges (i.e. broad, middle and narrow).

A political uprising over the language issue began in Assam in 1960, and as a result, a large number of Bengali population began moving to Siliguri and settling there. The Bangladesh War in 1971 caused a large influx of non-Muslim Bengalis, the majority of whom arrived in Siliguri and other North Bengal towns. Since the ULFA agitation in Assam began in 1980, there have been additional waves of migrants, including bengalis, some of whom have settled in Siliguri and the surrounding area, particularly in Dabgram, leading to a rapid increase in its population. Siliguri's population grew after 1985, increasing the town's population and significantly increasing its land value. Under the leadership of Swapan Kumar Sarkar, the foundation stone for the Kanchanjunga Krirangan was laid, which will replace Tilak Maidan. Thereafter some development plans were made, to construct a second rail gate beside Town Station and prepare the connecting roads and broadening of Kachari road, Station Feeder Road, Burdwan Road, Bidhan Road and Sevok Road. In addition, the Refugee Rehabilitation Department opened Bidhan Market, named after the former chief minister of West Bengal, Dr. Bidhan Chandra Roy, on a three-acre tract of land for the benefit of 800 refugee vendors, at a cost of more than Rs. 10,000,000.

In the mean time, Siliguri was officially given Municipal Corporation status by the West Bengal Assembly on May 12, 1990, replacing Municipality. Siliguri Municipal Corporation was created in 1994 when Siliguri Municipality was transformed into it (S.M.C). It should be remembered that Siliguri Municipal Corporation includes both Dabgram Census Town and Siliguri Municipality (21.80 sq. km). Mayor is being used instead of Chairmen as a nomenclature. As the first Mayor of the Siliguri Municipal Corporation, Bikash Ghosh was chosen, and he has since been followed by Munsi Nurul Islam, Asok Narayan Bhattacharya, and Goutam Deb. The Siliguri Municipality initially had 8 wards, which steadily increased to 19 in 1964, 30 in the late 1980s, and finally 47 in 1994 when it was upgraded to a Corporation.

However, the Siliguri Planning Organization (S.P.O) was established on June 13, 1964, by the West Bengal government's Development and Planning Department, fifteen years after the Siliguri Municipality was founded. The S.P.O. created an interim development plan for Siliguri in 1965 with the intention of determining the city's future land use pattern. However, over time, it became clear that S.P.O was unable to address the myriad urban issues that Siliguri was facing. This was because the town's territory had grown beyond the administrative boundaries of Siliguri Subdivision due to urbanization, and now extends into the neighbouring Jalpaiguri district. In accordance with the West Bengal Town and Country (Planning and Development) Act of 1979, the Siliguri Jalpaiguri Development Authority (S.J.D.A) was founded on April 1st, 1980. This recently established S.J.D.A absorbed the earlier S.P.O. In 1986, the S.J.D.A. created an outline development plan for the 260 sq. km. of the S.J.D.A region that encompassed the entire Siliguri Municipality, measuring 15.5 sq. km. at that time.

The Sino-Indian War of 1962 was one of the key elements leading to a drastic change of the entire Siliguri sub-division. Because of this, the Indian government had a distinct perspective on Siliguri in order to guarantee security for North-East India. A variety of military offices and divisions were established up for the purpose of ensuring national security. In addition to this, this area saw the establishment of numerous military camps and stations for members of the Indian Army, Air Force, B.S.F., and S.S.B. In accordance with this, a variety of development initiatives and financial aid were given, aiding in the growth of this region. But the most intriguing part of this dramatic transformation of the entire Siliguri sub-division within

a short period of time is that the entire transformation took place without any development of large-scale industry. It would seem, at least on the surface, that there is no production base for this region. This is mostly a one-centric commercial hub that serves the expanding needs of neighbouring nations like Bhutan, Nepal, Bangladesh and North East India. Siliguri really served as a pull factor for population movement. This led to emigration from Siliguri's rural districts and from neighbouring Jalpaiguri district. Many employees are employed in non-agricultural activities. Additionally, it is interesting to note that the four c.d. blocks (Matigara, Nakshalbari, Phansidewa, and Kharibari) of Siliguri sub-division are significantly distinct in character from Siliguri. This block contains the majority of the agricultural activities as well as other related activity.

Administrative Divisions

Administration wise Siliguri Municipal Corporation comes under two district, Darjeeling and Jalpaiguri. Geographically this municipal corporation is situated within latitude of 26°42'N to 26°56'N and the longitude of 88°20'E to 88°29'E. It has an average elevation of 122 metres. Siliguri Municipal Corporation under Darjeeling district has an area of 20.1 sq. km. It consists of 33 Wards (Ward No. 1 to 30 and Ward No. 45 to 47). Siliguri Municipal Corporation under Jalpaiguri District has an area of 21.8 sq. km. It consists of 14 Wards (Ward No. 31 to 44).

Matigara block is located between $26^0 40^{'}$ N to $26^0 57^{'}$ N and $88^0 17^{'}$ E to $88^0 30^{'}$ E respectively. It has an average elevation of 127 metres and an area of 132.61 sq. km. Of these, rural area is 120.62 sq. km and urban area is 11.98 sq. km. According to 2011 census it consists of six census towns, viz. Bairatisal, Tari, Jitu, Kalkut, Mathapari, Baramohonsingh and five gram panchayats, viz., Atharakhai, Matigara-I, Patharghata, Champasari, and Matigara-II.

Naxalbari block is located between $26^0 38^{'}$ N to $26^0 48^{'}$ N and $88^0 10^{'}$ to $88^0 22^{'}$ E respectively. It has an average elevation of 152 metres above sea level. This block occupies an area of about 188.12 sq. km. Of these, rural area is 173.67 sq. km and urban area is 14.45 Sq. km. According to census 2011 this block consists of six Census Towns, viz., Uttar Bagdogra, Lalman, Dakshin Bagdogra, Dumriguri, Geni, Bhimram and six gram panchayats, viz., Gossaipur, Lower Bagdogra, Naxalbari, Hatighisa, Moniram and Upper Bagdogra.

Phansidewa block is located between $26^0 26^{'}$ N to $26^0 41^{'}$ N and $88^0 14^{'}$ to $88^0 24^{'}$ E respectively. It has an average elevation of 98 metres above sea level having an area about 312.1 sq. km. According to census 2011 this block consists of rural areas only with seven gram panchayats, viz., Bidhannagar-I, Chathat-Bansgaon Kismat, Ghoshpukur, Jalas-Nizamtara, Bidhannagar- II, Phansidewa-Bansgaon Kismat and Hetmuri-Singhjhora.

Kharibari block is located between $26^0 30^{'}$ N to $26^0 39^{'}$ N and $88^0 08^{'}$ to $88^0 15^{'}$ E respectively. This block covers 144.88 sq. km. Of these, rural area is 140.83 sq. km. and urban area is 4.05 sq. km. According to census 2011 this block consists of two census towns, viz., Shyamdhan and Kharbari and four gram panchayats, viz., Binnabari, Buraganj, Kharibari-Panisali and Raniganj-Panisali.

Map No. 2 C.D. Block wise map of the study area

Source: Prepared by the researcher

Physical set-up of the study area

Siliguri sub-divisaion is part of an outlying hills of the lower Himalayas and a stretch of land along their base, known as Terai, a gently sloping land, partly covered with riverine deposits. The hills rise abruptly from the Terai plains and the elevation increases northward. The hilly part are fluvio-glacial deposits of the quaternary period, while most of the southern part consists of pleistocene to recent flood plain deposits. In the Terai plain due to sudden decease in slope, rivers appear in wide and shallow beds with carrying huge loads. The several physical attributes like physiography, slope, geology, drainage, climatic characteristics, soil, and natural vegetation of this region are described here.

Physiography

The Siliguri sub-division is bounded to the north by the high hills of the Lesser Himalayas and to the south by gentle alluvium, the majority of the study area is made up of unconsolidated material derived from the Himalayas and brought down by rivers that originate from these hills. The average surface elevations along the north-south axis is 350m and 30m above mean sea level, respectively. The area's general slope runs from north-east to south-west.

The cross-sections study show that there are a number of break-in-slopes, and the variation in slopes at different heights indicates that the area is undergoing tectonic activity. The study area is divided into three micro-divisions based on slopes, contours, and cross-sections, the nature of erosion, material composition, and drainage characteristics.

a) Structural Hills: A comparatively tiny northern portion of the study region, which is part of the Siwaliks formation, is forming hogbacks and cuestas with high relief and a rugged profile, as well as some structurally controlled drainage. The Siwalik's height is more than 260 metres above mean sea level. Headward erosion by the rivers in the Siwalik, scarp face and moderately steep slope in the higher part of the hills are significant features in the study area. The dip direction is toward the south-west and parallel to the topographical slope. The dip runs parallel to the topographical slope and faces south-west. As a result, the lower part of the hill has flat topography, while the higher part is heavily dissected by streams and rivers. The structure hills are densely forested.

b) Piedmont Plains: Long sloppy lands from the hills to the plain, known as piedmont plains, are formed by materials from the Siwalik and the Lesser Himalayas. It covers a large portion of the study area. The piedmont plain has been divided into two sections based on contour height, slope, and constituent material composition: (i) upper piedmont plain and (ii) lower piedmont plain.

i) Upper piedmont plain: Upper piedmont plain: This plain is a depression in the Lesser Himalayas and is made up of a variety of boulders, cobbles, pebbles, gravels, sands, silts, and clays. From north to south, its general height ranges from 200 to 260 m.

ii) Lower piedmont plain: This plain is made up of unconsolidated materials such as loose sands, gravels, silts, and clays. This plain's average elevation ranges from 120 to 200 metres, with a moderate to gentle slope to the south.

c) Terai Plains: Terai Plain is south of the piedmont plain and has a gentle southerly slope. The presence of a spring line, from which a number of springs originate, marks the junction of the Terai plain and the piedmont plain. This plain encompasses a large portion of the research area. The general elevation ranges from 40 to 120 metres above mean sea level. It is made up of sands, silts, clays, and some gravel and pebble beds that have been altered.

This micro-division has been further classified into two categories.

i) Plains: The plain is made up of alluvium deposited by the Mahananda, Balason, and Mechi rivers, as well as their tributaries. Sands, silts, and clays from rivers, with 'lenticular' deposition of gravels, make up the alluvium. There are a few prominent topographical features in this zone. The slope is generally north to south.

Physiographically this area could be divided into (a) upland plains of older alluvium and (b) low land plains of newer alluvium.

(a) Upland plain: The upland plains of older alluvium, which cover a large area, are not inundated during floods. It is heavily cultivated and primarily composed of sands, silts, and clays.

(b) Low land plain: It is situated adjacent to drainage lines and is prone to flooding during the rainy season each year, when fresh silt and loam of light colour are deposited. Following the floods, the soil becomes moist, and winter cultivation does not require any irrigation.

ii) Terraces: The terraces are classified according to their levels and origins. The stand over height ranges from 35 to 60 metres, and the slope is very gentle with a southerly orientation.

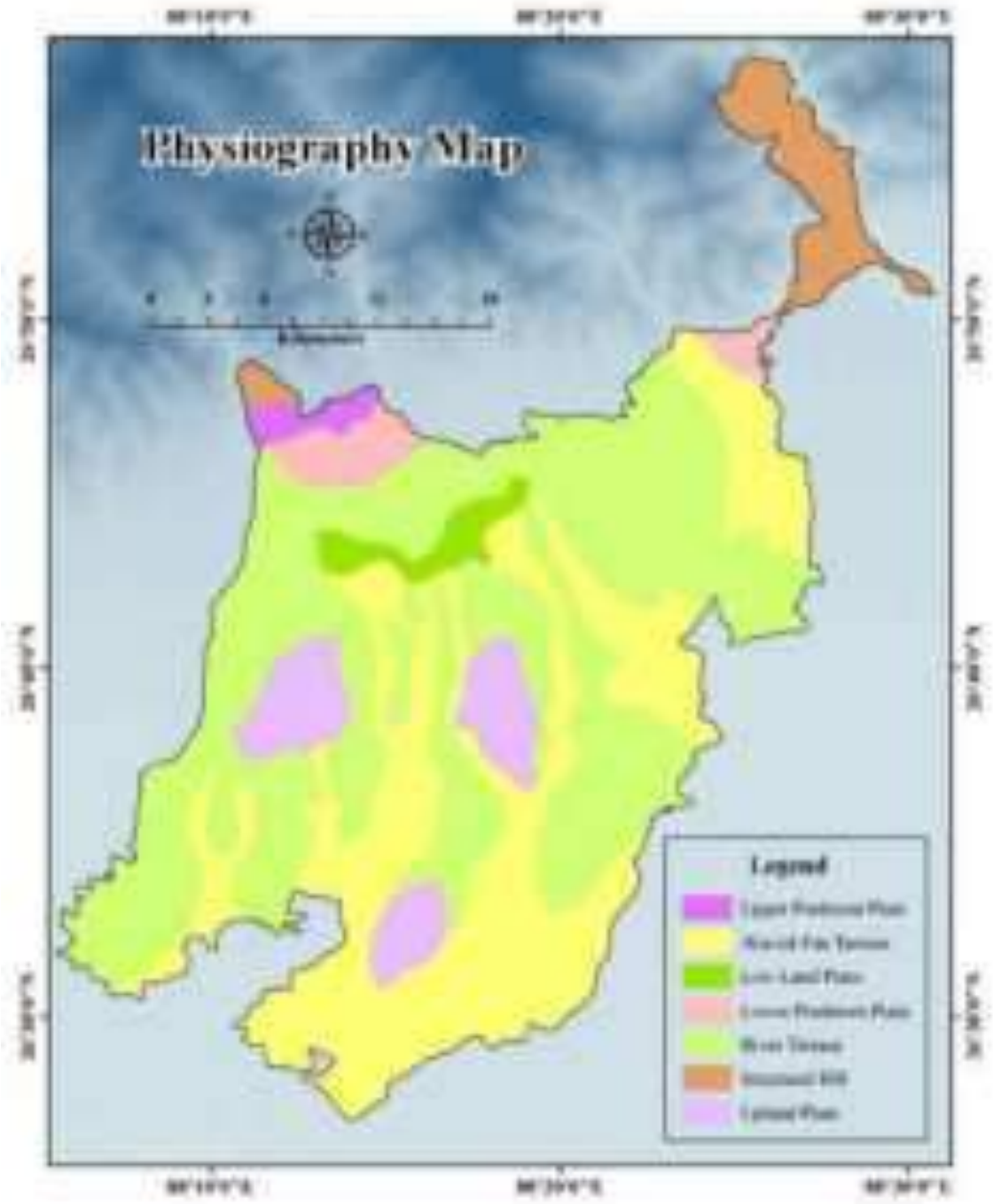
Terraces may be further classified into two groups- (a) River terraces and (b) Alluvial fan terraces.

(a) River terraces: River terraces represent different levels of older flood or low land plains that have undergone repeated upliftment due to changes in long physical, climatic, and tectonic conditions. The Mechi and Mahananda rivers both have wide terraces. The river terraces indicate non-cyclic deposition. The Mechi river's high level river terraces are made up of rounded and sub-angular boulders mixed in a coarse matrix embedded in red clay.

(b) Alluvial fan terraces: Geomorphologically, due to intensive fluvial action alluvial fan terraces were developed on both sides of the rivers and also played an important role in formation and modification of landforms. Boulders and pebbles embedded in sand, silt, and clay make up the majority of alluvial fan terraces. The colours of

fan materials on river cuttings are typically black and yellow, indicating that they are clay materials.

