

CHAPTER – II

**GEOGRAPHICAL SET UP
OF THE STUDY AREA**

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2.1 Introduction

The present chapter focuses on the physical as well as socio-cultural and socio-economic conditions of the study area. The main objective of this chapter is to study the physical and socio-economic as well as socio-cultural background of the study area along with the Sikkim as a whole. The chapter also deals with the physical and socio-economic as well as socio-cultural set up to the possibility of in-migration of the population to the study area. After the merger of Sikkim with Indian Union, how the physical and human environment are changing day by day and how it accelerates or decelerates the process of in-migration into the study area have been described. Historical background of the study has also been discussed in this chapter. Among the physical features of the study area physiographic features, geology, drainage system, climatic conditions, soil and its degradation and vegetation cover are discussed. The chapter also deals with socio-cultural along with economic conditions such as the distribution, density and growth of population, sex ratio, distribution of schedule caste and schedule tribe population, different occupational structure and economic activities, health, land use pattern, agricultural pattern, irrigation system, minerals, energy resources, transport and communication, ethnicity and tourism of the study area along with the state of Sikkim as a whole.

2.2 Database and methodology

2.2.1 Database

The present chapter is mainly based on secondary data, which was collected from the different websites and reports published by the different departments of Government of Sikkim and Government of India. Physiographic and drainage maps have been prepared from DEM, downloaded from United States Geological Society (<https://earthexplorer.usgs.gov/>). Geology and rocks and minerals were collected from the Geological Survey of India, Sikkim division. The road transport network of the study area was digitized from Google Earth. Soil map was collected from the National resource Atlas of Sikkim. Vegetation cover map has been prepared using NDVI from Landsat 8. ArcGIS 10.3 and Global mapper 26 have been used.

Socio-cultural attributes such as population, decadal changes, density, distribution of scheduled caste and scheduled tribe population, sex ratio, literacy rate, distribution of workers and non-workers were collected from the report on District census handbook, 2011 (Census of India, 2011) and Department of Economics, Monitoring and Evaluation, Government of Sikkim (DESME, Govt. of Sikkim, 2018). Health related data were collected from the website of the Department of Health, Government of Sikkim (Govt. of Sikkim, 2018). Land use pattern of Sikkim has been collected from Human development report, 2001 (Govt. of Sikkim, 2013) and statistical profile of Sikkim, 2006-07 (DESME, 2018). Distribution of minerals was collected from the report published by the G.S.I. of Sikkim (ENVIS, 2018). Cropping pattern, district-wise agricultural area, production and yield has been collected from Department of food security and agriculture development department, Government of Sikkim (Govt. of Sikkim, 2018). The large, small and micro industries have been collected from the annual reports, published by the Ministry of MSME, Government of Sikkim (DCMSME, 2018). The energy production and distribution were collected from the Sikkim energy and power department, Government of Sikkim (ENVIS, 2018). Data regarding the numbers of domestic and foreign tourists visited the state during 2011-2017 has been collected from the Tourism and civil aviation department, Government of Sikkim (Department of Tourism, Govt. of Sikkim, 2018). The suitable statistical techniques have been used by SPSS version 26.0.

2.2.2 Methodology

The collected secondary data and maps summarised using the following suitable statistical methods.

- **Normalized Difference Vegetation Index (NDVI)**

The Normalized Difference Vegetation Index (NDVI) was introduced by ROUSE et al. (1974). NDVI has been prepared from Landsat 8 image (resolution 30m) with near-infrared band (band 5) and red band (band 4). NDVI has been calculated using the math algebra of data management tools in ArcGIS software version 10.3. The target WRS Path/Row of East and South district is 139/41 and the date of acquisition on 7 July 2018. The calculation of NDVI defined as

$$NDVI = \frac{NIR - R}{NIR + R} \dots\dots\dots 2.1$$

- **Decadal changes**

To find out decadal changes of the population, the following formula has been used (Srivastava and Srivastava, 2004).

$$Di = \frac{Pi - P}{P} \times 100 \dots \dots \dots 2.2$$

Where, Di = Decadal variation of population

Pi = Total population of present decade

P = Total population of past decade

- **Literacy rate**

To find out literacy rate, there are two methods or indices of literacy have been used in measuring the level of literacy (Maurya, 2014):

i) Crude literacy rate and ii) Effective literacy rate

To find out the Crude literacy rate (CLR) following formula has been used.

$$CLR = \frac{\text{Literate population}}{\text{Total population}} \times 100 \dots \dots \dots 2.3$$

Here effective literacy rate is used to find out the level of literacy of the state and the study area, where children upto age of 7 years are not included in the total population of the area. Effective literacy rates are calculated by the following formula:

$$\text{Effective Literacy rate} = \frac{\text{Number of literates}}{\text{Total population above 7 years of age}} \times 100 \dots \dots \dots 2.4$$

- **Health**

For the discussion of health conditions of the study area as well as Sikkim, availability of health institutions, availability of beds in the health institutions and availability of doctors in the area has been taken into consideration. The following formula is adopted to find out the availability of health institutions, availability of beds in the health institutions and availability of doctors per 10000 thousand population of the area.

$$\text{Health institutions per 10000 population} = \frac{\text{Total number of health institutions}}{\text{Total population}} \times 10000 \dots \dots \dots 2.5$$

$$\text{Beds per 10000 population} = \frac{\text{Total number of beds in health institutions}}{\text{Total population}} \times 10000 \dots \dots 2.6$$

$$\text{Number of doctors per 10000 population} = \frac{\text{Total number doctors}}{\text{Total population}} \times 10000 \dots \dots \dots 2.7$$

- **Crop combination**

Crop combination of the East and South districts of Sikkim has been prepared with the help of statistical technique used by Weaver in 1954. Total harvested land occupied by each crop in the area is taken into consideration. Actual percentage of area under each crop, which occupies more than 1% of the total cropping area has been computed to determine the crop combination of the study area (Weaver, 1954). The theoretical measurement for the crop combination was employed as follows:

- Monoculture = 100% of the total cropland for one crop
- Two crop combination = 50% in each crop for two crops
- Three crop combination = 33.33% in each crop for three crops
- Four crop combination = 25% in each crop for four crops
- Five crop combination = 20% in each crop for five crops

After the calculation of the combination of crops, determining of the minimum value of the crop combination using the method of standard deviation (SD) as follows:

$$SD = \frac{\sum d^2}{n} \dots\dots\dots 2.8$$

Where, d = Difference between percentage of theoretical value and percentage of actual harvested area of crop land

n = total number of crops in a given combination

- **Annual growth rate**

The annual growth rate of domestic and foreign tourists is taken into consideration to determine the aspects of tourism in Sikkim, which is one of the main bases of Sikkim's economy. The annual growth rate of tourists during 2011-2017 is calculated by the following formula (Srivastava and Srivastava, 2004).

$$Gi = \frac{Ti - T}{T} \times 100 \dots\dots\dots 2.9$$

Where, Gi = Annual growth rate of tourists

Ti = Total tourists visited in present year

T = Total tourists visited in last year

2.3 Historical background of Sikkim

Sikkim is a stunning state in the north-eastern fringe of India. No extensive information has been recognized about the history of Sikkim, it is supposed that 'Lepchas' or *rong* (*ravine* folk) were the indigenous populace of Sikkim (Subba, 2010). Later, the 'lepchas' got occupied with other clans. In the ninth century, Guru *Rinpoche*, a Buddhist saint, happened to pass through the domain of Sikkim (Chhetri, 2010). The monk blessed the soil and introduced the belief of Buddhism to Sikkim. He also prognosticates that the state would be governed by the royals in the centuries afterwards (Chakraborty, 2012).

Guru *Tashi*, the king of *Mi-nyak* House in *Kham* of East Tibet came to the Chumbi Valley of Sikkim and established the settlements during the 13th century (Chhetri, 2010). The descendants of Guru Tashi cultured by local customs and made excellent kindred with the 'Lepchas' people. Due to these good relationships, the grandson of Guru *Tashi* became the ruler of Sikkim (Gurung, 2011).

The organized history of Sikkim can be said to have begun with the blessing of its first *Chogyal* (King) in 1642 AD. The gazetteer of Sikkim, which was compiled by H. H. Risley in 1894, throws light on the different racial groups of the area. In ancient times, Sikkim was known as '*Mavel-Lyang*', meaning a secret heaven to the Lepchas (Joshi, 2004). Later on, the Tibetans called the region '*Denzong*' meaning the basin of rice (Bhattacharyya, 1984). The present name of Sikkim is of Limboo or *Tsong* origin (Nepali), which means 'A new home' (Gurung, 2011). Dr. H.H. Risley, in his Gazetteer of Sikkim State' has mentioned that the 'Sikhim' has been imitative from the Limboo word '*Su*' and '*Khim*' meaning a new home or place. With the course of time the word was stained into '*Sukhim*', which was later anglicized to 'Sikkim' (Risley, 1894). The name thus seems to have originated more to mean a new place or house than any other else. Before the entrance of the Bhutias from Tibet, Sikkim was occupied by different Kirati tribes (Plaisier, 2007). Lepchas have studied the ingenious inhabitants though, Limboos are also considered as a very old community of the region. It is so because the border of Limbuana, the then land of the Limboos, had expansion upto the left bank of the Teesta before the boundaries between both the countries were pinched (Gurung, 2011). However, during the influx of the Bhutias from Tibet, the region is implicit in having mostly the Lepchas, although the Limboos and the Mangars are also reported to

have been found in little numbers in diverse passages in the region. There is no genuine record of the origin of the Lepchas (Basnet, 1974).

As already mentioned, the real account of Sikkim begins with the emergence of the *Chogyal* kingdom under the *Namgyal* dynasty. After a religious conflict in Tibet, a group of opponent order fled southward into Sikkim (Chhetri, 2010). At first, the Tibetan in-migration was very poor. Later, with the raise in the number of migrants, the need for society was felt (Bhattacharyya, 1984). As a result, in the early 17th century, after the intercontinental conflicts and Chinese war, three Red Hat sect Lamas fled to Sikkim and established a Tibetan kingdom (Gurung, 2011). They were *Lama Latshun Chembo*, *Lama Katog* and *Lama Nga-Dag*, who jointly sacred the first *Chogyal* of Sikkim in 1642 at Yuksom in the western part of Sikkim (Subba, 2008). The *Namgyal* dynasty ruled for more than three hundred years.

2.3.1 Namgyal dynasty of Sikkim

In 1642, Phuntsog Namgyal was the initial ruler to set up a centralized government in Sikkim.

Table 2.1 Chronological order of Namgyal Dynasty of Sikkim

Serial No.	Name of the King (Chogyal)	Period Ruled
1	Phuntsog Namgyal	1642 AD – 1670 AD
2	Tensung Namgyal	1670 AD – 1700 AD
3	Chagdor Namgyal	1700 AD – 1717 AD
4	Gyurmed Namgyal	1717 AD – 1733 AD
5	Namgyal Phuntsog II	1733 AD – 1780 AD
6	Tenzing Namgyal	1780 AD – 1793 AD
7	Tsugphud Namgyal	1793 AD – 1863 AD
8	Sidkeong Namgyal	1863 AD – 1874 AD
9	Thutob Namgyal	1874 AD – 1914 AD
10	Tashi Namgyal	1914 AD – 1963 AD
11	Palden Thondup Namgyal	1963 AD – 1975 AD

Source: Sikkim chronicle, Durga P. Chhetri, 2010

During the time of Palden Thondup Namgyal, democratic movement of the people had unhurriedly but progressively gained impetus. New political parties were formed and demand for democracy became stronger (Chhetri, 2010).

Palden Thondup Namgyal was the last *Chogyal* of Sikkim. The political disorder that began at the end of the Tashi Namgyal's rule reached such a height that the new king failed entirely to save the foundation of the kingdom (Chhetri, 2010). In 1975 the democratically elected government was established and the Namgyal dynasty that lasted for 333 years came to an end (Kazi, 2020). The Tripartite Agreement signed on 8th April 1973 was instrumental in changing the political system of the country. The Agreement was signed at Gangtok between the Government of India, the *Chogyal* and the leaders of political parties (Chhetri, 2010). Among other things, the establishment of responsible government, guarantee of fundamental rights, rule of law and independent judiciary were the main requirements of the Agreement.

Thus, the first democratically elected government was formed with Kazi Lhendup Dorji as the Chief Minister. The Assembly that met on 10th April, 1975 passed two important resolutions – firstly, the resolution demanding the institution of *Chogyal* and secondly, the resolution of merger of Sikkim with India. Both the above-mentioned resolutions were passed collectively by the House which was later authorized by majority of people in a state-wide referendum held on the 14th April, 1975 (Sidhu, 2018). Finally, the foundation of monarchy was abolished and Sikkim was merged with India by the Thirty Sixth Constitutional (Amendment) Act passed in 1975 and became the 22nd State of Indian Union on 16th May, 1975 (Gurung, 2011).

2.4 Physical Characteristics

Sikkim is a tiny, awfully mountainous state in the Indian Himalayas with sharply defined and tremendously steep watersheds, barely 114 km long and 64 km wide and measuring only 7096 sq. Km. in area (DESME, Govt. of Sikkim, 2018). The physical landscape of the state is characterized by great variations in elevation. The elevation of the state ranges between 250 m in the south to above 8500 m from mean sea level in the north.

2.4.1 Physiography

Sikkim has a very uneven landscape and disturbing physical features. The whole state is bounded on the north, east and west by high ridges and looks like an arena. The convex gulf of the greater Himalayas in the northern part separates the state from the Tibetan highlands (Chowdhury, 200). The longitudinal Chola range separates the state from eastern Tibet and the Singalila range marks the border between Sikkim and Nepal in the west.

Geologically, the state belongs to the upper part of the Teesta Basin. The physical landscape of the state greatly enhances the work of the river Teesta. The structural operation of the land is from north to south (Starkel and Sarkar, 2014). The north-western part of the state is highly elevated and therefore covered with snow almost all the year round. Similarly, landscape features are found throughout the northern and eastern highlands (Chowdhury, 2006).

The current landscape of the state is the ongoing glacial, periglacial; glacio-fluvial, fluvial and pluvial activities are constantly changing the appearance of the topography of this young fold mountains (Choudhury, 2006).

Table 2.2 Broad physiographic division of Sikkim

Sl. No.	Zone	Altitude	Special character
1	Lower hills	300m to 1800m	Hilly topography with flat cultivated lands
2	Upper hills	1800m to 3000m	Major forest areas
3	Alpine zone	3000m to 4500m	Covered with scrubs and grassland
4	Snow land	Above 4500m	snow land area without vegetations

Source: Sikkim: Geographical perspective, Choudhury. M., 2006

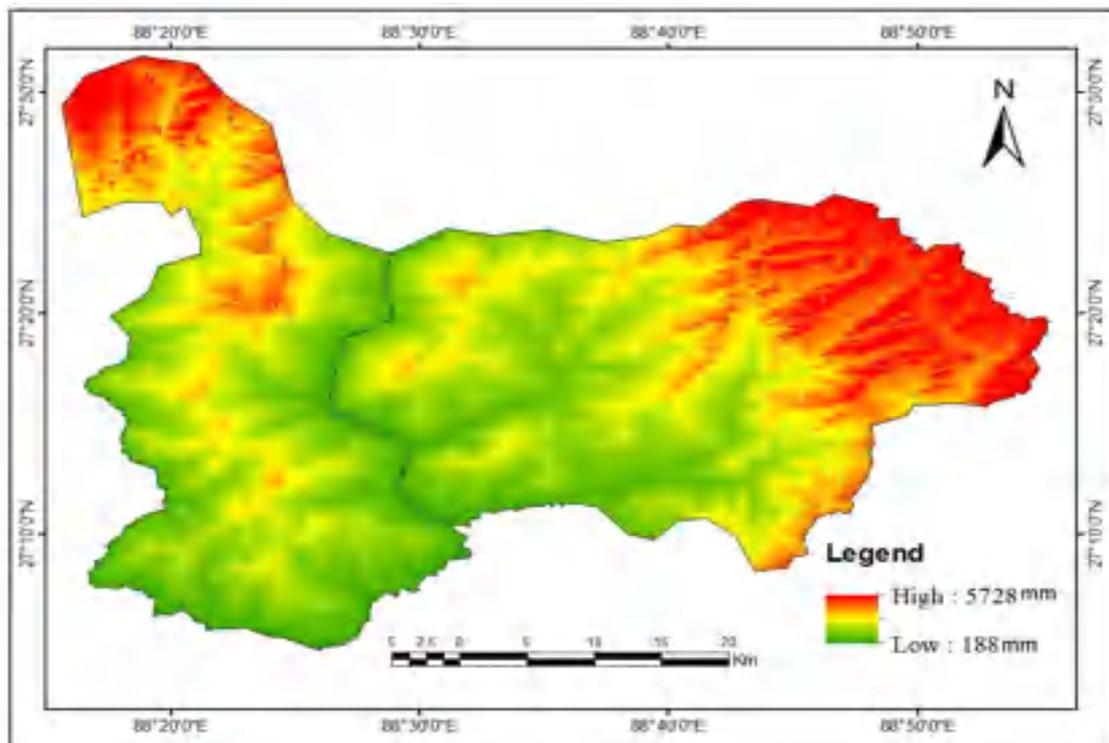


Figure 2.1 Physiographic divisions of the study area

The East district of the state is an absolutely mountainous area and the region adjoining China is generally roofed with snow (Kumar and Singh, 2001). Approximately three fourths of the district is covered by forest. The topography of the district is out and out mountainous. The district is sloping towards west from east. River basin of the district has a mean elevation of about 300m above mean sea level in the west and upward to the east with an average height of near about 5500m above the mean sea level (Negi, 1991). The East district of Sikkim is bounded by some of the world's most significant mountain ranges which are Mt. *Lamaongden* (Ht. 19366 ft above MSL), and Mt. *Masunyang* (Ht. 19300 ft. above MSL). These mountains are interspersed with several passes (La) linking to the neighboring countries. These passes are Jelep La (4300m above MSL), Nathu La (4300m above MSL) and Cho La, Bhutan La (4000m above MSL) (DESME, Govt. of Sikkim, 2015).

The broad relief of the South district is sloping in the direction of the south from the north. The part is highly elevated with an average of 4600m above the mean sea level in the southern part (Rawat et al., 2012). Mainly the river basin has a mean elevation of less than 330m from mean sea level. The elevation of the district ranges from 300m in extreme south of Rangit valley and Teesta valley in east to 5000m in the north (Sharma, 2008). The farthest northern part of the district is snow bound having more than 5000m from sea level covering an area of 55km sq. Some part of Alpine zone is also covered by snow, occupying about 70km sq. of the whole area of the district, having forest and mixed jungles (Sharma, 2008). The middle hills have an area of 160 km sq. and lower hills have covered 300km sq. out of the total district area (Sharma, 2008). The river valley has occupied around 140 sq. km. Most of the inhabitant blocks of the districts fall in the lower hills which have the altitudinal range of 600m to 1800m, because these areas are favourable for settlement due to low degree of slope which is comparatively easier for agricultural practice (Rawat et al., 2012).