Map No. 3 Physiography Map of the Study Area



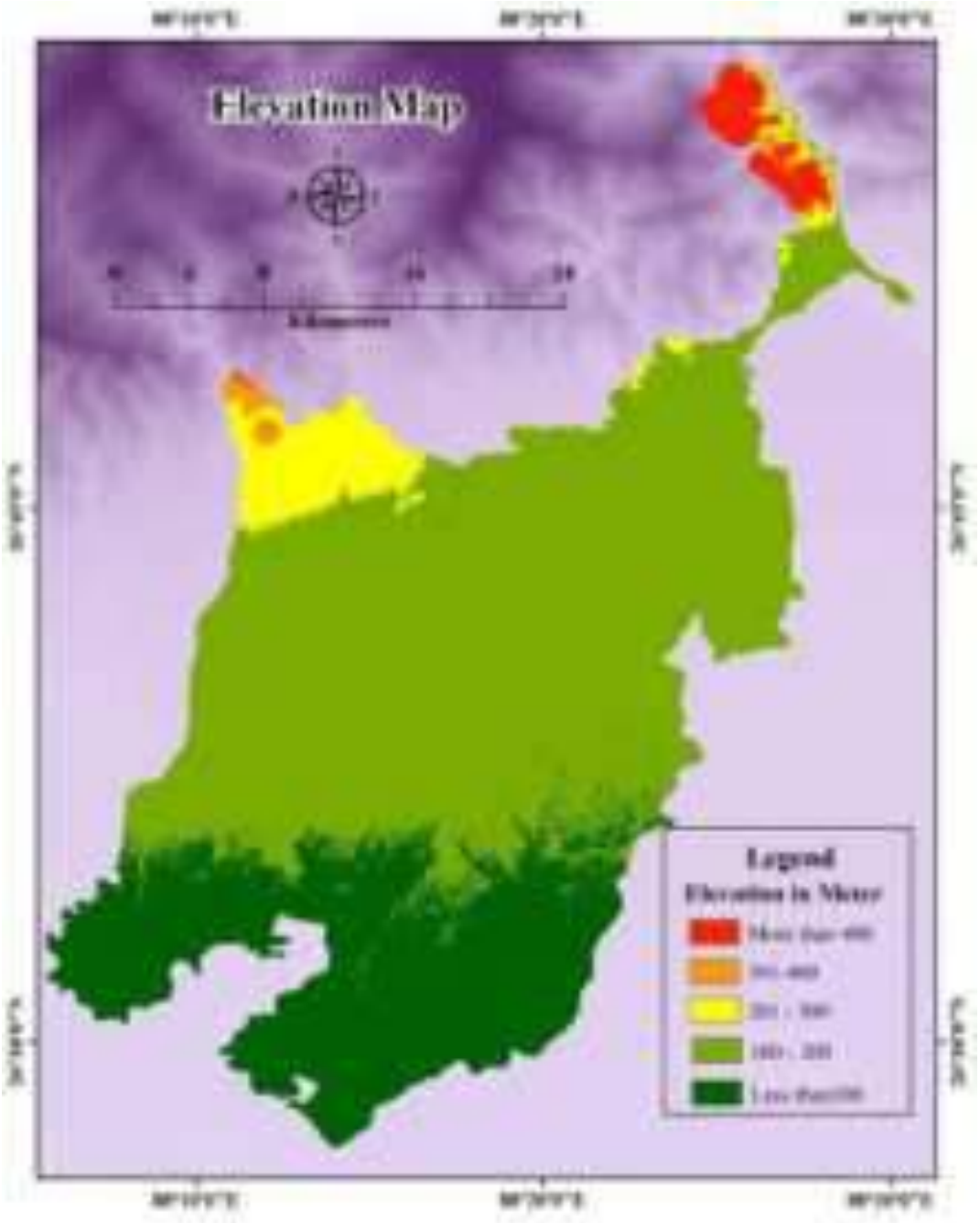
Source: Prepared by the researcher

Elevation

Elevation of any area is extremely important for identifying physiographic characteristics. Elevation has a direct relationship with the rate of rainfall infiltration, soil productivity, the amount of vegetation cover, and so on. According to the prepared ASTER DEM (SRTM), the sub-division lies between 48 mt. to 1299 mt. from mean sea level. The northern part of the study region is made up of uneven hilly terrain having dense vegetation. On the contrary, the majority of the study area i.e. 72 percent, is covered by moderate to low elevation, which is primarily found in the southern and central parts, and this area is a densely populated zone with high agricultural activity and maximum built-up areas. As a result, the elevation can be classified into five categories within the

study area: Very high elevation (More than 400 mt.), High elevation (300- 400 mt.), Moderate elevation (200–300 mt.), Low elevation (100-200 mt.), and Very low elevation (Less than 100 mt.).

Map No. 4 Elevtaion map of the study area



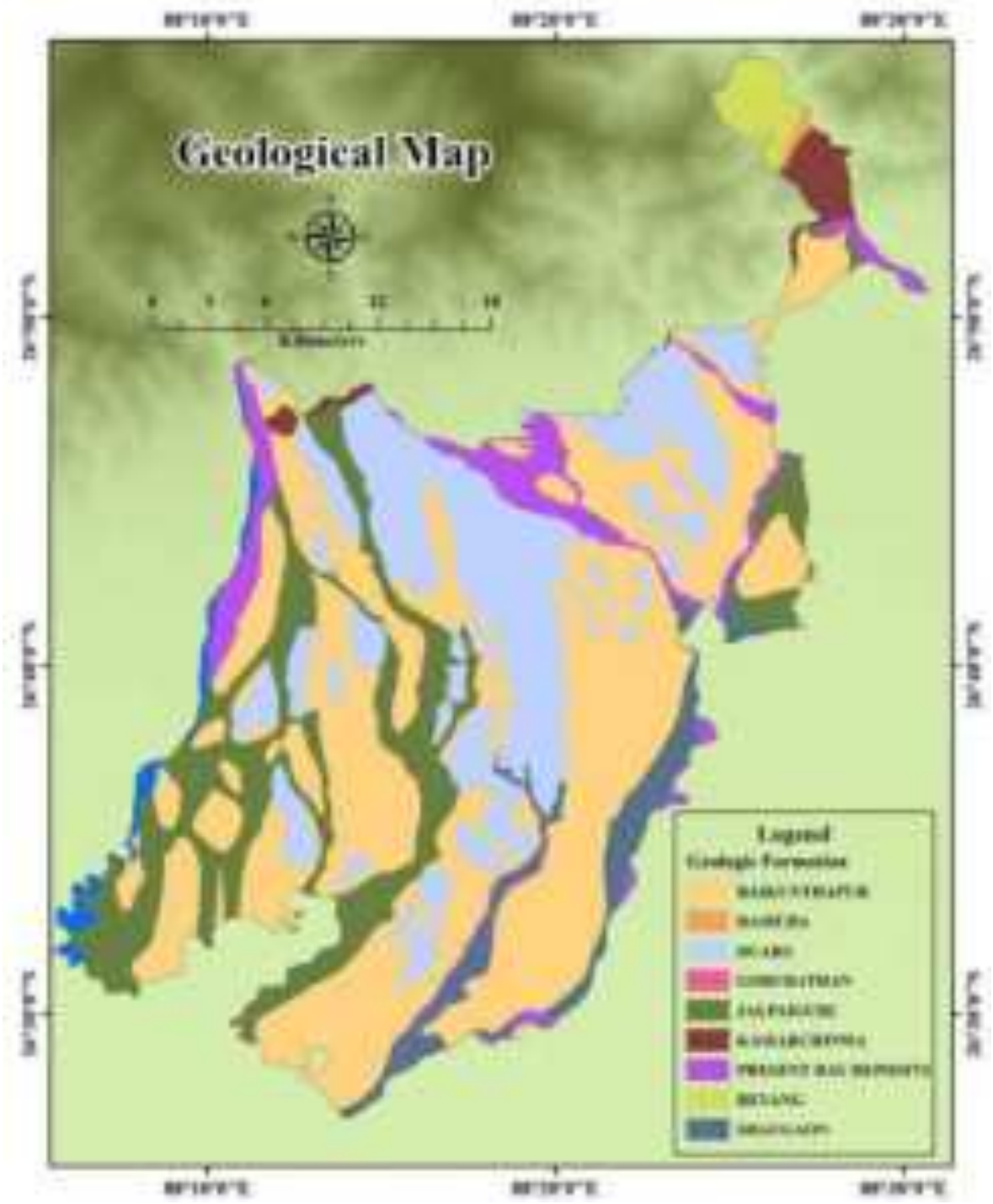
Source: Prepared by the researcher

Geological formations

The geological formation of any area is critical because the rate of infiltration and runoff is primarily determined by the porosity of specific types of rocks. The entire region exhibits features of unusual variation, both stratigraphically and petrographically. The Siwaliks are the first group of rocks encountered while travelling north from the plains of newer alluvial deposits. They are composed of hard and highly feldspathic and slightly micaceous sandstones, quartz pebbles, and schist. A continuous belt of stratified and unstratified deposits of gravels, boulders, sands, and clay occurs along the entire base of this Siwalik zone, forming a sort of transition between the hills and the plains. The daling intrude far inside the plains of Bengal by a series of spur and promontories, through the Siwalik. The map revealed that geologically the study area can be divided into nine major geological formations with four chronological groups. The sequential formations are Baikunthapur formation, Damuda formation, Duars Formation, Gorubathan formation, Jalpaiguri Formation, Kamarchinwa formation, Reyang Formation, Shaugaon Formation and Present day deposites. Northern tip of Matigara block that is the part of sivok hill forest covers with reyang formation, just below this damuda formation can be seen in a smaller strip. There after kamarchinwa formation can also be found in the southern portion of sivok forest. Baikunthapur and Dooars formation can be found almost in

every block and this two type of formation covers more than half of the study area. The Jalpaiguri formation can be found in Siliguri Municipal Corporation region, Kharibari, along the western boundary of Phasidewa block and scartterly some part of Nakshalbari block. The present day deposits are found along the river valley of study area. Shaugaon formation can be found in the eastern portion of the Phasidewa block. However, the majority of the study area is covered by undifferentiated fluvial-glacial sediments that were deposited during the very recent Quaternary period and spread primarily in the southern part, followed by the undifferentiated Siwalik group (Plio-Pleistocene) that mainly extends from the western to the eastern part in a linear form. Thus, it is clear that the study area has been subjected to significant tectonic activity in the geological past, as it is composed of a variety of geological structures ranging from hard crystalline gneiss to deposited alluvium.

Map No. 5 Geological map of the study area



Source: Prepared by the researcher

Drainage System

The drainage inversion of the major rivers of North Bengal, from converging drainage in the hills to divergent drainage in the plains, is one of their most distinguishing features. During the monsoon months, most of the channels, which are normally dry during the dry season, drain a large amount of water. The gradients of their long profiles have also changed significantly. The majority of the rivers are quite large. All rivers in the North Bengal plains are international in the sense that they flow through India and Bangladesh in the lower reaches and Nepal and Bhutan in the upper reaches. Most of the rivers are flowing in a braided channel. The rivers of North Bengal are divided into two systems: the Mahananda system and the Teesta system. All of the rivers originate from forested mountains and are perennial in nature. Rivers dominate the Terai's topography. The courses can be divided into three sections:

(a) The hill section, where rivers confine their waters within deep gorges or defiles and the course of the river is more or less fixed;

(b) The course of the river between its debouchure (the outward opening of a river, of a valley, or of a strait) from the hills to the plains, where semicircular fans are formed by the deposition of boulders and coarser soil particles; and

(c) The plains section, where semicircular fans are formed by the deposition of boulders and coarser soil particles.

The area is mostly covered by dense jungle. The most important rivers encountered from west to east are the Mechi, which forms the border between Nepal and the Darjeeling district, the Balasan, the Mahananda, and the Teesta. The Teesta, which flows through the Terai for a short distance, receives no tributaries from this region. It empties into the Brahmaputra and the Baikunthapur jungle mahal, forming the Terai's watershed between the Ganges and the Brahmaputra. The Terai is a region in north-east India's western plains where tea is grown. Here the gardens are concentrated between the Mechi, the old Balasan and the Mahananda rivers.

a. The Mechi River: The Mechi River, which rises at an elevation of 905m south of the west facing Rangbang spur of the Singalila range and flows through a deep gorge throughout the hilly course, forms the western boundary of the study area as well as the border between Nepal and India. It descends into the Bhabar tract, where its bed widens dramatically. The Mechi runs through the tea garden of Lohagrah. Kiyang Khola is a left bank tributary of Mechi that joins the Ashi Jhora and the Mana Jhora at an elevation of 635 metres. Floods and other tectonic activities cause it to change course several times. Although the old and new Mechi are separated by several kilometres, they both flow in the same direction.

b. The Balasan River: The Balasan rises from the Ghum-Simana ridge's Lepchajagat Peak, flows south almost parallel to the 88º15' E meridian until it reaches the plains at an altitude of 300 m, and then turns south-east, where its valley is larger than the Mahananda's. There are two notable tributaries of river Balason, one is Rinchintong on the left bank and the other is Rangbong on the right bank. It splits into two branches as it enters the plains, one called Old Balasan and the other called New Balasan, both of which join the Mahananda just below Siliguri. In the mountain's foothills, there are numerous terraces. The amount of water flowing through the new channel is significant. The river has numerous tributaries. Pulungdang Khola, Rangbang Nala, Manjwa Jhora, Dudhia Jhora, and the Chenga are just a few examples.

c. The Mahananda River: The Mahananda River, which originates at Paglajhora Falls of Mahaldiram hills, east of Kurseong from an elevation 2103.12 m, forms the study area's eastern boundary. During the monsoon, the catchment area receives a lot of rain. After debouching the hills, the Mahananda flows south until it reaches Siliguri, where it turns south-west. Finally, the river empties into the Ganges. There are several tributaries, including the Trinai, Ronchandi, and Dauk.

Table No. 1 Rivers and their tributaries in study area

Watershed	Sub-Watershed	Flow Regime	Rivers & Tributaries
Brahmaputra	Teesta	Middle	Teesta
Ganga	Mahananda	Upper	Mahananda, Balason, Mechi

Source: Cajee L,2018

Map No. 6 Drainage map of the study area

Source: Prepared by the researcher

Climatic characteristics

Darjeeling district has two different climatic conditions due to its distinctive topographical features having hills in a larger portion of the district and plain lands of Terai towards south and south-eastern part. The marshy tract of Terai is humid and warm, showing typical tropical and sub-tropical climatic conditions depending upon the elevation.

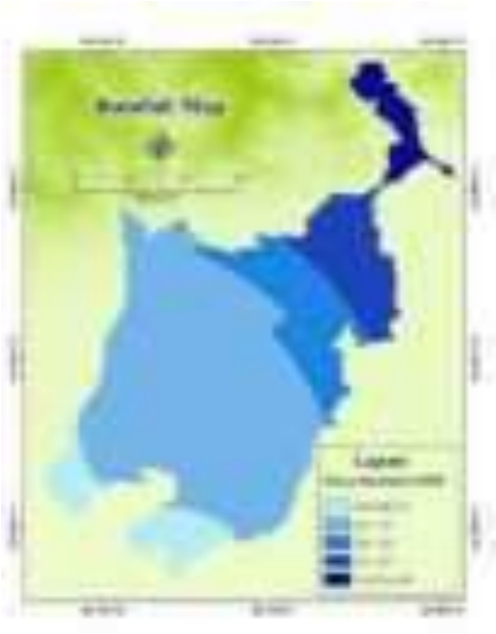
a. Rainfall: The Darjeeling Himalayan region's rainfall pattern is influenced by the south–west monsoon, and it receives high annual rainfall with frequent heavy rains, primarily between June and September (monsoon period). The southern front of the Darjeeling Himalaya acts as a first orographic shield for south-west monsoon winds that arrive from the Bay of Bengal towards Himalaya during the monsoon season, resulting in the highest rainfall intensity (Prokop and Walanus 2017). However, the study region's annual mean rainfall is around 2203 mm.

b. Temperature: The mean minimum and maximum temperatures are 13.8 °C and 28.6°C, respectively. The maximum temperature is usually reached during monsoon and the lowest temperature is reached during the cold winter, between December to March, depending on elevation.

The rainfall map and temperature maps for the research area have been created using the Inverse Distance Weighted Interpolation Method (IDW) in ArcGIS 10.3 software. The study region has been classified into five rainfall zone. These ranges from 200 mm to 300 mm. Almost half of the study area falls under two rainfall zones i.e. 216 to 225 mm and <215 mm. The high rainfall zone i.e. >245 mm can be found in northern part of Matigara block.

On the other hand, the study area has been classified into 5 temperature zones, i.e. <14°C, 14° to 16°C, 16.1° to 18°C, 18.1° to 20°C and >22°C. The southern part of the study area consists of two blocks viz. Kharibari and Phansidewa falls under the highest temperature category i.e. >22°C. The second highest temperature zone i.e. 18.1°C to 20°C is found in the central part of the study area. Rest of the temperature categories are found in the northern part of the study area.

Map No. 7 Rainfall map of the study area



Source: Prepared by the researcher

Map No.8 Temperature map of the study area

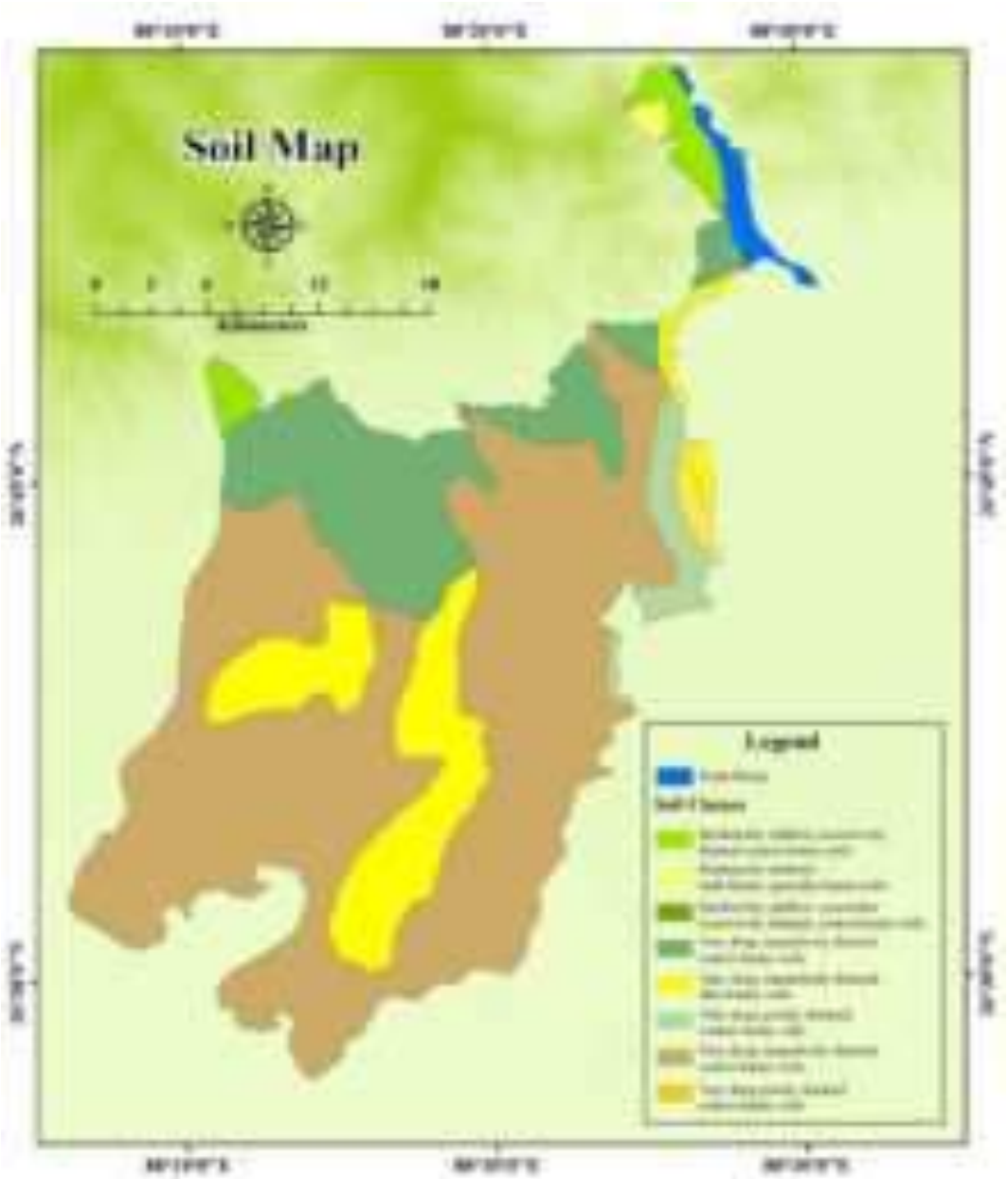
Source: Prepared by the researcher

Soil

Soils typically have a strong correlation with an area's physiographic condition. The small northern part of the study area is dominated by soils originated from the underlying geological structure. On the contrary, the entire southern part of the area is controlled by the soil developed by both fluvial action and lithological process. Both of the process ultimately controlled the structure, texture and other properties of soil.

According to National Bureau of Soil Survey (NBSS) and Land Use Planning (LUP), the study area can be classified into 8 categories with respect to soil types. The northern tip of the Matigara block and north-western tip of Naxalbari block is covered with moderately shallow, excessively drained coarse loamy soil. On steep side slopes there is gravelly loamy surface soil. Very deep imperfectly drained coarse loamy soil occur on piedmont plains with loamy surface has been found in the central and northern part of Naxalbari block and few patches in the northern part of Matigara block. More than half of the study area has been covered with very deep imperfectly drained coarse loamy soil occurring on level to nearly level piedmont plain with loamy surface. Few patches of very deep imperfectly drained coarse loamy soil occur on very gently sloping lower piedmont plain has been found in central part stretching towards the southern part of the study area and a small portion in eastern part. Along the eastern boundary of Matigara block a very deep poorly drained coarse loamy soils has been found. Moderately shallow well drained gravelly loamy soil occur on the steep side slopes with gravelly loamy surface has been found along the eastern part of Siliguri Municipal Corporation.

Map No. 9 Soil map of the study area



Source: Prepared by Researcher

Natural Vegetation

Vegetation is primarily influenced by climate and soil in a given location. There is a dense cover of vegetation in the study area, which is highly associated with the form of slopes. The area is characterized by steep slopes on the north and north-western sides. The natural forests of study area may be grouped into following broad categories:

a) Tropical semi-evergreen forest: These type of forests are restricted to foothills. The important species are michelia champaca, terminalia myriocarpa, ailanthus grandis and phoebe species. All these species yield valuable commercial timbers.

b) Tropical moist deciduous forest: Moist deciduous forests have shorea robusta as important species. Among its associates, the species like michelia champaca, schima wallichii and chukrassia velutina which are interspersed with riverain forests of acacia catechu, dalbergia sissoo and bombax ceiba, exist.

c) Sub-tropical hill forest: These forests occur upto an elevation of 1.824 m (refer under sub-tropical broad-leaved hill forests by Champion and Seth, 1968). The common species are betula cylindrostachys, anus nepalensis, schima wallichii and engelhardtia spectata etc.

Manmade Forests: The valuable indigenous species form the main component of the plantations in the district. An exotic conifer, cryptomeria japonica, has done exceedingly well in the hilly tracts of this area. Other exotic conifers like pinus petula, cupressus species etc. have also shown great promise in the region

There are several reserved or protected forest in this area namely Bagdogra Range, Panighata Range, Mahananda Wild Life Forest. In addition, many open forest areas can be found here, especially to the south of the study area. (An area recorded as forest but not included in Reserved or Protected forest category. Ownership status of such forests varies from state to state.)

The main factors for dense vegetation in the terai region is low land with gentle slopes and excellent soil fertility. The vast bamboo bushes cover the majority of the land. Twenty to thirty fern species can also be found on the lower and upper terraces of hilly patches. The plains of the study region are densely covered with weeds and grasses.

Conclusion

Therefore, the study area of Siliguri Municipal Corporation and 4 C.D blocks of Siliguri sub-division viz. Matigara, Naxalbari, Kharibari and Phansidewa have a total area of 819.61 sq. km. According to the census 2011, the total population of the study area is 1189838 persons consisting of 65417 urban population and 535221 rural population. J.D. Hooller first used the term 'siligoree' in 1867. Siliguri was declared a sub-division head quarter under Darjeeling district for the first time in 1907. Initially Siliguri developed rather sporadically. After the First World War in 1919, modern motorised transportation system was introduced in Siliguri to transport people from Siliguri to Darjeeling and back. Public bus was introduced in Siliguri in the year 1925, commuting people from Siliguri to Naxalbari and back. Gradually the population of Siliguri reached 7000 in 1931 and for the first time it was recognized as a census town. During the period of partition and social unrest, the population of Siliguri increased rapidly due to influx of huge number of refugees from East Pakistan.

Siliguri got the status of a municipality in 1949 after independence. After the Chinese invasion in 1962, the roads in and around Siliguri was developed rapidly for strategic purpose. Gradually a large number of military, air force and army bases were established in and around Siliguri making this town a very important cotterpin in Indian defence system. With the development of NJP railway station in 1964 on the outskirts of the city, Siliguri emerged as a railway transportation hub connecting north-east India with the mainland. The construction of Farakka Barrage in 1974 led to uninterrupted rail and road connectivity between Siliguri and South Bengal making people's movement more convenient resulting in further growth of Siliguri. After the creation of Bangladesh in 1971, another wave of refugees came to Siliguri resulting in rapid increase in population. Finally, in 1994, Siliguri got the status of a Municipal Corporation.

In terms of physiography, the study area is part of an outlying hills of the lower Himalayas and a stretch of land along the base known as terai. The elevation of the study area ranges from 48 m to 1299 m above the mean sea level. Major rivers flowing through the study area are Teesta, Mahananda, Balasan and Mechi. The annual average rainfall in the study area is above 2000 mm with mean maximum and minimum temperature lying between 13.8° C to 28.6° C. Forests are abundant in the study area with a number of reserved and protected one.

Agriculture in the study area is of diverse nature with crops like paddy, jute, potato and various vegetables cultivated in abundance. Tea plantation is very common in the study area and the economy of the region depends a lot on the processing of the tea leaves. Siliguri is essentially an urban centre which has flourished with the passage of time due to development in trade and commerce. It is the main distribution hub of industrial and household goods moving to the neighbouring state of Sikkim, Darjeeling hills, North-East India, Nepal and Bhutan. Tourism is well developed in North Bengal and Siliguri acts as the gateway to different tourist spots located in Sikkim, Darjeeling and the forests of North Bengal.

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Population Growth of Rural & Urban Settlement of Siliguri Subdivision

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ABSTRACT

Population growth is a demographic process whereby increasing proportion population in area, structural change and behavioral transformation affecting both people and place. This process is spreading all over the world. It includes both the developmental opportunities and some harmful effects. Siliguri, the gateway to North East India, is crucial for the State of West Bengal as well as Eastern India. Especially, in developing countries like India, chronological population increase of any particular area create hardship environmental condition particularly for local residents. The level of population growth in Siliguri subdivision is at acceleration stage. The present investigation has been made to analyse the Population growth rate & try to find out the relationship between the distance and population growth in this area.

Introduction

"Change in the size of a population, whether positive or negative is called 'growth'. Growth of population comes from only three source- births, deaths and migration" (George W. Barday, 1958). Population growth is the term used to describe changes in population size that are accompanied by a numerical increase. Basically, three key factors—births, deaths, and migration within the time period under consideration—are the main causes of population growth in a region. The pattern of population distribution in a region is mostly determined by changes in population characteristics such as location, distribution, density, growth, and movement throughout the past. Additionally, the factors affecting population change play a crucial role in determining the demographic characteristic of "place," and the population growth pattern in a given area beautifully illustrates the economic potential and evolving character of various sub-areas within a region. The changes in population trends, whether positive or negative, represent the history of man's adaptation to the environmental options available in the location.

Objective

- To study the growth of rural and urban settlements within study area.
- To find out the relationship between distance from Siliguri Municipal Corporation with the population growth in rural settlements.

Database The secondary data like demographic characteristics, growth of rural and urban settlements and economic activities was collected from District Census Handbook, Town and Village Directory, West Bengal Administrative Atlas, Government Reports, Occasional Papers and other reports of Census of India. The analysis will take into consideration the three consecutive census years of 1991, 2001 and 2011.

Methodology

To fulfill the objective i.e. to study the growth of rural and urban settlements within study area decadal population growth rate for the rural and urban settlements will be analyzed from 1991 onwards and the change will be taken into account. To calculating the distance from Siliguri Municipal Corporation to the actual road distance of each village and census towns of the study area from Siliguri Municipal Corporation has also been calculated.

Population growth in India

About the demographic characteristics of the ancient era, little is known. Of course, contemporary scholars have given numerous estimates based on the size of the troops and the amount of arable land. Around the year 1600 AD, Kingsley Davis estimated the population of India to be 125 million, and he said that it stayed there until around the year 1750 AD. After 1871, systematic decennial censuses were carried out, which provided for accurate population calculation. The census data is available over the past 100 years, which offer largely accurate projections of the population and growth rate. Even though the numbers are always shifting, India currently accounts for about 17.5% of the world's population with just 2.4 percent of its total land area. India's population in 2011 was estimated to be 1.21 billion. India has the second largest population in the world, only after China.

Table No. 1 Trend of population growth in India

Census years	Population (In Million)	Decadal Growth Rate (In %)
1901	238.4	-
1911	252.1	5.7
1921	251.3	-0.3

1931	279.0	11.0
1941	318.7	14.0
1951	361.1	13.3
1961	439.2	21.5
1971	548.2	24.8
1981	683.3	24.6
1991	846.3	23.8
2001	1024.8	20.2
2011	1210.1	17.7
Source: Census of India 2011, Calculated by the Researcher		

The population growth pattern in India during the course of the 20th century is depicted in the above table. It is evident that population growth fluctuated up until 2011. The table make it abundantly evident that, except during 1911–21 when the "Influenza Epidemic" occurred in 1918, the decadal population growth rate has been rising steadily since 1901. Therefore, the population growth rate between 1911-21 was negative. After 1921, the population grew quickly as a result of government initiatives to promote the development of healthcare facilities and combat sickness (Cholera, Malaria, Small pox, etc.). The rapid population expansion is mostly the result of a declining death rate rather than an abrupt increase in birth rates. Moreover, the partition of the country resulted in waves of migrants coming from both East and West Pakistan which also accounted for a rapid expansion of population in India during this time. The population growth rate had slightly increased from 1931 to 1941 but had barely changed from 1941 to 1951. Thereafter, the decadal growth rate of population was high upto 1981. After this period, the rate of population growth in India began to show a downward trend as a result of advancements in the medical field, birth control measures, public awareness of social issues and governmental policies etc.