2.4.2 Geology

Geological structure is not only a dominant controlling factor in the determination of relief and physiographic features on a region, but also in the formation and nature of rocks and minerals (Mukherjee, 1997). The importance of the study of geological structure of a region can hardly be overemphasized as it is fundamental to various

economic activities including agriculture and mining (Gerrard, 1994). Besides, a thorough study of geological structures is fundamental to land use planning of an area.

Sikkim Himalaya, which is the Lesser Himalayan series, made up a solid succession of Proterozoic - Paleozoic Daling, Gondwana and Buxa rocks (Bhattacharyya and Mitra, 2009). Sikkim Himalaya has been sub-divided into following distinct tectonic domains (Dasgupta et. al. 2004), which are siwalik, lesser Himalayan domains and higher Himalayan domains. These domains are separated one from another by the thrust faults (Banerjee et al., 2019).

Stratigraphically speaking, Sikkim has been characterised into four structural belts.

- i. Foothill belt
- ii. Inner Belt
- iii. Axial Belt
- iv. Trans-Axial Belt.

All the above four structural belts are lying in a sequential way, i.e., from north to south. A narrow strip of Gondwana rocks in the foothill belt is exposed in the form of 'tectonic window' (Boot, 1988). Sikkim is recognised as a young fold mountain system which falls under the greater and lesser Himalaya. Tectonically speaking, the study area is composed of Kanchendzonga and Darjeeling Gneiss along with Chungthang formation (graphite schist, marbles, calc-silicate rocks, quartzite and infrequently amphibolite) with granites and Tethyan sedimentaries (Basu, 2013). The Tethyan Mesozoic and Palaeozoic sequence in the northern and north-western part of Sikkim are fossiliferous (Basu, 2013).

The northern part, eastern part and western part of the state are composed of hard massive gneissose rocks, while central part and southern part of the state are composed of soft, thin and schistose rocks (Patro and Harinarayana, 2009).

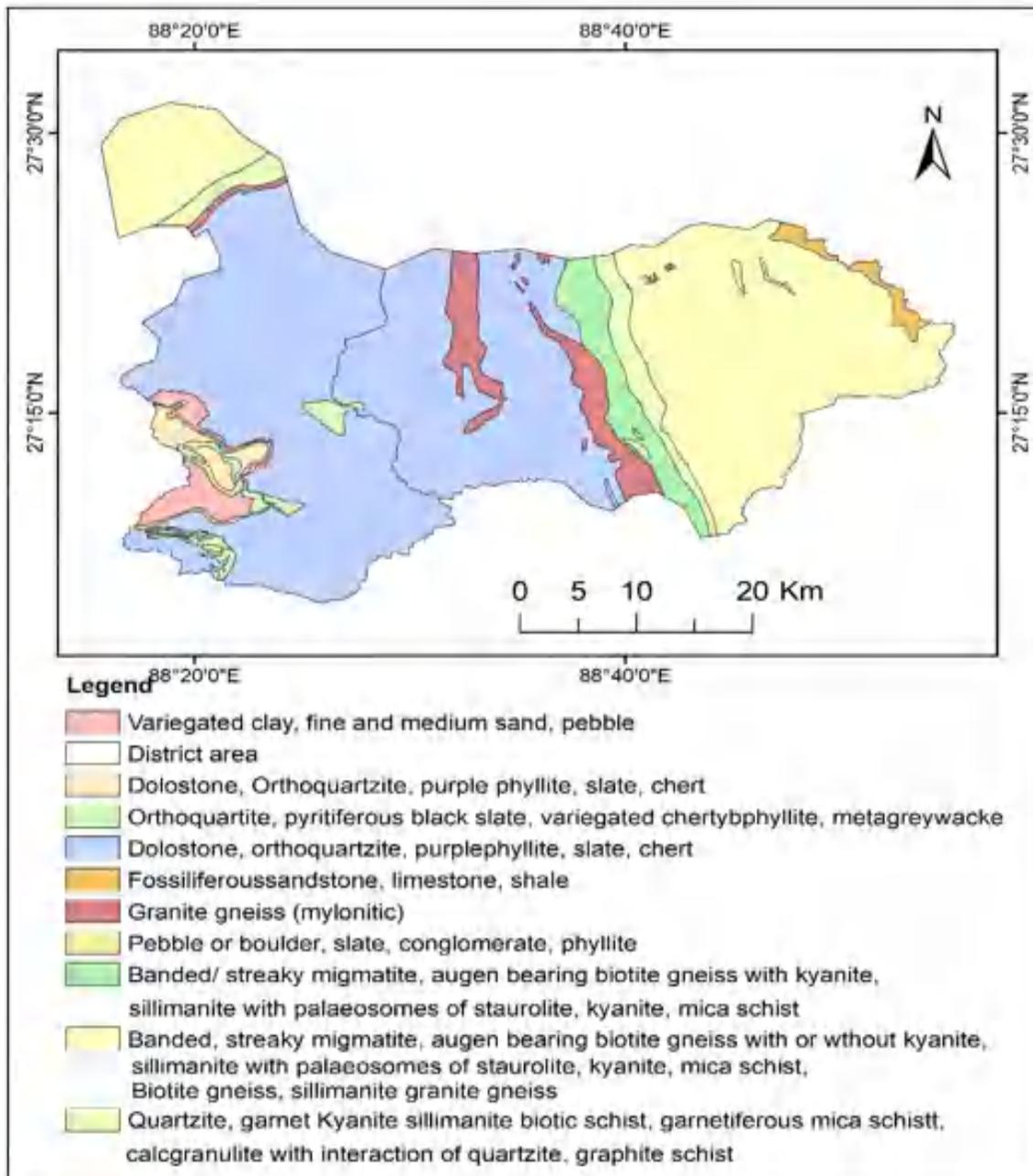


Figure 2.2 Geology map of the study area

2.4.3 Drainage system

Numerous seasonal and perennial rivers and their tributaries dissect Sikkim, forming a unique and intricate river system. Because of the folded structure of the mountain, all the river system of the state has formed a dendritic pattern (Choudhury, 2006). In accordance with the trend of the transverse ranges and the spurs, the course of the main rivers of the region is generally aligned in the north-south direction. The most imperative river of the State is Teesta, which separates the region into two different split fifty-fifty (Mukhopadhyay, 1982). The central basin of which is emphasised by the

relatively softer rocks. The river Teesta, the heart of Sikkim, rising from the snout of the Zemu glacier, is fed by numerous tributaries (Choudhuri and Choudhuri, 2015). Within a few kilometres from the source, it drops to 1,000 metres near Singhik and Mangan. Through the North district and the boundary of East and South districts, it leaves the State at Rangpo (Negi, 1991). The main trunk tributary which forms a unique drainage system with the countless streams flowing down the slope of the Himalayas is the Rangit. It is the most important tributary of Teesta (Sikkim ENVIS, 2019). It originates in the Talung glaciers in West Sikkim. River Rangit travels for about 60 kms. Downstream and joins with the Teesta below Melli Bazar. It also divides the South district from the West district (Das and Ray, 2001). It is fed by the Kanchanjunga group of glaciers and a number of tributaries flowing from the eastern slope of the Singaliia range and also from the western slope of the water divide of Teesta and Rangit (Mukhopadhyay, 1982). Important tributaries are Relli, Rathong, Rimbi, Kalej, Rishi and Roathak (Table 2.3).

Table 2.3 Major Tributaries of Teesta River

Sl. No.	Left-bank Tributaries	Right-bank Tributaries
1.	Lachung Chhu	Zemu Chhu
2	Chakung Chhu	Rangyong Chhu
3	Dik Chhu	Rangit River
4	Rani Khola	
5	Rangpo Chhu	

Source: Sikkim ENVIS, 2018

Teesta is the main physical boundary between East and South districts of Sikkim (Rawat et al., 2012). The East district of Sikkim is drained by three main rivers, which are *Dik Chhu*, *Rongni Chhu* and *Rongpo Chhu*. The *Dik Chhu* is the left bank tributaries of Teesta (Goyal and Goswami, 2018). It has two main feeders, which are *Bakcha Chhu* and *Rate Chhu*. *Bakcha Chhu* and *Rate Chhu* originate from North district and South district respectively in the Indo-Tibetan border ranges in the east. *Dik Chhu* marks the boundary of North and East districts of Sikkim. *Dik chhu* meets Teesta near Rakdong (Meetei et al., 2007).

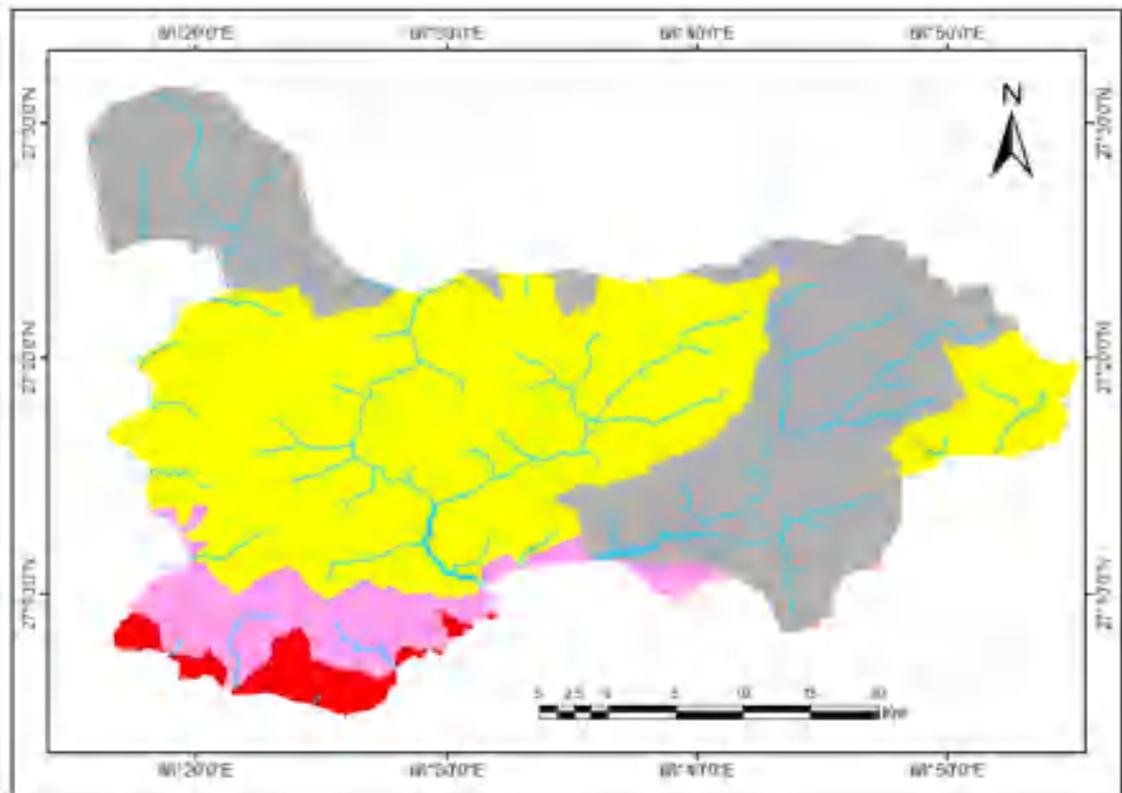


Figure 2.3 Drainage map of the study area

The *Rongni Chhu*, another left bank tributary of Teesta is the combination of three tributaries, i.e. *Yali Chhu*, *Rora Chhu* and *Takchom Chhu*. All these streams originated in the East district of Sikkim. The *Rongni Chhu*, also known as *Rani Khola* and it meets the Teesta at Singtam (Forest and Environmental Department, Govt. of Sikkim, 2018).

The *Rangpo Chhu*, also the left bank tributary of Teesta originated from a lake near the Indo-Chinese border in the East district of Sikkim. Its feeders include *Byu Chhu*, *Lunze Chhu*, *Rangli Khola* and *Rishi Khola*. The *Rangpo Chhu* meets the Teesta near Rangpo (Forest and Environmental Department, Govt. of Sikkim, 2018).

The South District of Sikkim is drained by two important river systems of Rangit and Teesta River and their swift flowing tributaries (Mukhopadhyay, 1982). The two river systems bounded the district from east. West and southern boundary and play a dominant role in sculpturing the land surface feature of the district and both following north to south (Negi, 1991). The Rangit River originated from Kanchi reserve forest area with an altitude of about (4600m) in the northern part of Ravongla Sub-division and follows westward as head stream and joined by *Rangdung Chhu* and *Langdung*

Chhu near Phamthang block beyond this it flows Rangit River (Das and Ray, 2001). It is joined by *Ramman Khola* and then known as Great Rangit and ultimately falls into Teesta at Melli (Rawat et al., 2012). The Rangit River which flanks the western and southern boundary of the district has a total length of about 98 km from head water source to Melli, where it joined to Teesta (Sadangi, 2008).

Various tributaries of Rangit which originate from the south District. Important tributaries are *Rangdung Chhu* and *Kayan Chhu*, both have 12km each length. The tributary which joins near Phamtham is *Langdung Chhu* which is also 12km in length (Rudra, 2018). Downward the tributaries which join the Rangit river are *Barme Chhu*, *Sangang Chu*, *Bania Khola*, *Rayong Khola*, and *Rinchu Khola*. The most important tributary which joins the Rangit River in the southern part is *Manpur Khola* and *Khani Khola* (Mukhopadhyay, 1982).

The eastern bound Teesta has a length of 45 km from Lingi where it touches the south district to Melli where it leaves the south district and the Sikkim enters the west Bengal (Rudra, 2018). Out of the tributaries of Teesta River originated from south district *Rangpham Chhu* and *Rangpo Khola* has the longest length both having 12km each. The second longest tributary is *Katlej Khola* which has 9 km length (Rawat et al., 2012). The other remaining tributaries i.e., *Brum Khola*, *Ben Khola*, *PungPung Khola*, *Seti Khola* and *Rabi Khola* have more than 6.5 km (Lama et. Al. 2004).

2.2.4 Climate

Sikkim has a peculiar climatic condition which varies from tropical heat in the lower valleys to the freezing cold in the higher altitudes. State is basically divided into: subtropical humid type (upto 1500 m), semi-temperate type (1500 m to 2000 m), temperate type (2000 m to 3000 m), Snow forest type (3000 m to 4000 m), Tundra type (4000m to 6000m), and arctic type (above 6000 m) (Choudhury, 2006). The zone above 6000 m remains permanently snow covered throughout the year; however, snow comes down upto 2500 m as during winter. Sikkim Himalaya is presumed to be the most humid place in the entire Indian Himalaya because it is situated very close to Bay of Bengal and is directly exposed to moisture overloaded southwest monsoon (Bawa and Ingty, 2012). Sikkim is one of the wettest regions in India as it comes directly on the path of the monsoon clouds; nonetheless, the rainfall varies with varying altitude. Sikkim receives rain from mid-February to early-November, but the intensity is higher during late-May to early-September (Barua, et al., 2004). The monsoon normally

occurs from June to August, of which July is the wettest month of the year receiving total rainfall upto 5000 mm (Pangthang, East Sikkim), which is the highest in the eastern Himalaya (Bawa and Ingty, 2012). The downpour is very less in the northern part of Sikkim because the monsoon cloud dries out by the time it reaches the northern barrier. The temperature is not uniform in the state due to variability in the altitude (Rawat et al., 2012).

The East and South districts as a whole comes under the influence of south west monsoon climate conditions due to the location and direct exposure or over looking to the Bengal plain (Rahman et al., 2012). But the districts have its own regional variation caused by its topographical location, elevation, topography and other physical aspects, which inversely produce local rainfall patterns, variation in temperature etc. (Vishwakarma et al., 2016). The months during February to May have experienced a pleasant climatic condition (Figure 2.6). Which pulls in-migrants to the study area.

2.2.4.1 Temperature

Highest mean monthly temperature of the study area during 2015 was recorded in July (26.34 °C) and lowest mean monthly temperature was recorded in January (14.36 °C). Highest maximum temperature of the study area was recorded for the year 2015 during the month of July (29.89 °C) and lowest maximum temperature was recorded in the month of January (20.28 °C). Highest minimum temperature of the study area during 2015 was 22.79 °C for the month of July and lowest minimum temperature was 8.44 °C for the month of January. Mean maximum temperature of the study area was 26.86 °C and mean minimum temperature was 17.14 °C during 2015. Average mean temperature was recorded 22.00 °C. (Table 2.4). Coldest month of the study area is January and the hottest month of the study area is July during 2015. Winter season prevails during December to January and these months are in dry condition due to the effects of north-east monsoon. Snowfall has occurred in the high-altitude areas during the winter season. Summer season prevails during May to September in the study area. Rainy season occurred along with summer season from the month of June to September due to the effects of south-west monsoon.

Table 2.4 Monthly weather parameters of the study area, 2015

Month	Temperature °C			Relative Humidity in %			Sunshine Hours	Rainfall (cm)
	Max.	Min.	Mean	Max.	Min.	Mean		
Jan	20.28	8.44	14.36	87.19	49.61	68.40	0.93	0.36
Feb	23.56	10.95	17.25	86.86	42.93	64.90	3.07	0.96
Mar	27.06	14.78	20.92	82.67	39.9	61.29	2.8	2.91
Apr	27.35	17.88	22.61	83.8	41.76	62.78	3.67	11.90
May	29.42	20.74	25.08	86.32	53.96	70.14	4.25	15.30
Jun	29.44	22.47	25.96	88.56	60.36	74.46	3.29	24.87
Jul	29.89	22.79	26.34	90.64	71.29	80.97	0.92	15.32
Aug	29.11	22.77	25.94	90.45	66.8	78.63	2.26	15.10
Sep	29.62	22.30	25.96	90.4	62.66	76.53	2.02	9.92
Oct	28.95	19.08	24.02	90.38	50.93	70.66	5.01	2.53
Nov	26.08	14.34	20.21	88.56	52.2	70.38	1.77	2.50
Dec	21.50	9.19	15.34	87.12	50.35	68.74	0.3	0.04