Population growth in West Bengal

According to 2011 census, West Bengal had a population of 9.13 crores. The state had 17.54 percent of the total population of the country with 88,752 sq. km area. It is the fourth most populous state in India and the fourteenth-largest Indian state by area. The population which was 26.30 million just after independence has grown to 91.35 million in 2011. Because half of the state was ceded to Bangladesh after partition, only the post-independence period of West Bengal's population growth information has been taken into account here. The decadal population growth from 1951 to 1981 is definitely an unprecedented one that corresponds with a period of tremendous growth, as seen by the significantly lower death rate brought on by improved health condition and influx of migrants from Bangladesh.

Because more health institutions have been established, more people are aware of population explosion, and better government population policies, the decadal population growth between 1981 and 2011 appears to have decreased compared to the previous period. Therefore, even if the state's absolute population is increasing, the rate of population growth is dropping during the last two decades. The death rate was quite low throughout this time, and the fertility rate was stable and average. Since 1951, West Bengal's population growth rate can be compared to the national average. Table no. 3.2 shows that the population growth rate is not uniform.

Table No. 2 Trend of population growth in West Bengal

Census years	Population (In Million)	Growth Rate (In %)
1951	26.30	13.22
1961	34.93	32.80
1971	44.31	26.87
1981	54.58	23.17
1991	68.08	24.73
2001	80.18	17.77
2011	91.35	13.93
Source: Census of India 2011, Calculated by the Researcher		

Population growth in Siliguri Subdivision during 1991-2011

Explanation for the variations in population growth in each of the 1991-2001 and 2001-2011 decades is presented below, on the basis of data obtained from the census report of India 1991, 2001, 2011 (table 3.3 & 3.4). The table reveals that there is significant difference in the decadal growth of population in each of the 4 blocks in the study area. The decadal change in population from 1991-2001 was 43.81 percent for Matigara, 54.60 percent for Naxalbari, 22.46 percent for Phasidewa and 37.83 percent for Kharibari. Steady development in economy, along with increased incidence of migration, improvement in educational facilities, infrastructural development and improved health and medical facilities are some of the important factors that accelerated the population growth during this period.

Although in the following decade i.e. 2001-2011, the rate of growth of rural population witnessed a decline in all the four blocks of the study area, there was a positive growth in the total population. The highest growth rate in population during 2001-2011 was recorded at Matigara, followed by Kharibari, Phansidewa and Naxalbari respectively. Matigara block which is located nearest to Siliguri Municipal Corporation witnessed a growth in population over 50 percent during 2001-2011. The decline in the rural population can be attributed to development of rural health care centres, along with active participation of N.G.Os in spreading awareness about family planning and measures of population control.

Table No. 3 Decadal variation of population growth in Siliguri Subdivision

Sl. No.	Blocks/ Municipal Corporation	Population			% of Decadal Variation	
		1991	2001	2011	1991-2001	2001-2011
1	Matigara	89927	129326	197278	43.81	52.54
2	Naxalbari	93731	144915	165523	54.60	14.22
4	Phasidewa	140045	171508	204522	22.46	19.24
3	Kharibari	64012	88230	109251	37.83	23.82
5	Siliguri	216950	472374	513265	117.73	8.66

Source: Census of India 1991, 2001 and 2011, Calculated by the Researcher.

The table 3.4 shows the decadal variation in the growth rate of rural and urban population in the study area. The table shows that rural population in each of the four blocks increased from 1991 to 2011. However, the rural population growth was not uniform in all the decades. In some decade growth was low while in some decades the growth was high. The decadal change in rural population of Matigara in 2001-2011 was 9.41 percent, which was 45.40 percent during the previous decade. The sharp decline in rural growth rate was due to the conversion of rural villages into census towns. Similarly, the decadal change in rural population of Naxalbari in 2001-2011 was negative at -24.33 percent owing to conversion of rural villages into census towns. The decadal change in rural population for Phasidewa and Kharibari in 2001-2011 remained at 19.24 percent and 10.39 percent respectively. These figures are significantly lower than their decadal change of rural population for the previous decade.

According to the table 3.4, urban population of the region witnessed a steady increase in growth rate. The urban growth in each of the four blocks however is not uniform and show block wise decadal variation. Infact the blocks of Phansidewa and Kharibari did not have any urban centre so their urban population was nil during 1991 and 2001. For the other two blocks, the decadal growth rate of urban population recorded has either been very low in some cases while very high in other. During 1991-2001, Matigara block experienced growth of urban population of 14.92 percentage with a single census town namely Bairatisal. Naxalbari Block on the other hand witnessed an urban population growth rate of 30.75 % with the single census town namely, Uttar Bagdogra. During the same period, Siliguri Municipal Corporation also witnessed a very high population growth rate. This high growth rate was due to the emergence of Siliguri as one of the most important urban centre in the entire North Bengal. Along with this easy availability of basic infrastructural facilities and the extension of municipal boundary also contributed towards high growth rate of urban population. Consequently, Siliguri Municipal Corporation experienced 117.73 percent decadal growth rate in 1991-2001 which is far more than the national and state urban decadal growth rate. The following decade of 2001-2011 also saw a rise in the urban population growth rate with Matigara block experiencing a massive increase of (1041.44%) due to conversion of 5 big villages into census towns. Similarly, the urban population of Naxalbari block increased rapidly with 329.85 percent, as a result of rural-urban migration. This decade was marked by growth of industries which attracted rural population towards urban centres because of the increased employment opportunities. Easy access to infrastructural facilities, better education and health facilities and increased opportunity of trade and commerce and other services also resulted in influx of rural population into towns. Kharibari block in 2011 saw emergence of two urban centre namely Shyamdhan, Kharibari. During 2001-2011, Siliguri Municipal Corporation experienced a growth of 8.66 percent indicating a balanced urban growth, which is far lower than the previous decade.

Table No. 4 Decadal variation of rural & urban population in the study area

Sl. No.	Blocks	Population						Percentage of decadal variation			
		1991		2001		2011		1991-2001		2001-2011	
		Rura	Urb	Rural	Urba	Rura	Ur	Ru	Urban	Rura	Urban
1	Matigara	85224	4703	123921	5405	135583	61695	45.40	14.92	9.41	1041.44
2	Naxalbari	81667	12064	129141	15774	97717	67806	58.13	30.75	-24.33	329.85
3	Phansidewa	140045	-	171508	-	204522	-	22.46	-	19.24	-
4	Kharibari	64012	-	88230	-	97399	11852	37.80	-	10.39	-

Source: Census of India 1991, 2001 and 2011, Calculated by the Researcher.

Size class classification of rural settlements in the study area

The census of India classifies rural settlements on the basis of their population size into seven categories. These are less than 200 populations, 200-499 population, 500-999 population, 1000-1999 population, 2000-4999 population, 5000-9999 population and more than 10000 populations. Accordingly, all the villages in the study area has been classified for 1991, 2001 and 2011 respectively.

Table No. 5 C.D. block wise number of inhabited villages, 1991

Category	Matigara	Naxalbari	Phasidewa	Kharibari	Total
<200	4	15	10	5	34
200-499	14	16	12	22	64
500-999	17	27	32	25	101
1000-1999	27	22	26	18	93
2000-4999	6	12	16	5	39
5000-9999	1	-	3	-	4
>10000	-	-	-	-	-
Total	69	92	99	75	335

Source: Census of India 1991, Calculated by the Researcher.

From the above table 3.5 it can be seen that in the year 1991, there were 335 villages situated in Siliguri sub-division consisting of 69 villages in Matigara block, 92 villages in Naxalbari block, 99 villages in Phasidewa block and 75 villages in Kharibari block. The population size of villages in each of the blocks varied. The villages have therefore been categorized into seven categories. i.e., below 200, 200-499, 500-999, 1000-1999, 2000-4999, 5000-9999 and above 10000 on the basis of their total population. In the year 1991 there were total 34 villages having population below 200, with 4 villages in Matigara block, 15 villages in Naxalbari block, 10 villages in Phasidewa block and 5 villages in Kharibari block. There were 64 villages having population between 200-499, out of which 14 villages are in Matigara block, 16 villages in Naxalbari block, 12 villages in Phasidewa block and 22 villages in Kharibari block. In the category of population size 500-999 there were 101 villages, consisting of 17 villages in Matigara block, 27 villages in Naxalbari block, 32 villages in Phasidewa block and 25 villages in Kharibari Block, respectively. In the category of population size 1000-1999, there were 93 villages, with 27 villages from Matigara block, 22 villages from Naxalbari block, 26 villages from Phasidewa block and 18 villages from Kharibari block. In the category of population size 2000-4999, there were 39 villages, consisting 6 villages from Matigara block, 12 villages from Naxalbari block, 16 villages from Phasidewa block and 5 villages from Kharibari block. In the category of population size 5000-9999, there were 4 villages, consisting 1 village in Matigara block and 3 villages in Phasidewa block, respectively. There isn't any village with population above 10000 in any of the four blocks. In terms of the total number of villages in 1991, the highest was in Phansidewa block and lowest was in Matigara block. From the above discussion is clear that the number of villages and their distribution is different from one block to another.

Table No. 6 C.D. block wise number of inhabited villages, 2001

Category	Matigara	Naxalbari	Phasidewa	Kharibari	Total
<200	10	12	12	3	37
200-499	6	9	12	22	49
500-999	14	19	30	16	79
1000-1999	18	24	23	24	89
2000-4999	17	12	19	9	57
5000-9999	2	5	6	1	14
10000>	2	1	1	-	4
Total	69	82	103	75	329

Source: Census of India 2001, Calculated by the Researcher.

Table 3.6 shows the total number of inhabited villages in the study area in 2001. There were 329 villages situated in Siliguri sub-division in the year 2001 consisting of 69 villages in Matigara, 82 villages in Naxalbari, 103 villages in Phasidewa and 75 villages in Kharibari. The size of population in these villages varies. These villages are further divided according to their total population size into seven categories. i.e., total population below 200, 200-499, 500-999, 1000-1999, 2000-4999, 5000-9999 and above 10000. In the year 2001 there were total 37 villages having population below 200, consisting of 10 villages in Matigara block, 12 villages in Naxalbari block, 12 villages in Phasidewa block and 3 villages in Kharibari block. There were 49 villages with population between 200-499, with 6 villages in Matigara block, 9 villages in Naxalbari

block, 12 villages in Phasidewa block and 22 villages in Kharibari block. Similarly, there were 79 villages with population size 500-999 out of which 14 villages were in Matigara block, 19 villages in Naxalbari block, 30 villages in Phasidewa block and 16 villages in Kharibari block. There were 89 villages with the population size of 1000-1999, with18 villages in Matigara block, 24 villages in Naxalbari block, 23 villages in Phasidewa block and 24 villages in Kharibari block. In the population size category of 2000-4999, there were 57 villages consisting of 17 villages in Matigara block, 12 villages in Naxalbari block, 19 villages in Phasidewa block, 9 villages in Kharibari block respectively. Similarly, there were 14 villages with the population size of 5000-9999, consisting of 2 villages in Matigara block, 5 villages in Naxalbari block, 6 villages in Phasidewa block and 1 village in Kharibari block respectively. Finally, there were 4 villages having population above 10000, with 2 villages in Matigara block, 1 village in Naxalbari block and 1 village in Phasidewa block respectively. It can be seen that the number of villages in each block along with their respective population size and their distribution differ from one block to another in the study area.

Table No. 7 C.D. block wise number of inhabited villages, 2011

Category	Matigara	Naxalbari	Phasidewa	Kharibari	Total
<200	7	7	7	5	26
200-499	10	13	11	11	45
500-999	6	21	24	21	72
1000-1999	10	24	29	22	85
2000-4999	18	13	22	13	66
5000-9999	8	0	8	1	17
10000>	0	0	2	-	2
Total	59	78	103	73	313

Source: District Census Hand Book, Census of India 2011, Calculated by Researcher

Table 3.7 shows the distribution of villages according to their size class in the study area for 2011. From the above table it seen that in the year 2011 there are 313 inhabited villages in Siliguri sub-division consisting of 59 villages in Matigara, 78 villages in Naxalbari, 103 villages in Phasidewa and 73 villages in Kharibari. The size of population in these villages is non homogenous and differ from village to village. The villages are divided according to their total population size into seven categories of total population i.e., below 200, 200-499, 500-999, 1000-1999, 2000-4999, 5000-9999, above 10000. In the year 2011 there were total 26 villages having population below 200, consisting of 7 villages in Matigara block, 7 villages in Naxalbari block, 7 villages in Phasidewa block and 5 villages in Kharibari block. Likewise, there were 45 villages having population between 200-499, with 10 villages in Matigara block, 13 villages in Naxalbari block, 11 villages in Phasidewa block and 11 villages in Kharibari block. In the category of population size 500-999 there were 72 villages consisting 6 villages in Matigara block, 21 villages in Naxalbari block, 24 villages in Phasidewa block and 21 villages in Kharibari block respectively. In the category of population size 1000-1999, there were 85 villages consisting of 10 villages in Matigara block, 24 villages in Naxalbari block, 29 villages in Phasidewa block and 22 villages in Kharibari block respectively. In the category of population size 2000-4999, there were 66 villages consisting of 18 villages in Matigara block, 13 villages in Naxalbari block, 22 villages in Phasidewa block and 13 villages in Kharibari block respectively. In the category of population size 5000-9999, there were 17 villages consisting of 8 villages in Matigara block, 8 villages in Phasidewa block and 1 village in Kharibari block, respectively. There were 2 villages having population above 10000 which belongs to Phasidewa block.Thus it is seen that the number of villages and their distribution differ from block to block in the study area.

It is worth mentioning that in 1991 and 2001, there were only 2 census towns viz. Bairatisal (Matigara block) and Uttar Bagdogra (Naxalbari block) however, in 2011 census the number of census towns rapidly increased to 14. Out of the total number of newly formed census towns, Matigara block consisted of 6 census towns namely, Bairatisal, Tari, Jitu, Kalkut, Mathapari and Bara Mohonsingh. Naxalbari block consisted of 6 census towns namely Lalman, Uttar Bagdogra, Dakshin Bagdogra, Dumriguri, Geni and Bhimram. Kharibari block consisted 2 census towns viz. Shyamdhan and Kharibari. One interesting fact is from 1991 to 2011 the total number of villages in the smallest four size class categories has declined while the same in largest three size class categories has increased in the study area.

Population growth across the villages and census towns of the study area

In the previous section, temporal trend of population growth in Siliguri sub-division and Siliguri Municipal Corporation has been analyzed and it is observed that the growth of population in different parts of the study area cannot be assumed to be uniform. Hence, spatial analysis of population growth becomes necessary. In this context the present part deals with the trend of population growth at village level for the time of period 1991-2011. With the present study being geographically diverse and spread over an area of 819.61 sq. km, differences in population growth becomes a natural phenomenon. Attempts will therefore be made to identify and give a detailed account on the inter-block difference in population growth during the decades of 1991-2001 and 2001-2011 respectively. Since it has been found that the total number of villages has changed in different years of census (1991-335, 2001-329, and 2011-313) only those villages which were present in two consequtive census year

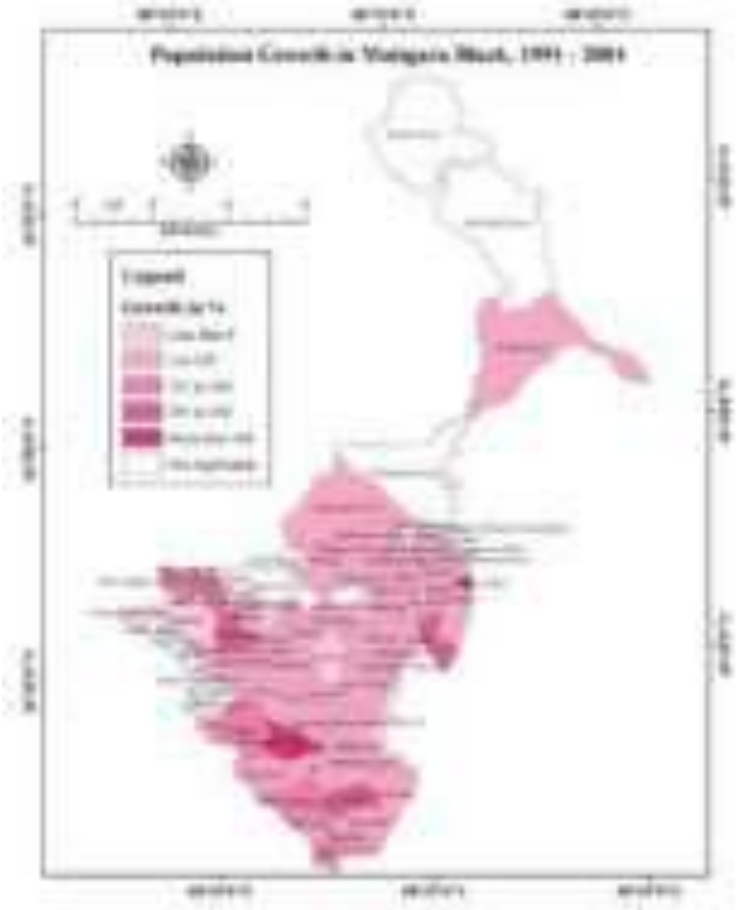
have been taken into consideration to show the change in population.

Table 8 C.D. block wise village level population & growth of population: Matigara block

Sl. No	Name	Distance from S.M.C in km.	Population			Decadal Growth Rate (%)	
			1991	2001	2011	1991-2001	2001-2011
1	Bairatisal	11.4	6996	_	_	_	_
2	Bairatisal(C.T)*	11.4	4703	5405	4916	14.93	-9.05
3	Baniakhari	8.4	1984	3555	5088	79.18	43.12
4	Bara Adalpur Dwitiya	16.6	677	1858	419	174.45	-77.45
5	Bara Gharia	6.6	1393	1979	3744	42.07	89.19
6	Bara Mohansingh**	9.8	3242	11006	15616	239.48	41.89
7	Bataliguri	15.8	289	265	362	-8.30	36.60
8	Champasari Chhat	11.5	_	88	96	_	9.09
9	Chamta	9.9	1060	1305	3446	23.11	164.06
10	Chmamtataguri	10.1	382	713	1267	86.65	77.70
11	Daknikata	6.9	1321	1669	4497	26.34	169.44
12	Damra Gayer Chhat	11.2	1164	21	_	-98.20	_
13	Dhukuria	8.7	1275	1147	1783	-10.04	55.45
14	Dumriguri Chhat	16	627	768	950	22.49	23.70
15	Duramarir Chhat	11.5	993	147	_	-85.20	_
16	Foutsingher Chhat	5.8	440	713	_	62.05	_
17	Fulbari Pataner Chhat	15.2	151	170	234	12.58	37.65
18	Gal Makhari	11.2	242	73	45	-69.83	-38.36
19	Gaur Charan	6.8	1054	1889	4124	79.22	118.32
20	Gouri	16.6	347	399	428	14.99	7.27
21	Guria	10.7	1547	2008	2913	29.80	45.07
22	Jadu Bhitar Chhat	10.2	445	799	1242	79.55	55.44
23	Jhauguri	12.4	354	677	767	91.24	13.29
24	Jhauguri Chhat	11.8	1770	1745	147	-1.41	-91.58
25	Jitu**	8.4	2534	5004	5892	97.47	17.75
26	Jugi Bhita	13.5	942	1153	1528	22.40	32.52
27	Kala Bari	8.5	575	784	1482	36.35	89.03
28	Kalam	8.1	528	2146	5664	306.44	163.93
29	Kalkut**	6.8	1278	4356	9184	240.85	110.84
30	Kamala Barir Chhat	12.7	207	236	264	14.01	11.86
31	Karai Bari	10.7	765	841	1183	9.93	40.67
32	Kauakhali	5.4	1838	3917	6615	113.11	68.88
33	Kawakhari	8.3	1210	2048	3676	69.26	79.49
34	Khaprul	15.9	2402	1671	4004	-30.43	139.62
35	Kho Palasi	14.1	633	2764	5284	336.65	91.17
36	Khok Long	16.3	1275	3359	737	163.45	-78.06
37	Khoklong Chaat	16.2	344	47	52	-86.34	10.64
38	Lachka	14.5	806	1035	1126	28.41	8.79
39	Lalsara Chhat	18.5	328	430	551	31.10	28.14
40	Mahatram	8.6	1767	2531	1299	43.24	-48.68
41	Mahish Mari	9.4	831	1306	6010	57.16	360.18
42	Malahar	8.3	451	127	376	-71.84	196.06
43	Mathapari**	7	3144	6689	11529	112.75	72.36
44	Matigara Hat	6.1	1990	3828	4710	92.36	23.04
45	Mohandi Forest	12.8	502	556	_	10.76	_
46	Mohorgon Tea Garden	13.3	1801	2873	3169	59.52	10.30
47	Nengti Chhara	10	344	1994	3182	479.65	59.58
48	Nichitpur	9	542	688	990	26.94	43.90
49	Nimai	11	1349	2172	3816	61.01	75.69
50	Nunu Bairagi Chhat	8.9	32	_	_	_	_
51	Nunubairagi	12.9	1088	218	364	-79.96	66.97

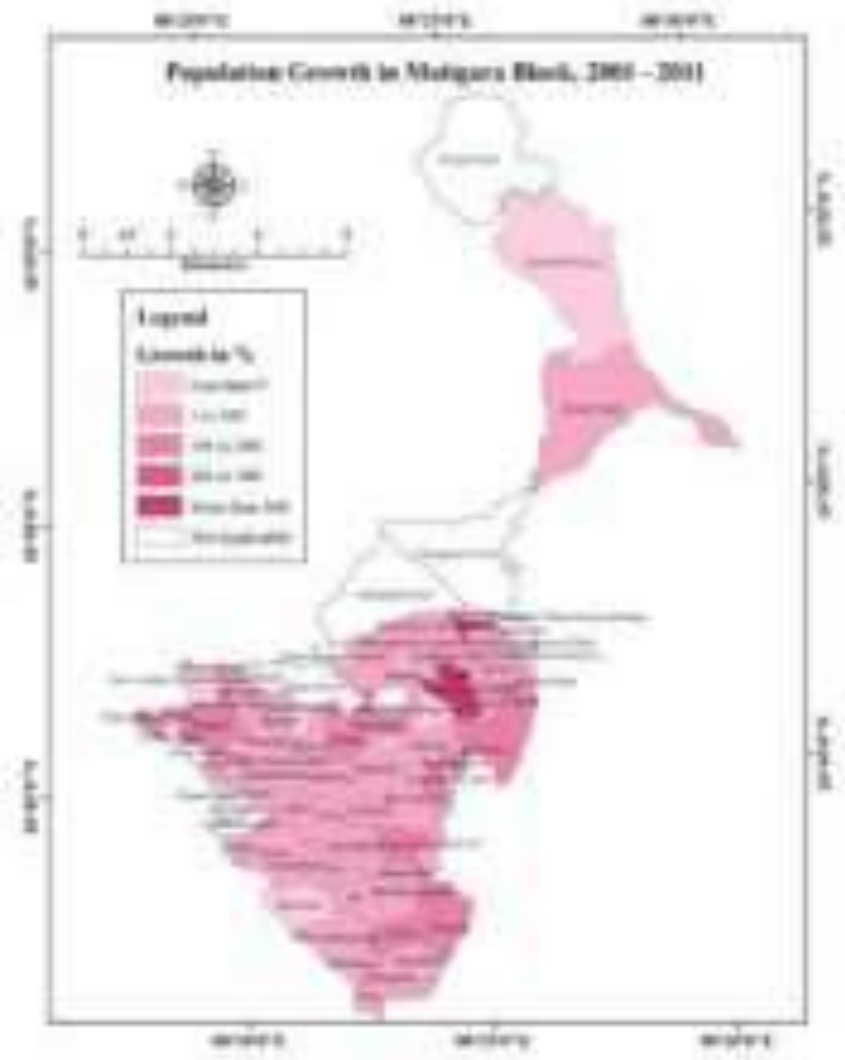
52	Palash	7.9	1052	1525	4204	44.96	175.67
53	Pancha Kulguri	12.4	814	1715	2485	110.69	44.90
54	Panchanai	9.1	1257	2446	5105	94.59	108.71
55	Patan	15.7	_	125	142	_	13.60
56	Patan Jharer	17.6	825	693	_	-16.00	_
57	Patiram	4	2450	3232	8315	31.92	157.27
58	Pelku	8.6	656	1802	3112	174.70	72.70
59	Purba Karai Barir Chhat	10.9	_	22	314	_	1327.27
60	Rajpairi	11.1	994	1526	2018	53.52	32.24
61	Rangia	10.5	1163	2876	3682	147.29	28.03
62	Ruhinir Chhat	14.3	1917	1850	98	-3.50	-94.70
63	Rupan Chhat	10	19	119	238	526.32	100.00
64	Salbari Chhat Pratham	8	257	312	107	21.40	-65.71
65	Shal Bari Chhat Dwitia	12.2	54	_	_	_	_
66	Sisa Bari	9.8	441	684	1085	55.10	58.63
67	Sivok Hill Forest	23.2	_	510	321	_	-37.06
68	Sivoke Forest	17.4	595	632	1045	6.22	65.35
69	Sukna Pratham Khanda	12.2	1576	_	_	_	_
70	Tari**	8.8	1671	10037	14558	500.66	45.04
71	Thiknikata	7.1	1216	2438	3294	100.49	35.11
72	Tomba	3.5	1874	3687	9632	96.74	161.24
73	Uday Sing	8.1	1038	1362	2092	31.21	53.60
74	Ujanu	4.3	2929	561	660	-80.85	17.65
*village declared as census town in 2001							
**village declared as census town in 2011							
Source: Census of India 1991, 2001 & 2011, Calculated by the Researcher							

Map No. 1 Population growth in Matigara block, 1991-2001



Source: Prepared by the Researcher

Map No. 2 Population growth in Matigara block, 2001-2011



Source: Prepared by the Researcher

During 1991-2001 the highest growth rate in Matigara block was found in Rupan Chhat village, recording a population growth of 526% whereas the lowest growth rate was observed in Damragayer Chhat recording a growth of -98%. On the other hand, in the following decade of 2001-11, highest population growth was observed in Purba Karai Barir Chhat recording a growth rate of 1327% while the lowest growth was witnessed in Jhauguri Chhat, recording a growth rate of -91.58%.

Table No. 9 C.D. block wise village level population & growth of population: Naxalbari block

Sl. No	Name	Distance from S.M.C in km.	Population			Decadal Growth Rate (%)	
			1991	2001	2011	1991-2001	2001-2011
1	Atal	21.5	928	1542	1487	66.16	-3.57
2	Bair Bhita	24.9	128	116	111	-9.38	-4.31
3	Bara Bhita	17.7	110	199	176	80.91	-11.56
4	Bara Chenga	32.5	2292	_	_	_	_
5	Bara Maniram	28.3	771	644	886	-16.47	37.58
6	Baraj Haru	24.3	639	1063	1465	66.35	37.82
7	Batlabari	12.9	1158	1488	1813	28.50	21.84
8	Bauni Bhita	15.1	514	811	932	57.78	14.92
9	Belgachi	28.5	1312	1788	1947	36.28	8.89
10	Bhakat Ram	23.9	295	_	_	_	_

11	Bharat Sing	10.4	333	533	700	60.06	31.33
12	Bhelu	24.1	87	85	564	-2.30	563.53
13	Bhimram**	27.1	3028	9310	11058	207.46	18.78
14	Bhujia Bani	15.5	1276	1047	1487	-17.95	42.02
15	Bhujia Banir Chhat	13	453	2846	2248	528.26	-21.01
16	Birsing	23.7	1099	1289	1380	17.29	7.06
17	Budh Karan	24.8	1417	1608	1632	13.48	1.49
18	Chhota Chenga	29.9	1127	820	754	-27.24	-8.05
19	Chhota Ganja	28.5	5	101	96	1920.00	-4.95
20	Chhota Ganjer Chhat	29.2	146	31	68	-78.77	119.35
21	Chhota Maniram	32	1131	1497	1999	32.36	33.53
22	Dakshin Bagdogra**	16.4	1213	5744	2647	373.54	-53.92
23	Dalkajhar Forest	21.8	_	8318	512	_	-93.84
24	Damdama	23.1	625	1198	1294	91.68	8.01
25	Dayaram	29.3	2498	2505	3182	0.28	27.03
26	Deoan Bhitar Chhat	25.5	41	_	_	_	_
27	Deomani	19.1	850	1088	1735	28.00	59.47
28	Dhakna	29.7	1875	2406	3537	28.32	47.01
29	Dhani Bani	25.7	656	_	_	_	_
30	Dhani Banir Chhat	27.8	_	91	509	_	459.34
31	Dhemal	18	229	338	459	47.60	35.80
32	Dumri Guri**	17.1	2233	10947	13416	390.24	22.55
33	Fakna	27.7	687	1092	1424	58.95	30.40
34	Gaziram	24.2	446	1053	579	136.10	-45.01
35	Geni**	26.6	2805	7080	8747	152.41	23.55
36	Ghusuru	25.2	1126	1389	1373	23.36	-1.15
37	Grammani	24.1	205	484	340	136.10	-29.75
38	Grammanir Chhat	24.3	573	344	476	-39.97	38.37
39	Hoda Bhitar Chhat	28.7	609	979	980	60.76	0.10
40	Huchai Mallik	25	559	698	616	24.87	-11.75
41	Jamidar Guri	26.4	_	716	790	_	10.34
42	Jamidar Gurir Chhat	26.1	123	85	209	-30.89	145.88
43	Jhabar Chhat	29.9	225	164	243	-27.11	48.17
44	Kamala	28.7	2304	3505	4908	52.13	40.03
45	Kamalpur	16	1388	2370	3022	70.75	27.51
46	Ketugabur	28.6	648	1405	1814	116.82	29.11
47	Kilaram	28.4	1285	1584	1931	23.27	21.91
48	Lakshman	19.2	633	_	_	_	_
49	Lakshmaner Chhat	20.6	415	_	_	_	_
50	Lalman**	11.4	2927	5001	6894	70.86	37.85
51	Lohagar Forest	33.2	171	_	_	_	_
52	Lohagar Tea Garden	36.6	1513	_	_	_	_
53	Lohasing	31.5	2152	1339	1363	-37.78	1.79
54	M.M.Terai	25.5	444	1090	1204	145.50	10.46
55	Maha Sing	22.1	529	500	662	-5.48	32.40
56	Mangal Sing	22.1	1300	1859	2327	43.00	25.17
57	Manjha Tea Garden	32.2	968	1145	1323	18.29	15.55