Source: Indian Meteorological Department (IMD), 2015

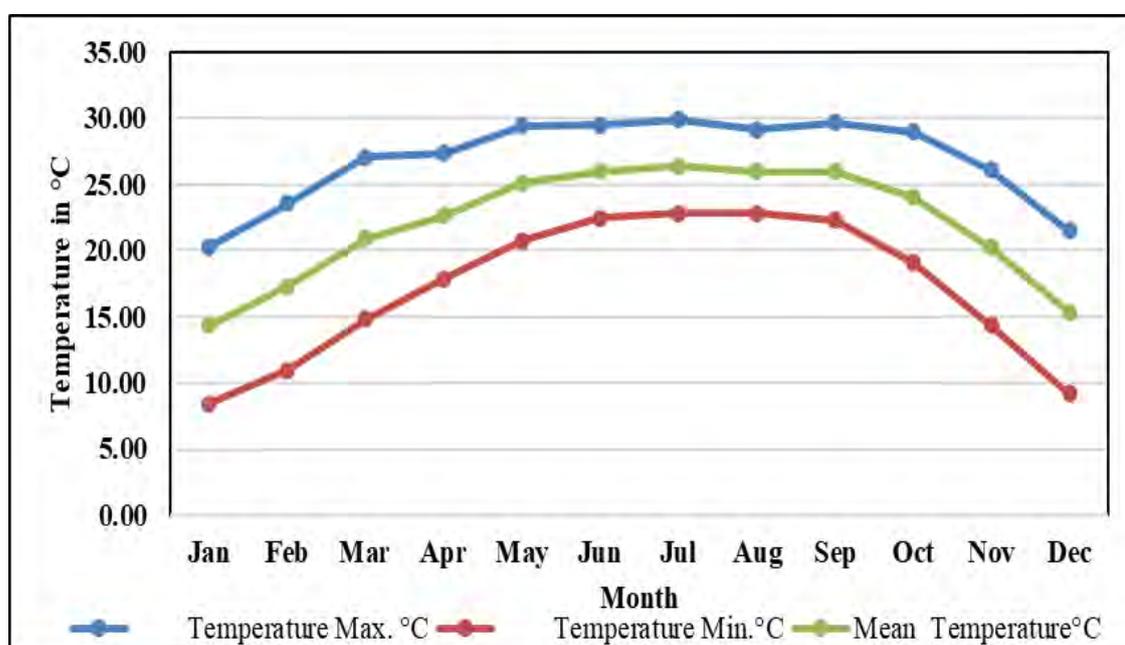


Figure 2.4 Monthly maximum, minimum and mean temperature of the study area, 2015

2.2.4.2 Rainfall

Yearly rainfall of the study area is widely varied from 24.87 cm in the month of June to only 0.04 cm in the December. The average annual rainfall is found 8.48 cm in the study area (Table 2.4). Nearly, 80% of rainfall of the area has occurred during the rainy season by the effects of south-west monsoon. Rainfall of the study area during the pre-monsoonal season ranges between 15.3 cm in May to 2.91 cm in March. Whereas, during the winter season in the area rainfall ranges between 0.96 cm in February to only

0.04 cm in December. The relation between temperature and rainfall of the area are directly proportional to each other's which means rainfall has increased along with increasing tendency of temperature and vice-versa.

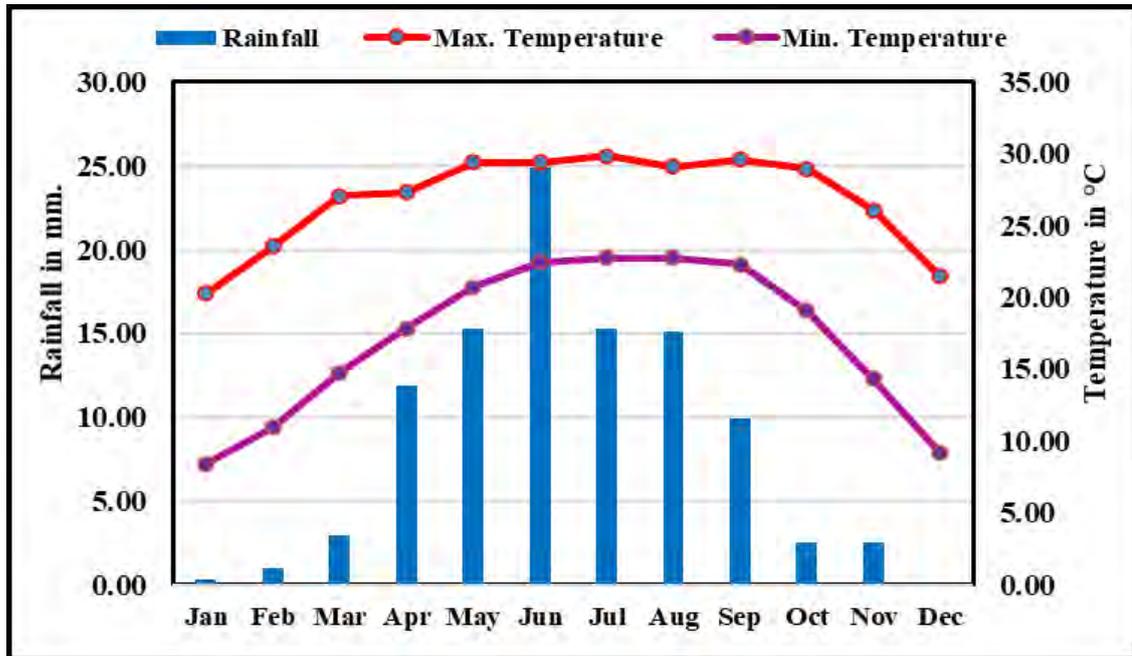


Figure 2.5 Rainfall and maximum-minimum temperature of the study area, 2015

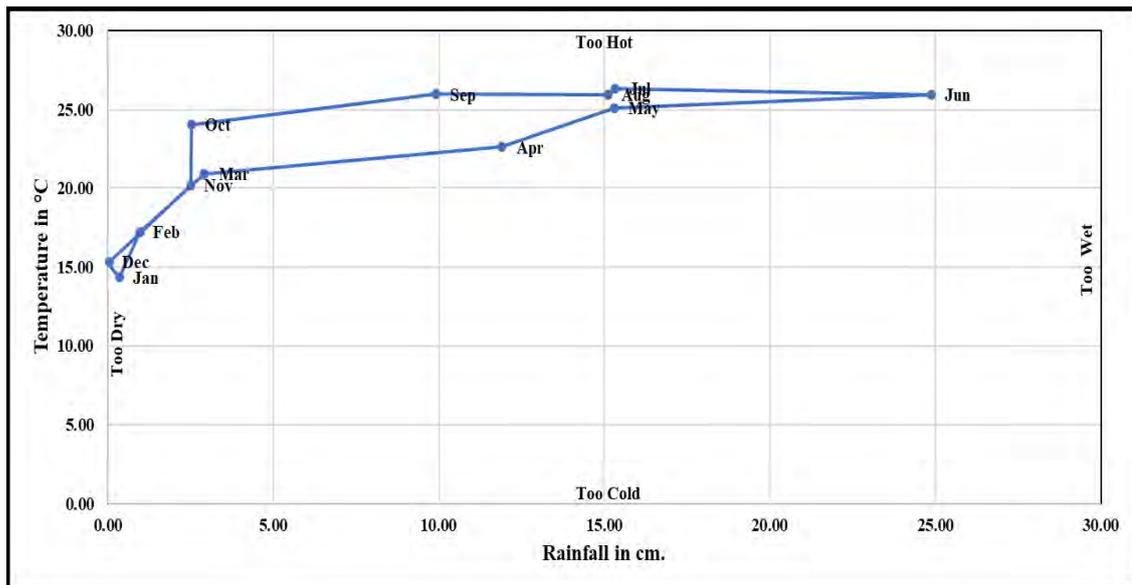


Figure 2.6 Hythergraph of the study area, 2015 after Griffith Taylor, 1949

2.2.4.3 Relative Humidity

The highest mean monthly relative humidity of the study area is 80.97% during the month of July and lowest mean monthly relative humidity of the study area is 61.29% for the month of March. Highest maximum relative humidity is found in July (90.64%)

and lowest maximum relative humidity is found in March (82.67%). Highest minimum relative humidity in 2015 was recorded for the month of July (71.29%) and lowest minimum relative humidity was recorded during March (39.90%). In the study area in 2015 average mean relative humidity was 70.65%; average maximum relative humidity was 87.75% and average minimum relative humidity was 53.56%. So, it revealed that the wettest month of the study area is July and the driest month of the study area is March. Relative humidity of the area varies with the occurrence of south-east and north-west monsoon.

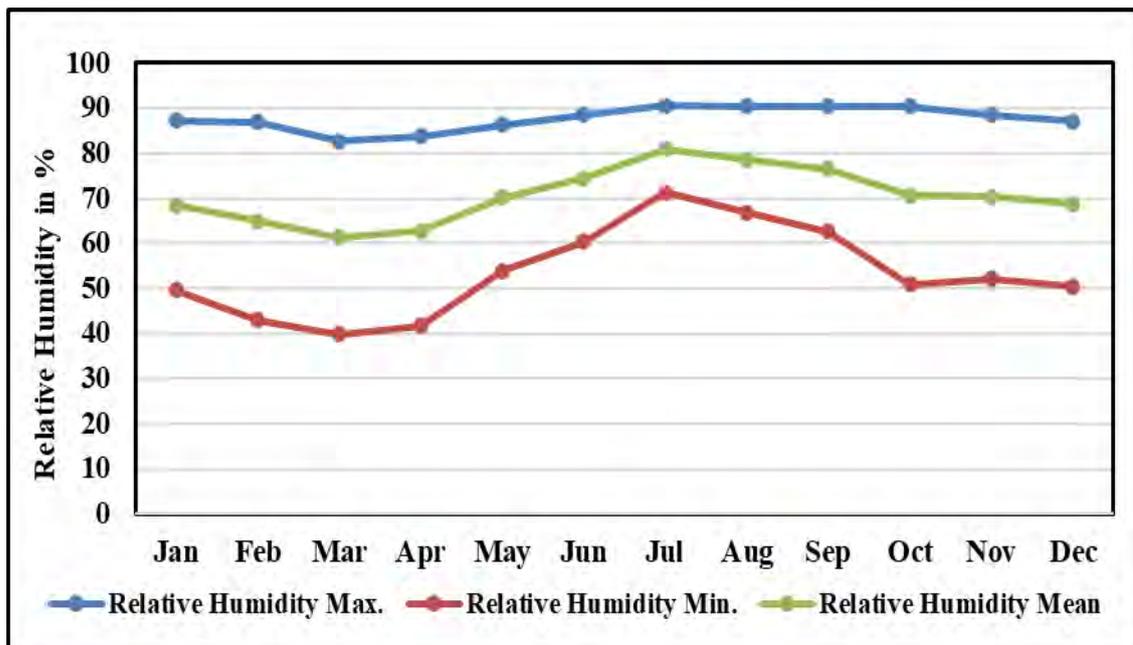


Figure 2.7 Monthly maximum, minimum and mean relative humidity of the study area, 2015

2.2.4.4 Sunshine hours

The average annual sunshine hours per day of the study area in 2015 is 2.52 hours per day and it varied from 5.01 hours per day in October to 0.30 hours per day in December. During the winter season in the study area the sunshine hours varied from 0.30 hours per day in December to 3.07 hours per day in February, whereas during the rainy season, it varied from 3.29 hours per day in June to 0.92 hours per day in July. Short length of sunshine hours in the study area is recorded during December, January and July. In the month of December and January it is due to the foggy weather condition and in the month of July it is due to the massive rains occurred by the south-west monsoon. Little visibility of the study area has occurred in these months. But, the months during pre-monsoonal season have a decent sunshine hour in the study area.

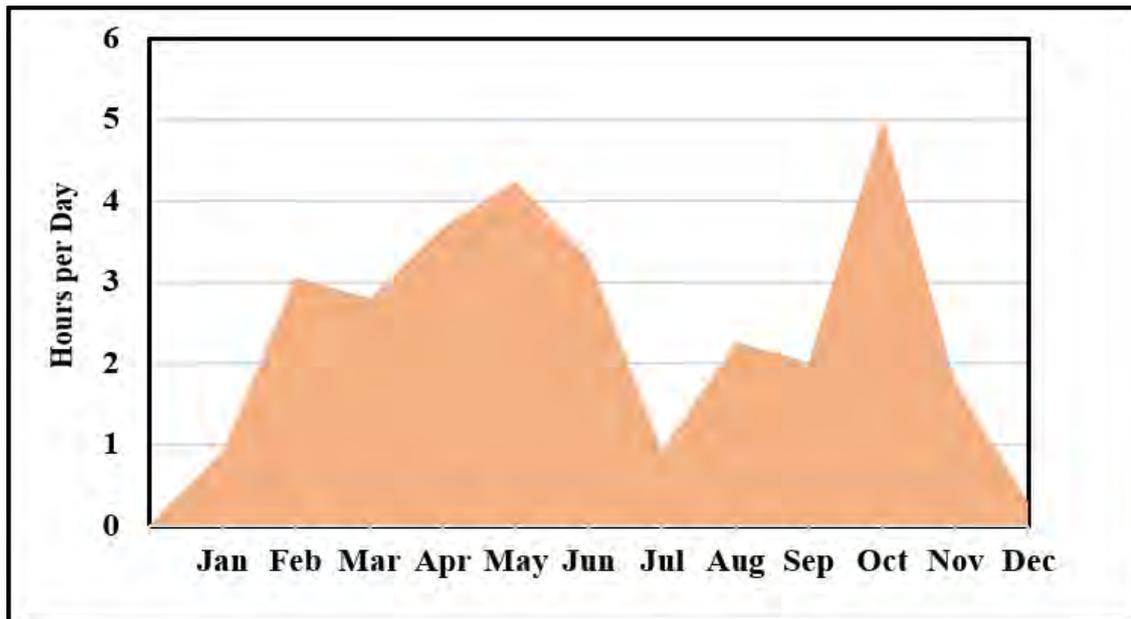


Figure 2.8 Sunshine hours per day of the study area, 2015

2.2.5 Soil

Sikkim being a fragment of the Himalayas has a diverse type of soil. Due to non-appearance of regular and organised survey, very slight is therefore known about the soils of the region (Gajbhiye et al., 2003). Here, soils of this State in general, are imitative from sedimentary and metamorphic rocks; as a result, they are loose in structure, thin and light in texture (Gajbhiye et al., 2003).

Soil is the product of interaction among the five forming factors, viz., parent material, climate, vegetation, topography and time (De and Ghosh, 2013). As Sikkim experiences a wide variation of physiographic and vegetation conditions, the composition of soil differs from place to place. The texture, wideness and fruitfulness of the soil are influenced by the incline of soil, climate and vegetal cover (Subba, 2009). On the whole, the texture of the soil of the region is loamy sand to clay loam with variable number of coarse segments (Debnath et al., 2012). On an average the soil depth at hill slopes varies from 60 to 90 cms. Sikkim being a hilly area has an acidic type of soil reaction with high organic matter content (mostly 2 to 5 per cent) (Sharma et al., 2016). Which is better for cultivation and also another attraction of agricultural migrant workers.

The higher areas, which are under the influence of snow or moving ice, are covered by fluvio-glacial soils, while in the glaciated area boulders, clay and outwash soils are found. Near the snow line soil is immature (Martin et al., 1993).

Table 2.5 shows the classification of soil in the study area. There are thirteen types of soils found in the study area. Fine loamy mixed soil, coarse loamy ever fragmented soil covered an area of 355.44 sq. km. (21.21%) which is found in southern and parts of the central zone in the study area. Coarse loamy excessive drainage weak soil structure soil is found in the western, central and eastern parts in the study area, it covers 44.45 sq. km (2.65%) of the study area. Coarse loamy excessive drainage stony soil and fine & mixed loamy soil covered maximum area. It covers 380.45 sq. km. (22.70%) of the study area and is found in the southern, western and central parts of the area. Coarse loamy excessive drainage rocky valley fill soil is found in the western, southern and central parts of the area. It covers 193.46 sq. km (11.54%) area. Coarse loamy cemented soil, loamy skeletal inclusive rocky surface covers an area of 157.12 sq. km (9.38%) and found in the area of the marginal eastern part. Fine loamy weak and mixed soil and Loamy skeletal weathered soil and coarse loamy rocky surface cover 137.05 sq.km (8.18%) and 130.25 sq. km. (7.77%) respectively. These soils are found in the mid central part and marginal southern part of the study area. Other soils of the area are Loamy skeletal excessive drainage soil and coarse loamy weak soil Loamy skeletal with moraines and boulders; Coarse loamy sandy deep soil, excessive drainage loamy skeletal soil; Coarse loamy very shallow soil, loamy skeletal rocky outcrop; Fine loamy stoniness soil and loamy skeletal excessive drainage soil. These soils are found over all the parts of the study area dispersedly (Figure 2.9).

Table 2.5 Classification of soil in the study area

SL No.	Soil type	Area in sq. km	Percentage
1	Fine loamy mixed soil, coarse loamy ever fragmental soil	355.44	21.21
2	Coarse loamy excessive drainage weak soil structure soil	44.45	2.65
3	Loamy skeletal excessive drainage soil coarse loamy weak soil	24.37	1.45
4	Loamy skeletal with moraines and boulders	58.57	3.49
5	Coarse loamy excessive drainage stony soil, fine & mixed loamy soil	380.45	22.70
6	Coarse loamy sandy deep soil, excessive drainage loamy skeletal soil	20.14	1.20
7	Coarse loamy shallow & cemented rocky soil	46.20	2.76
8	Coarse loamy very shallow soil, loamy skeletal rocky outcrop	88.67	5.29
9	Coarse loamy excessive drainage rocky valley fill soil	193.46	11.54
10	Fine loamy stoniness soil, loamy skeletal excessive drainage soil	39.72	2.37
11	Fine loamy weak and mixed soil	137.05	8.18
12	Loamy skeletal weathered soil, coarse loamy rocky surface	130.25	7.77
13	Coarse loamy cemented soil, loamy skeletal inclusive rocky surface	157.12	9.38