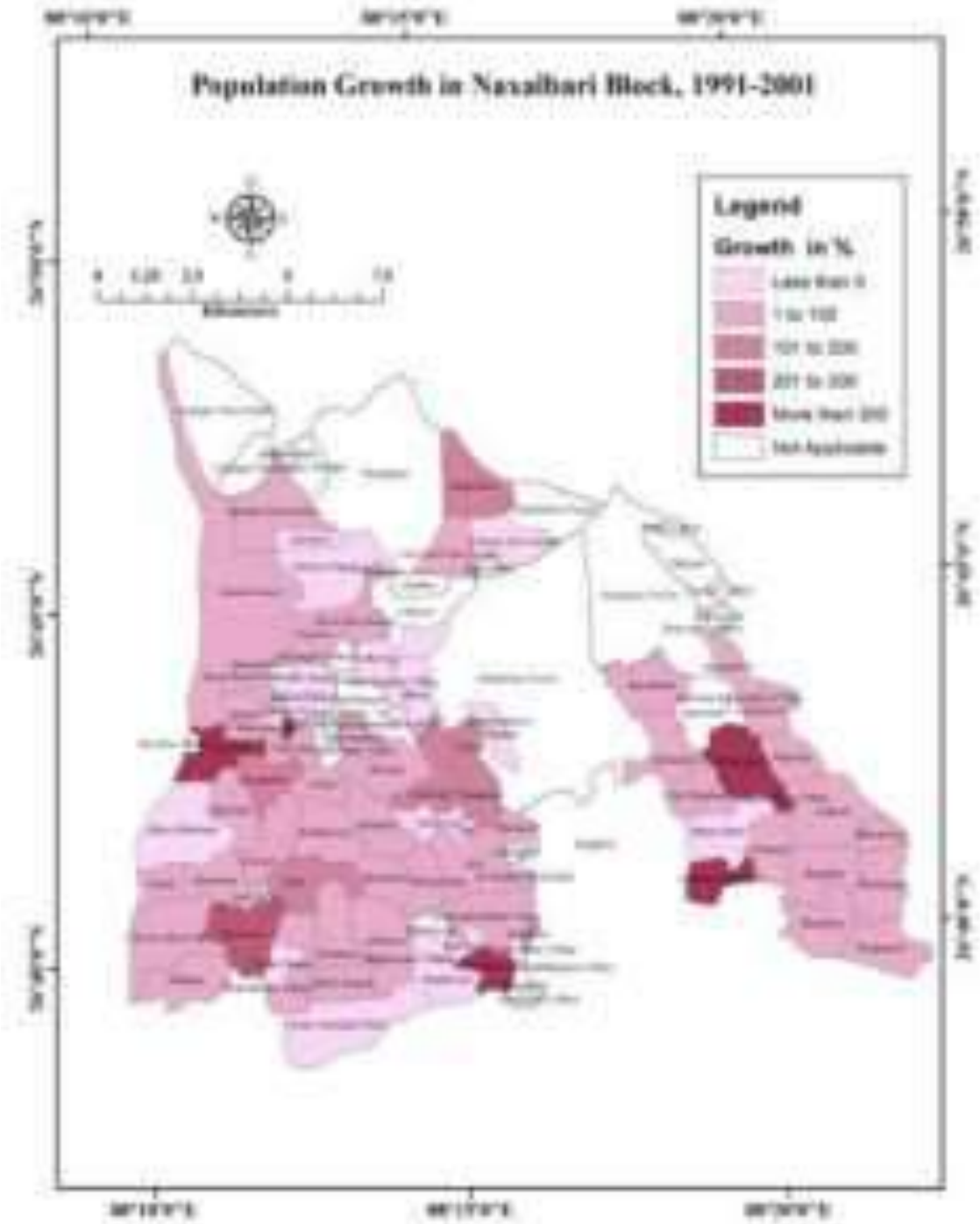
58	Marapur	31	1122	679	738	-39.48	8.69
59	Maya Ram	15.5	89	_	_	_	_
60	Mechi Forest	31.4	118	208	225	76.27	8.17
61	Minghara	25.5	215	_	_	_	_
62	Mingharar Chhat	25.9	190	229	787	20.53	243.67
63	Mir Jangla	29.3	1683	1571	_	-6.65	_
64	Mir Jangler Chhat	31	700	669	_	-4.43	_
65	Mudir Jangal	27.8	686	772	845	12.54	9.46
66	Naksal Bari	28.2	4612	1763	1618	-61.77	-8.22
67	Nandalal	21.6	513	1070	1522	108.58	42.24
68	Nehal	30.5	300	522	731	74.00	40.04
69	Nimu Bhitar Chhat	24.3	37	173	274	367.57	58.38
70	Nipania	30.8	1835	2477	2908	34.99	17.40
71	Omi	23.1	410	1230	1410	200.00	14.63
72	Ord Terai Tea Garden	25	1310	2166	2748	65.34	26.87
73	Panighata	30.4	4036	_	_	_	_
74	Panta Pari Forest	21.3	_	691	434	_	-37.19
75	Pata Ram	40.4	200	213	252	6.50	18.31
76	Putimari	12.7	767	879	1217	14.60	38.45
77	Raghuram	25.7	493	461	481	-6.49	4.34
78	Raghuramer Chhat	25.5	310	119	109	-61.61	-8.40
79	Raja Jhar	13	1534	2126	2590	38.59	21.83
80	Rang Mohan	33.1	794	_	_	_	_
81	Ranga Pani	10.6	1575	2729	3619	73.27	32.61
82	Rani Danga	10.3	3181	3944	4655	23.99	18.03
83	Rupsing	12.8	1838	2573	3499	39.99	35.99
84	Sat Bhaia	25.5	823	950	655	15.43	-31.05
85	Sebdela	24.1	859	866	1276	0.81	47.34
86	Shai Bhita	13.1	1242	1534	1851	23.51	20.66
87	Sirsia Tea Garden	29.5	764	886	245	15.97	-72.35
88	Siubar	29.4	761	879	1052	15.51	19.68
89	Surajibar	30	12	204	235	1600.00	15.20
90	Tarabari	15.9	148	151	163	2.03	7.95
91	Tarabarir Chhat	18.3	17	2	10	-88.24	400.00
92	Teprabhola	23.4	630	_	_	_	_
93	Tepuchamaru	24.5	598	_	_	_	_
94	Trihana Tea Garden	22.9	2431	2039	2016	-16.13	-1.13
95	Udiarip	26.7	_	_	663	_	_
96	Uttam Chand	28	491	457	569	-6.92	24.51
97	Uttam Chanded Chhat	33.1	645	574	538	-11.01	-6.27
98	Uttar Bagdogra (Ct)*	14.8	12064	15774	12064	30.75	-23.52

*village declared as census town in 2001

**village declared as census town in 2011

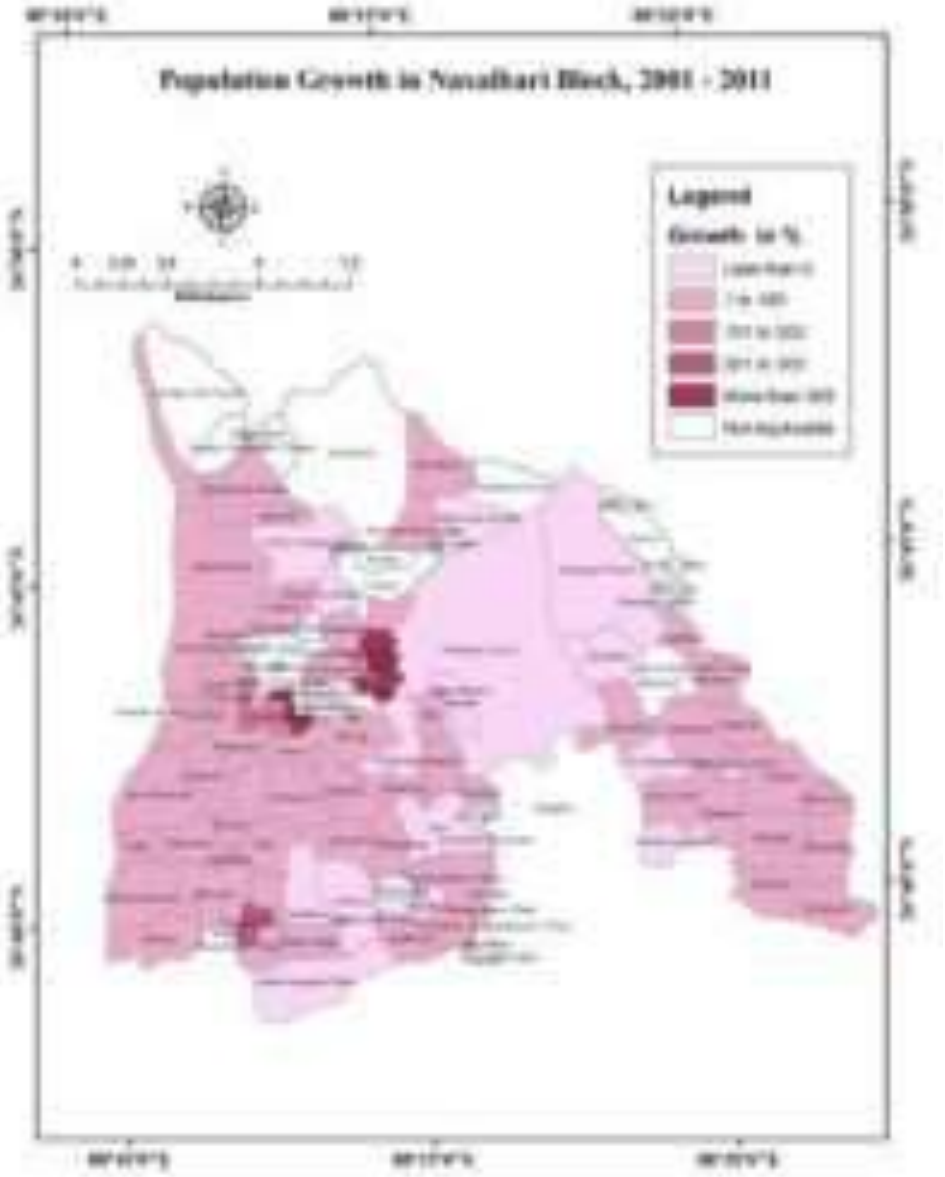
Source: Census of India 1991, 2001 &2011, Calculated by the Researcher.

Map No. 3 Population growth in Naxalbari block, 1991-2001



Source: Prepared by the Researcher

Map No. 4 Population growth in Naxalbari block, 2001-2011



Source: Prepared by the Researcher

During 1991-2001, the highest growth rate of population in Naxalbari block was observed in Chhota Ganja village recording a population growth of 1920% whereas the lowest growth rate was observed in Chhota Ganja Chhat recording a growth of -78.77%. On the other hand, in 2001-11 decade the highest population growth was observed in Bhelu recording a growth rate of 564% and the lowest growth was found in Dalkajhar Forest recording a growth rate of -93.84%.

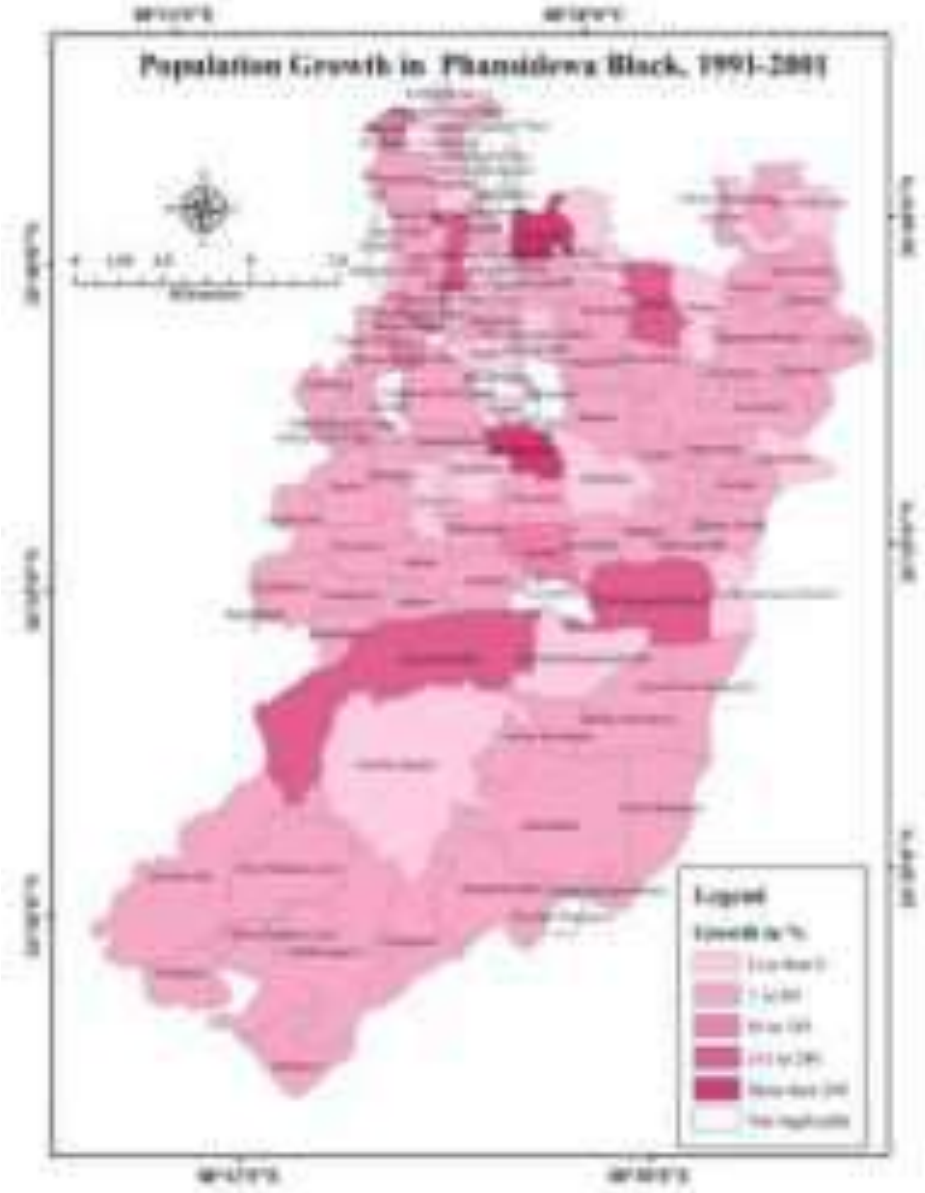
Table No. 10 C.D. block wise village level population & growth of population: Phansidewa block

Sl. No	Name	Distance from SMC in km.	Population			Decadal Growth Rate (%)	
			1991	2001	2011	1991-2001	2001-2011
1	Abhiram	18.1	497	1976	1773	297.59	-10.27
2	Ambari	12.1	933	1041	1371	11.58	31.70
3	Anti Gachh	16.9	778	820	2027	5.40	147.20
4	Bandar Gachh	22	2941	3825	3891	30.06	1.73
5	Bandi	21.8	1709	685	493	-59.92	-28.03
6	Bandia Chhat	22.7	_	124	961	_	675.00
7	Bangaru	23.1	1819	_	_	_	_
8	Bans Gaon	30.6	3515	4615	5958	31.29	29.10
9	Bansgaon Chakla	34.8	3031	3940	3876	29.99	-1.62