Source: Natural resource Atlas of Sikkim—soil spatial information, 2006

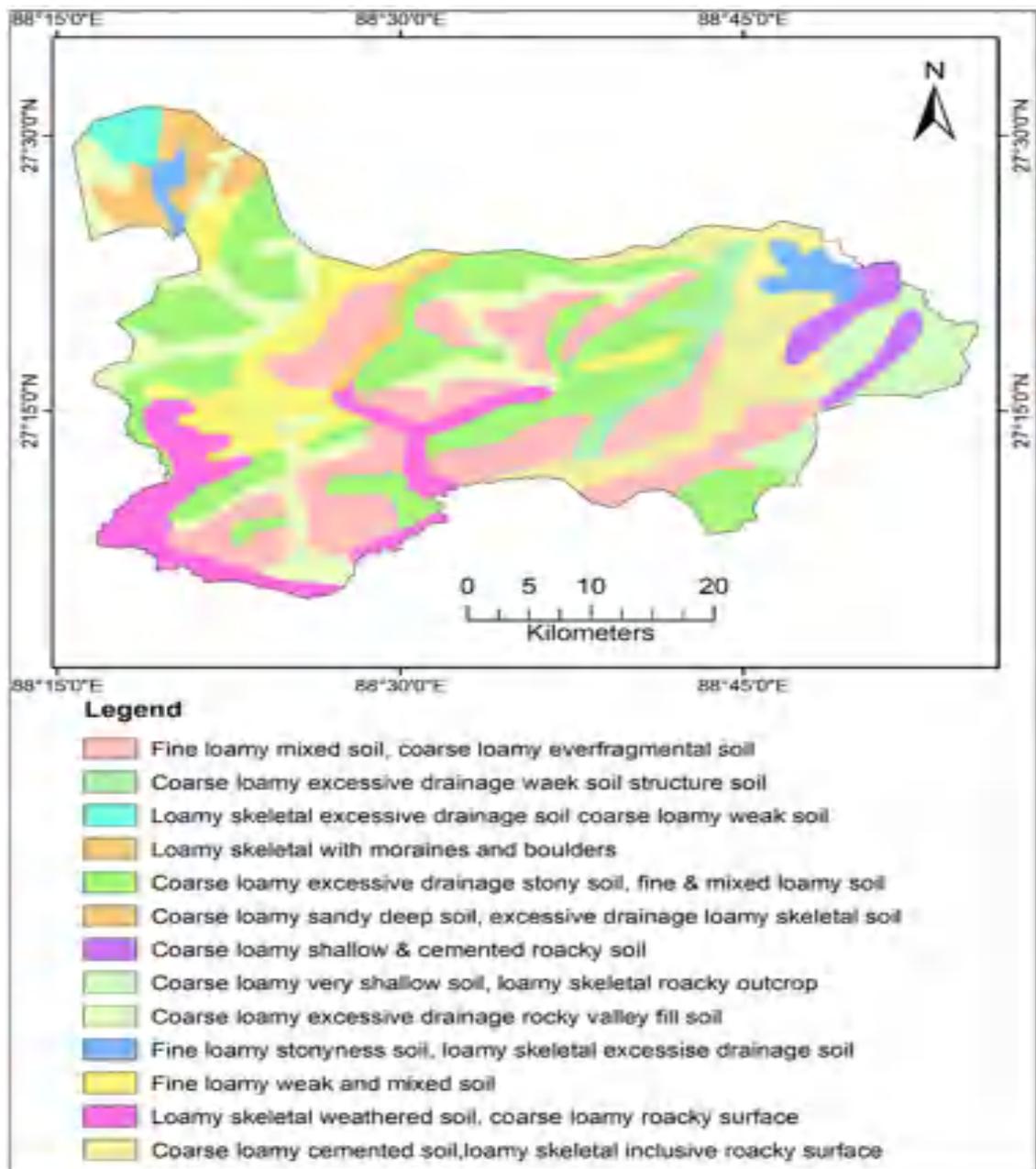


Figure 2.9 Soil cover map of the study area

2.2.6 Vegetation

Sikkim is a part of the Indo-Burmese biodiversity hotspot and has unique geographical features having wide range in altitude, high precipitation, etc., which make it home to a rich diversity of flora and fauna from tropical region to arctic region differing from valley to valley (Rai and Rai, 1994). The state has 46% of its total geographical area under the forest cover and the study area has more than 75% of vegetal cover. There is a record of over 450 tree species, 36 species of rhododendrons, 500 species of medicinal plants, 523 orchid species, 362 species of fern and its allies, 8 tree fern

species, 11 oak species, 16 conifer species, 23 bamboo species, 60 primula species and 150 species of wild edible plants in the state (Rai and Rai, 1994). Sikkim is famous for its orchids and rhododendrons; it occupies 72% of the rhododendron species of the country. For having various potential biological resources, Sikkim offers greater possibilities for nature-based initiatives to people (Badola and Aitken, 2010).

The major factors controlling the vegetation of the state are: (Biswas, 1967)

- ❖ Climatic conditions such as temperature, rainfall, soil, humidity and moisture.
- ❖ Relief including steepness of slope, terrain etc.
- ❖ Geology such as rock structure, morphology, rock formation and property of porosity, permeability, softness and hardness.
- ❖ Latitudinal and altitudinal variation.
- ❖ Soil fertility, soil nutrients, and its chemical composition.

In terms of vegetation the state is very high in both luxuriance and diversity. The important genera and species of gymnosperms in the state are *Pinus*, *Psunga*, *Abies*, *Yeas*, *Larix* and *Junipers* (Tambe and Rawat, 2010). The dominant flowering plants are *Rosaceae*, *Graminae*, *Rubiaceae*, *Labiatae* and *Orchdiceae* (Singh and Chauhan, 1997). The vegetation of the state can be classified according to altitudinal variation (Forest and Environmental Department, Govt. of Sikkim, 2018).

The following table shows the classification of vegetation on the basis of altitudes.

Table 2.6 Classification of Vegetation on the basis of altitude

Sl. No.	Zones	Altitude
1	Tropical	Upto 800 m above Mean sea level
2	Sub-tropical	From 800 – 1500 m above Mean sea level
2	Temperate	From 1500 – 3500 m above Mean sea level
3	Alpine	Above 3500 m above Mean sea level

Sources- Sikkim, A Statistical Profile 2006-07.

Table 2.7 shows that 982 sq. km. area is under dense forest which is 58.65% of the study area. whereas, sparse vegetation covers an area of 298.37 sq. km. (17.80%). Barren land and snow cover occupied 376.14 sq. km. (22.44%) and water body covered 18.46 sq. km. which is only 1.10% of the study area. Most of the study area has dense vegetal cover in all over the area. Sparse vegetation is found in the marginal eastern and western parts of the study area. Barren land and snow occupied the area near eastern and north-western boundary of the study area. Availability of water bodies is found in far marginal north-eastern and north-western parts of the study area.

Table 2.7 NDVI value and Class type

SL No.	Landsat 8 OLI/TIRS	Class type	Pixels	Area in sq km	Percentage
1	-0.19 to 0.0	Water body	20514	18.46	1.10
2	0.0 to 0.18	Barren land, snow cover	417931	376.14	22.44
3	0.18 to 0.3	Sparse Vegetation	331520	298.37	17.80
4	0.3 - 0.61	Dense Vegetation	109213	982.92	58.65

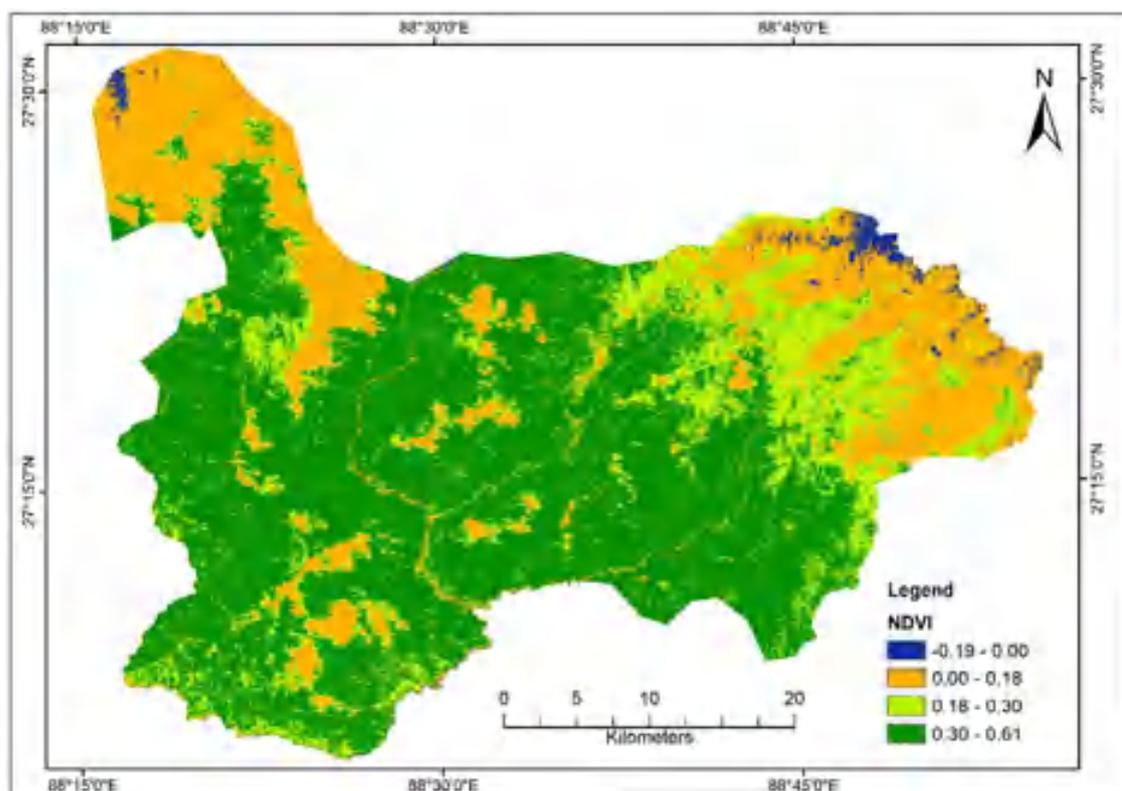


Figure 2.10 Vegetation cover of the study area

2.5 Socio-Cultural Characteristics

2.5.1 Population of Sikkim – An overview

Sikkim has recorded a total population of 610577, which amounts to 0.05% of the total population of the country. It occupies 0.22% of the total geographical area of India. The total population of Sikkim in 1891 was recorded at 30468, which grew up upto 610577 in 2011. The annual growth rate of India records 1.81%, which is higher than Sikkim during 2001-2011, which is 1.24%. The sex ratio has considerably reduced from 912 females per thousand males in 1891 to 889 in 2011. Literacy rate of the state is 81.42%

which is higher than the national average. The rate of urbanization is very high, which grew to 25.15% in 2011 from 11.11% in 2001(Census of India, 2001 & 2011).