10	Bansh Gaon Mangachh	25.9	589	614	724	4.24	17.92
11	Banur Chhat	21.5	259	313	446	20.85	42.49
12	Bara Paikpara Arazi	41.2	4075	5123	6899	25.72	34.67
13	Bara Pathu Ram	9.5	2557	2247	2728	-12.12	21.41
14	Barai Gachh	19.7	617	875	427	41.82	-51.20
15	Baramala	24.2	_	368	1799	0.00	388.86
16	Bhala Manashi	25.3	855	3135	2951	266.67	-5.87
17	Bharia Danga	24.5	137	153	_	11.68	0.00
18	Bharia Dangir Chhat	24.8	88	175	190	98.86	8.57
19	Bhisti	23.1	1994	400	459	-79.94	14.75
20	Bhuban Gurir Chhat	23	328	694	870	111.59	25.36
21	Bhushi Bhita	17.1	717	876	1011	22.18	15.41
22	Budharu Gaon	42	3901	5317	6841	36.30	28.66
23	Chaupukuria	20.5	2252	2778	1724	23.36	-37.94
24	Chhota Paikpara Arazi	40.7	482	712	763	47.72	7.16
25	Chhota Pathu Ram	8.3	888	1476	1918	66.22	29.95
26	Chikan Mati	44.7	536	738	2480	37.69	236.04
27	Churaman	25.9	607	948	842	56.18	-11.18
28	Dalur Chhat	20.7	433	560	786	29.33	40.36
29	Dandra Jhar	33.3	519	663	1050	27.75	58.37
30	Dhak Para	47.4	1990	2682	3322	34.77	23.86
31	Dhakna Gachh	32.7	146	133	184	-8.90	38.35
32	Dham Bhita	32	173	232	728	34.10	213.79
33	Dhamna Gachh	20.9	1500	1790	2356	19.33	31.62
34	Dhemaler Chhar	23.3	474	337	644	-28.90	91.10
35	Dwara Baksa	12	562	726	1161	29.18	59.92
36	Fakir Dwip	29.1	589	813	948	38.03	16.61
37	Farabari	29.5	1594	1488	1405	-6.65	-5.58
38	Foudi Gachh	30.3	627	949	787	51.36	-17.07
39	Fulbar	23.7	804	1487	1279	84.95	-13.99
40	Ganga Ram Tea Garden	24.1	2338	2792	2793	19.42	0.04
41	Gangaram Maler Chhat	21.1	405	104	109	-74.32	4.81
42	Guabari	19.2	1111	1816	2203	63.46	21.31
43	Halal	21.5	1195	1532	1511	28.20	-1.37
44	Haoda Bhita	27.3	2849	931	736	-67.32	-20.95
45	Hari Bhita	30.1	855	1084	1042	26.78	-3.87
46	Hatiram	14	820	980	1421	19.51	45.00
47	Hela Kadam Chhat	25.1	50	6	289	-88.00	4716.67
48	Hetmuri	19.4	1726	2141	2124	24.04	-0.79
49	Jabarali	16.6	796	1004	1836	26.13	82.87
50	Jogi Bhita	29.1	1671	2089	2221	25.01	6.32
51	Kadmi	20.5	817	991	1256	21.30	26.74
52	Kadopani	16	_	357	1206	_	237.82
53	Kadu Bhita	33.7	416	446	205	7.21	-54.04
54	Kalaram	10.4	1624	2105	2463	29.62	17.01
55	Kanti Bhita	30.7	560	915	645	63.39	-29.51
56	Kashi Ram	15.2	1959	2009	2372	2.55	18.07
57	Krishnapur Tea Garden	17.4	_	84	405	_	382.14
58	Kuchia	29	940	1270	1360	35.11	7.09
59	Lachubhita	25.3	-	764	1260	_	64.92
60	Lahu Gaon	44	7056	9959	12710	41.14	27.62
61	Laldas	12.1	640	752	738	17.50	-1.86
62	Liusi Pukuri	16.5	3967	4378	5185	10.36	18.43
63	Madhab Bhita	25.1	690	912	1090	32.17	19.52
64	Madhya Bansgaon	25.6	6014	7411	9132	23.23	23.22
65	Mahammad Baksa	13.7	1396	1779	2913	27.44	63.74
66	Mahideb	18.1	84	158	40	88.10	-74.68
67	Mahipal	23.1	1044	1549	1887	48.37	21.82
68	Mandila Jhar	44.5	4307	6444	6642	49.62	3.07

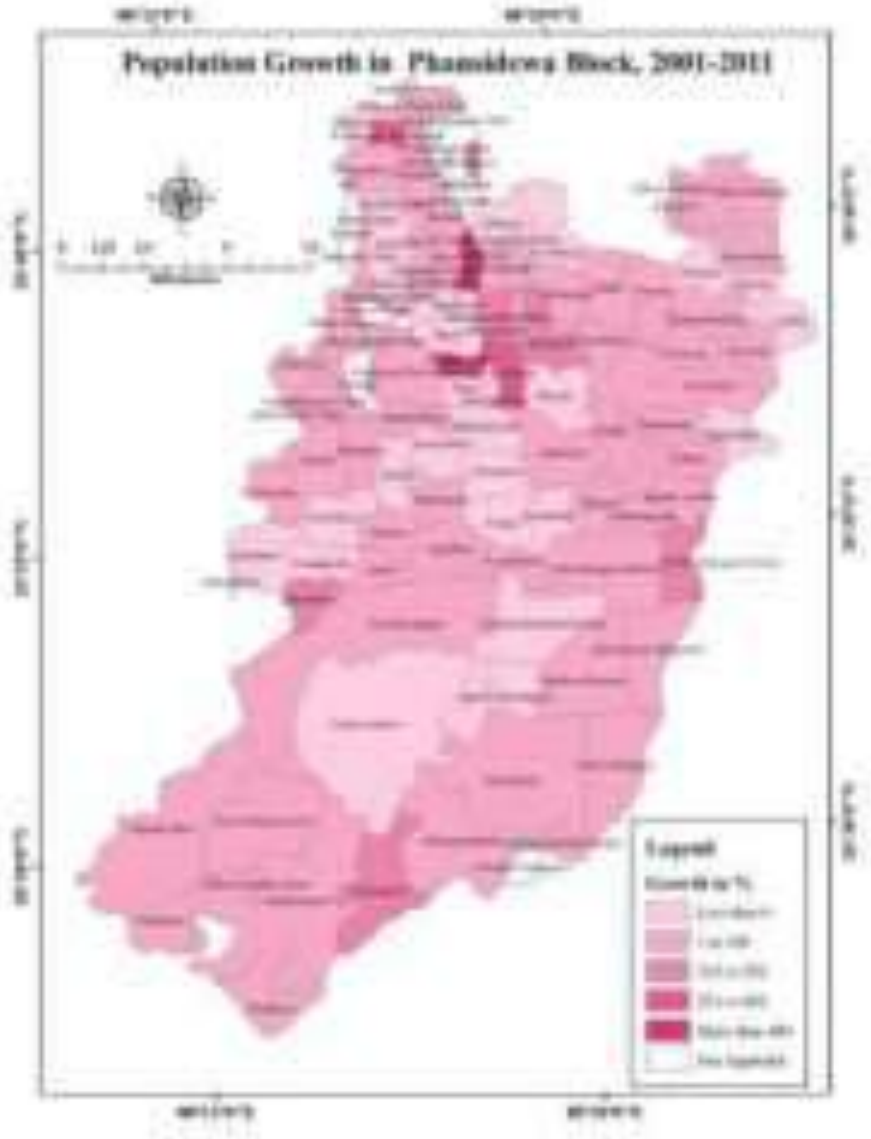
69	Meherulla	19.8	1071	214	1501	-80.02	601.40
70	Mohan Laler Chhat	34.3	152	220	307	44.74	39.55
71	Molani	28.5	1778	1956	3020	10.01	54.40
72	Muktar Chhat	21.9	17	24	18	41.18	-25.00
73	Narayan	13.2	1119	1566	695	39.95	-55.62
74	Nembutari	27.4	1181	725	776	-38.61	7.03
75	Nirmmal	13.2	2311	2227	2557	-3.63	14.82
76	Nitu Bhita Chhat	22.2	443	_	_	_	_
77	Panaullar Chhat	19.9	47	193	309	310.64	60.10
78	Paschim Bansgaon Kismat	26.9	3728	2560	1644	-31.33	-35.78
79	Paschim Bansh Gaon	28	1665	1993	1313	19.70	-34.12
80	Paschim Madati	37.1	3916	10772	13523	175.08	25.54
81	Pathar Hir Hira	27.2	431	497	502	15.31	1.01
82	Pathar Hir Hirar Chhat	26.2	980	3342	4039	241.02	20.86
83	Purba Bans Gaon	28.5	2224	2907	3859	30.71	32.75
84	Purbba Bansgaon Chakla	31.8	976	1302	1756	33.40	34.87
85	Purbba Bansgaon Kismat	22.1	2465	882	2184	-64.22	147.62
86	Purbba Madati	35.5	8926	6571	6424	-26.38	-2.24
87	Radha	14.4	596	1653	1932	177.35	16.88
88	Rahamu	11.8	557	709	702	27.29	-0.99
89	Rangali	31.4	368	455	617	23.64	35.60
90	Rupandighi	18.3	1488	1099	724	-26.14	-34.12
91	Sahananda	18.3	991	1212	1916	22.30	58.09
92	Sanga Tram	21.6	125	135	85	8.00	-37.04
93	Sannyasi Thaner Chhat	16.9	1424	915	930	-35.74	1.64
94	Sarcar Gachh	20.8	509	689	808	35.36	17.27
95	Sarcar Gachher Chhat	21.1	988	32	664	-96.76	1975.00
96	Sastu Gachh	32.5	448	552	634	23.21	14.86
97	Singi Jhor	18.1	966	643	1066	-33.44	65.79
98	Tarabari	15.5	-	_	289	_	_
99	Tar Bandha	15.7	1001	1271	1415	26.97	11.33
100	Tentul Guri	31.1	586	772	916	31.74	18.65
101	Tepu Tea Garden	22.2	660	2182	2438	230.61	11.73
102	Thakur Ganja	27.8	1441	1926	2571	33.66	33.49
103	Thuna	22.7	1150	1145	1070	-0.43	-6.55
104	Thunar Chhat	23.1	-	447	319	_	-28.64
105	Turi Bhita	20.4	1147	931	69	-18.83	-92.59
106	Uttar Bansgaon Kismat	23	1324	4199	5064	217.15	20.60
Source: Census of India 1991, 2001 &2011, Calculated by the Researcher.							

Map No. 5 Population growth in Phansidewa block, 1991-2001



Source: Prepared by the Researcher

Map No. 6 Population growth in Phansidewa block, 2001-2011



Source: Prepared by the Researcher

During 1991-2001 the highest growth rate in Phansidewa block was found in Panaullar Chhat village recording a population growth of 310.64% whereas the lowest growth rate was observed in Sarcargachher Chhat recording a growth of -96.76%. On the other hand, in 2001-11, the highest population growth was observed in Helakadam Chhat with a growth rate of 4716.67 % and the lowest growth rate of -74.76% was recorded in Mahideb.

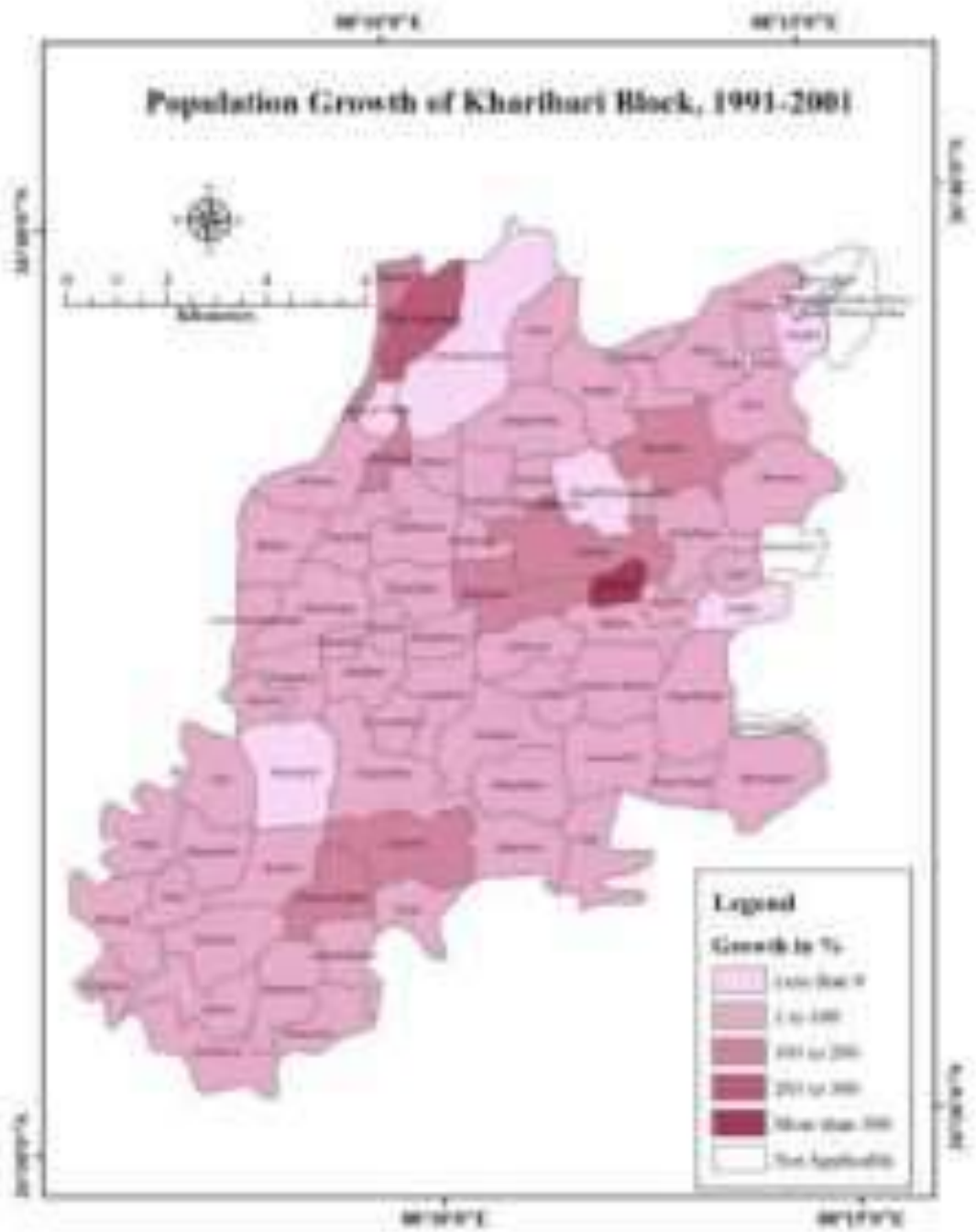
Table 11 C.D. block wise village level population & growth of population: Kharibari block

Sl. No	Name	Distance from SMC in km.	Population			Decadal Growth Rate %	
			1991	2001	2011	1991-2001	2001-2011
1	Alokjhari	38.5	279	395	529	41.58	33.92
2	Antaram	36.3	251	276	536	9.96	94.20
3	Arjanmahal	35.3	1016	1136	1488	11.81	30.99
4	Badal Bhita	35.7	785	501	408	-36.18	-18.56
5	Badora	37.6	209	264	329	26.32	24.62
6	Bagha	39.8	587	846	943	44.12	11.47
7	Bagula Hagi	35.2	586	692	813	18.09	17.49
8	Bairagi	47.8	1312	1514	1961	15.40	29.52
9	Bajarur Chhat	33.6	114	95	192	-16.67	102.11
10	Balahi Jhora	37.6	923	1301	1398	40.95	7.46
11	Banchha Bhita	42.4	710	1045	1463	47.18	40.00
12	Barsad Bhita	41.3	1781	2208	2671	23.98	20.97

13	Bhajanpur	44.2	1213	1774	2401	46.25	35.34
14	Bhatta Gachh	34.1	427	459	601	7.49	30.94
15	Bhog Bhita	36.4	1127	2535	2991	124.93	17.99
16	Bhulka	39.5	230	273	306	18.70	12.09
17	Bilakshu	45	361	454	762	25.76	67.84
18	Budh Sing	35.4	325	641	824	97.23	28.55
19	Bura Ganja	30.5	475	649	616	36.63	-5.08
20	Chayan Sing	37.4	1369	1871	2158	36.67	15.34
21	Chchur Muchur	38.4	997	1467	1682	47.14	14.66
22	Chekar Mari	43.8	630	709	876	12.54	23.55
23	Chiku	46.2	246	344	435	39.84	26.45
24	Chunilal	44.8	854	950	1192	11.24	25.47
25	Dagdhu	27.7	899	109	29	-87.88	-73.39
26	Dakua	27.3	318	447	508	40.57	13.65
27	Dangar Bhita	32.4	1327	1661	2207	25.17	32.87
28	Debi Ganja	47.1	1216	1837	2042	51.07	11.16
29	Debu Ram	38.3	890	1020	968	14.61	-5.10
30	Deoan Bhita	34.5	281	455	857	61.92	88.35
31	Dhulia	34.2	884	1126	1303	27.38	15.72
32	Dhupi Bhita	38.2	2179	3059	3518	40.39	15.00
33	Doha Guri	39.5	963	1135	1405	17.86	23.79
34	Duba	46.7	354	513	695	44.92	35.48
35	Dudha	34.3	621	322	379	-48.15	17.70
36	Ful Bari	36.7	125	266	810	112.80	204.51
37	Ful Barir Chat	34.9	84	260	171	209.52	-34.23
38	Gadhira	43.9	772	948	1164	22.80	22.78
39	Gandagal	34.4	1553	3120	4363	100.90	39.84
40	Gayen	45.9	997	1203	1469	20.66	22.11
41	Gua Bari	37.3	225	274	343	21.78	25.18
42	Hati Doba	33.5	853	1779	1962	108.56	10.29
43	Jagir	37.4	1108	1434	1662	29.42	15.90
44	Jama Tulla	38	400	442	506	10.50	14.48
45	Jatru	29.2	544	694	1008	27.57	45.24
46	Jiban Sing	37.1	516	866	1471	67.83	69.86
47	Jor Pakari	35.5	237	367	431	54.85	17.44
48	Katia	41	965	1592	1736	64.97	9.05
49	Kelabari	37.7	1520	2010	2562	32.24	27.46
50	Khari Bari	37.3	3943	5442	6660	38.02	22.38
51	Khopalashi	45.9	656	675	779	2.90	15.41
52	Khunia Pukhari	42	824	1955	2275	137.26	16.37
53	Kishor Doba	41.2	2427	2995	3653	23.40	21.97
54	Kungar Pur	39.8	403	444	498	10.17	12.16
55	Madan	32.2	82	213	236	159.76	10.80
56	Manasa	39.5	72	963	600	1237.50	-37.69
57	Manjaya	33.9	466	621	1906	33.26	206.92
58	Mayna Guri	42.8	2080	1325	1704	-36.30	28.60
59	Nazir	38.2	277	280	313	1.08	11.79
60	Pantha Bari	34.6	828	1000	607	20.77	-39.30
61	Paschim Ram Bandh	41	339	600	763	76.99	27.17
62	Pata Ram	40.4	1325	3276	4141	147.25	26.40
63	Rang Muni	48	693	1086	1411	56.71	29.93
64	Rangali	31.4	1536	1842	2425	19.92	31.65
65	Saheburam	35.9	1501	1724	1897	14.86	10.03
66	Salbari	38.9	268	344	538	28.36	56.40
67	Shyamdhan	37	2616	4708	5192	79.97	10.28
68	Sing Bhita	32.8	414	489	536	18.12	9.61

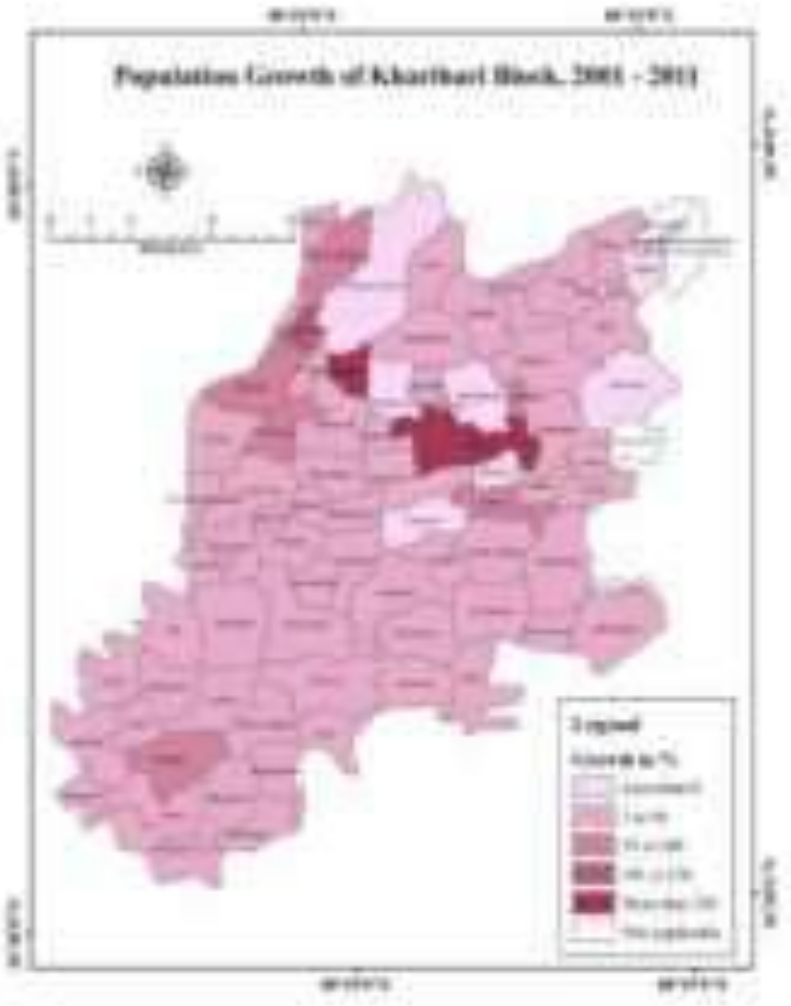
69	Sona (Chalani) Chandi	34.5	1450	1488	1751	2.62	17.67
70	Subal	30	246	280	394	13.82	40.71
71	Subal Bhita	35.6	677	959	1022	41.65	6.57
72	Tari	44.6	1064	1319	1736	23.97	31.61
73	Tharu Bhita	25.6	1216	242	89	-80.10	-63.22
74	Tukriajhar Forest	34.3	709	94	89	-86.74	-5.32
75	Uttar Ramdhan	32.3	1262	4528	6892	258.80	52.21
**village declared as census town in 2011							
Source: Census of India 1991, 2001 & 2011, Calculated by the Researcher.							

Map No. 7 Population growth of Kharibari block, 1991-2001



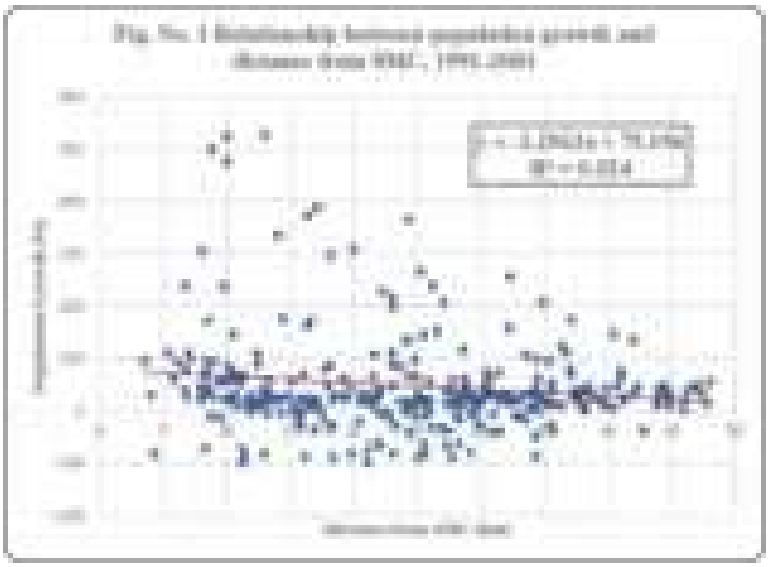
Source: Prepared by the Researcher

Map No. 8 Population growth of Kharibari block, 2001-2011



Source: Prepared by the Researcher

During 1991-2001 the highest growth rate in Kharibari block was experienced by Manasa village recording a population growth of 1237.50% whereas the lowest growth rate was observed in Dagdhu recording a growth of -87.80%. On the other hand, in 2001-11 decade the highest population growth was observed in Manjaya recording a growth rate of 206.92 % and the lowest growth rate was found in Dagdhu recording a growth rate of -73.39%.



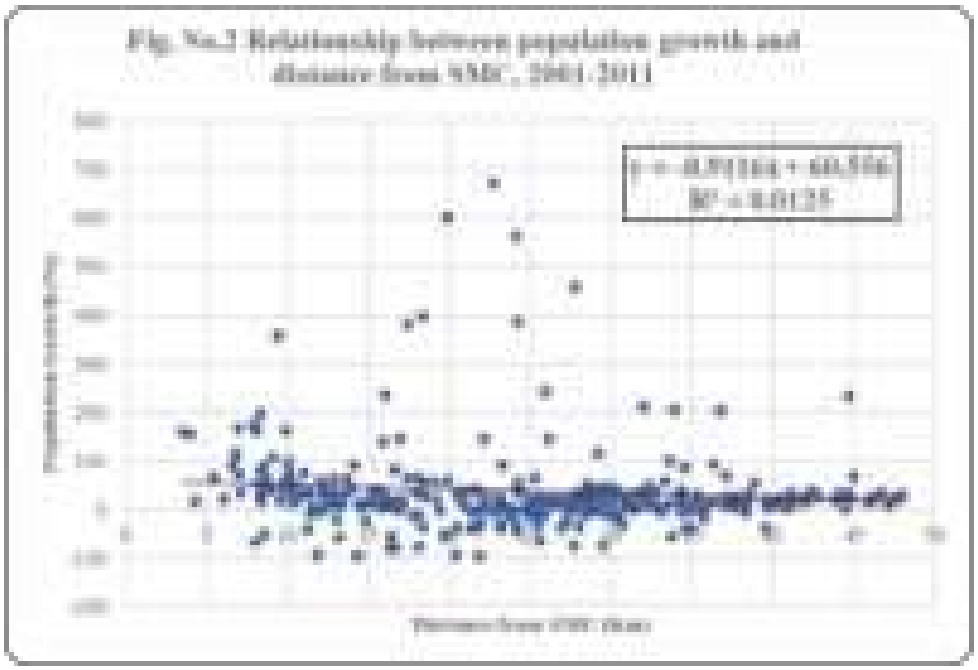


Figure 1 and 2 shows the relationship between distance from Siliguri Municipal Corporation and decadal growth rate of population for each village within the study area during 1991-2001 and 2001-2011 respectively. While calculating the regression equation and determining the R^2 value some villages with abnormally high decadal population growth has been left out deliberately. From the figures it can be observed that in Siliguri sub-division during 1991–2001 and 2001-2011, the distance from Siliguri Municipal Corporation and decadal growth rate of population for each village in the study area are independent of one another. The regression coefficient between these two variables validates the inference. Moreover, the coefficient of determination calculated was less than 2%, which means that less than 2% of variation in the decadal growth rate of population for each village can be explained by variation in distance from Siliguri Municipal Corporation. Therefore, other factors are more important in determining the decadal growth rate of population among the villages of the study area and distance from Siliguri Municipal Corporation does not have any significant influence in determining the population growth. Therefore, the first hypothesis taken for this study that with an increase in distance from Siliguri Municipal Corporation the population growth in rural settlements decrease is rejected and it can be said that distance from Siliguri Municipal Corporation does not have any influence in determining the decadal growth rate of population of the rural settlements in the study area.

Conclusion

Therefore, the major objective of this chapter was to analyze the growth of rural and urban settlement within the study area. To full fill this objective, the population growth was analyzed from 1991 to 2001 based on census data. The analysis was done for the four blocks, i.e. Matigara, Naxalbari, Phasidewa, Kharibari as well as Siliguri Municipal Corporation. The analysis shows that population growth in the study area has been very rapid from 1991 to 2011. However, the decadal growth of population was not uniform for all the blocks. Matigara block located closest to Siliguri Municipal Corporation witnessed very high population growth both during 1991- 2001 and 2001 -2011. This is due to the fact that population spillout from Siliguri Municipal Corporation to its surrounding areas has been taking place very rapidly from 1991 onwards. On the other hand, Phansidewa and Kharibari block located farthest from Siliguri Municipal Corporation have recorded relatively less population growth. Siliguri Municipal Corporation during 1991- 2001 more than doubled its population due to addition of adjoining area within its boundary but during the next decade it witnessed a very moderate population growth.

The size class classification of rural settlements within the study area was also done for each blocks. It was seen that Matigara and Naxalbari block saw a decrease in their total number of villages from 1991 to 2011, because during this period many villages were converted to census towns in these two blocks. However, for Phansidewa and Kharibari, the total number of villages from 1991 to 2011 did not change very much. Another interesting fact which requires attention is that the number of villages in the lowest four size classes have declined considerably in the study area in 2011 compared to 1991, but for the largest three size classes an opposite trend was visible.

At the village level there is a lot of variation in decadal population growth. Therefore, to analyze the growth of population for villages in the study area, decadal population growth of individual villages was computed for 1991-2001 and 2001-2011. While calculating the decadal population growth of villages, there was problem with some village which existed in one or two of the three census years under consideration. The village level population data shows there are some villages with very high decadal growth (over 1000%) in the study area. Negative population growth in villages of the study area is not uncommon. Some villages with very less population size has witnessed nearly 100% negative population growth which may be the result of a combination of factors like out migration and natural calamity. However, there is no significant relation between the distance of any village from Siliguri Municipal Corporation and their decadal population growth.

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This is to certify that Prof./Dr./Mr./Mrs./Ms. ...Tuhin Dey Roy, Research Scholar... of Department of Geography and Applied Geography, NBU......... attended the ICSSR-ERC Sponsored National Seminar on **Sustainable Urbanization in East India: Present Trends and Future Concerns**, organized by the Department of Geography, Siliguri Mahila Mahabidyalaya, Siliguri held during March 9-10, 2019. He/She has presented a research paper/ delivered special lecture entitled:

......Development of Transport Network and Associated Land Use and Land Cover Change: A case of Siliguri Subdivision......

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