Table 2.8 Total Population of the study area at each census from 1971 to 2011

Year	South			East		
	Total	Rural	Urban	Total	Rural	Urban
1971	53185	51963	1222	85621	68602	17019
1981	75976	70611	5365	138762	95520	43242
1991	98604	96035	2569	178452	146580	31872
2001	131525	127579	3946	245040	192188	52852
2011	146850	125651	21199	283583	161096	122487

Source: Census of India, 1971 to 2011

Sikkim has recorded 20 times growth of population from 1891-2011. For the last three decades rapid growth has taken place. State population alarmingly went up to 610577 in 2011. The natural increase however is not accelerated with growth. The rapid rate of growth is due to influx but birth and death rates have been reduced in the year 1981. Birth rate was 31.0 per thousand in 1981, which was reduced to 24.3 per thousand in 1991, then from 22.1 to 17.4 per thousand respectively during the decade 2001 - 2011. The high growth rate recorded during the decade 1971-1981 may be attributed to its merger in Indian Union. The district level decadal variation shows rapid expansion in population in the eastern region, wherein the population of 85621 in 1971 suddenly went up 178452 in 1991 and 283583 in 2011. Same trend is followed in the south district where the population of 53185 in 1971 suddenly went up to 98604 in 1991 and 146850 in 2011(Table 2.8 & Figure 2.11).

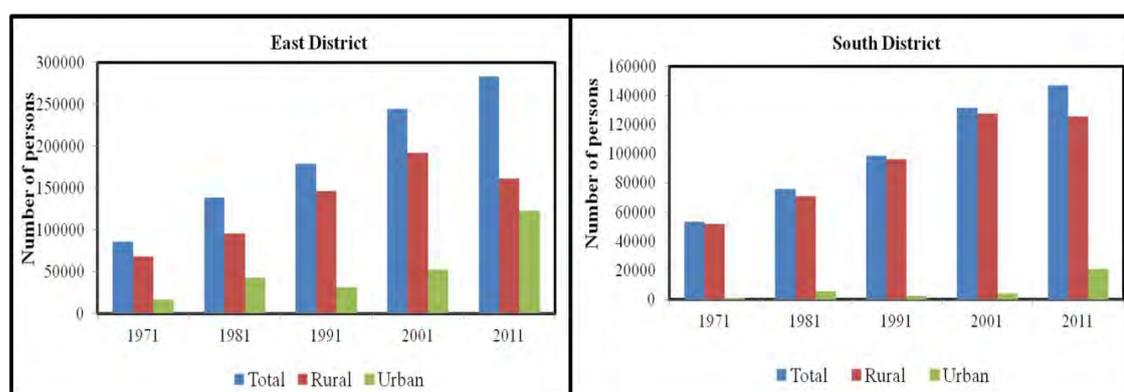


Figure 2.11 Total population of the study area (1971-2011)

2.5.2 Growth of Population

The population dynamics from 1891 to 2011 exhibit a growth of 20 times in Sikkim. It is mainly due to rapid natural growth of population and migration. For the past three decades there has been uncontrolled growth of population.

During the decade of 1971-1981 substantial increase at a rate of 5.07% per year was noticed in the urban areas. This could be mainly due to in-migration that took place after 1975 when a large number of job hunters poured into the state to work in various developmental activities like road constructions and hydro power projects etc. In the year 1981-1991 the population grew at a lower rate of 2.85% per year. However, in the year 1991-2001 growth rate was high at 3.29% per year (Table 2.9). This increase may not be the natural increase in population rather it could be due to in-migration to work in various developmental activities like road constructions and hydro power projects undertaken by the NHPC (Sharma and Pandey, 2017).

Table 2.9 Decadal growth of Sikkim and the Study area during 1971 - 2011

Decade	Sikkim	South	East
1971-81	50.77	62.07	42.85
1981-91	28.47	28.6	29.78
1991-01	33.06	37.31	33.39
2001-11	12.89	15.73	11.65

Source: Directorate of Economics, Statistics, Monitoring & Evaluation, Govt. of Sikkim (1971-2011)

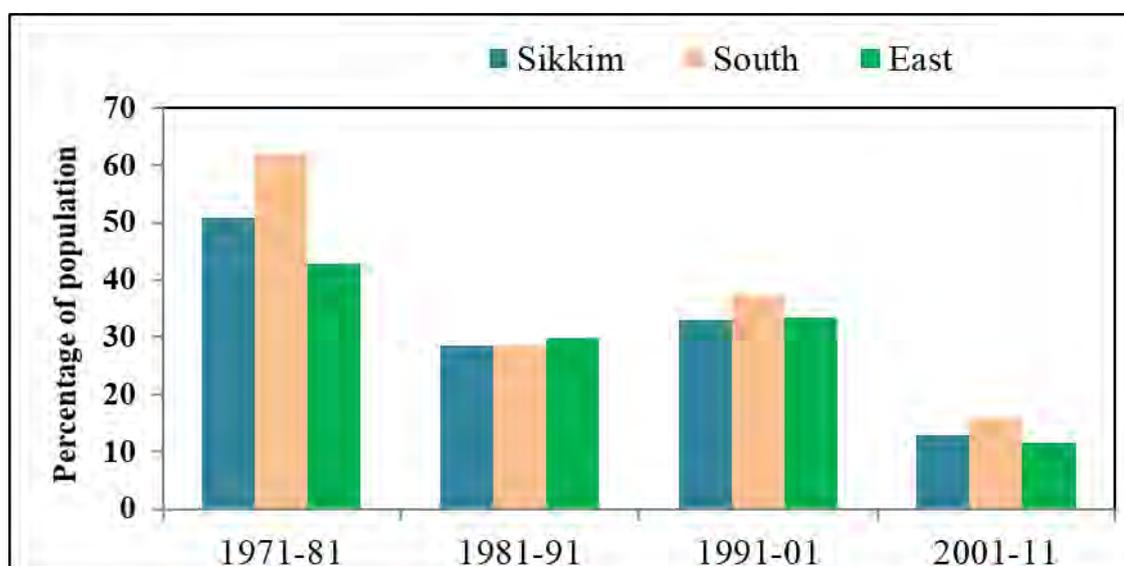


Figure 2.12 Decadal growth of population (1971-2011)

2.5.3 Distribution of Population

According to the 2011 census, the total population of the state of Sikkim is 610,577 which is 43,709 in the North District, 136,435 in the West District, 146,850 in the South District and 263,583 in the East District (Census of India, 2011).

Of this total population, 74.85% of the state population lives in rural areas and 25.15% of the state's population lives in urban areas (Census of India, 2011). In case of districts' distribution, in the South district, 85.56% of the population lives in rural areas and the remaining 14.44% live in the towns of Namchi (MC) and Jorethang (NP). Similarly, 56.81% of the population in the East District live in rural areas and 43.19% in urban areas in Gangtok (MC), Singtam (NP), Rangpo (NP) and Renak (CT). The high percentage of urban population in the East district caused by the four urban centres, (including Census Town) which are belong to East district. During the decade of 2001-2011, the rural and urban population grew by -4.99% and 156.52% respectively (Census of India, 2011).

With the exclusion of 51 forest blocks or villages of the state, out of 400 revenue blocks or villages, 136 are in the South district and 107 are in the East district. In addition to the revenue block, there are 51 forest blocks of which 2 (50.96%) are uninhabited. According to the definition of Census Town in the census of 2011, there are 34 large Revenue Blocks having above 2000 population of which 7 are in the South district and 13 are in the East district. There are only 3 Revenue Blocks which have a population above 5,000 and they fall in the East district only (Census of India, 2011).

2.5.4 Decadal changes of population

Decadal changes of population in the study area and also in the state have a peculiar scenario. During the decade 2001 – 2011, the decadal growth rate of the state is 12.9%, but in urban areas of the state it is 156.5%, whereas in rural areas it is -5.0%. On the other hand, in the East district, decadal variation of population during 2001 – 2011 is 11.7, while it is 131.8% in the urban areas of the district and -16.2% in the rural areas. Decadal variation in the South district of Sikkim has dramatically changed during 2001 – 2011 (Table 2.10). In the urban areas of the district, the percentage of decadal variation is 437.2% over the decade 2001 – 2011. So, it reveals that the massive population growth in the urban areas of the study area as well as in the state is the cause

of in-migration. High density of population in the urban areas of the study area is mainly due to the influx of in-migrants into the study area.

Table 2.10 Decadal changes in the study area by residence, 2011

State / District	Population 2011			Percentage decadal change 2001-2011		
	Total	Rural	Urban	Total	Rural	Urban
Sikkim	610577	456999	153578	12.89	-5.0	156.5
South District	146850	125651	21199	11.65	-1.5	437.2
East District	283583	161096	122487	15.73	-16.2	131.8

Source: Census of India, 2001 & 2011

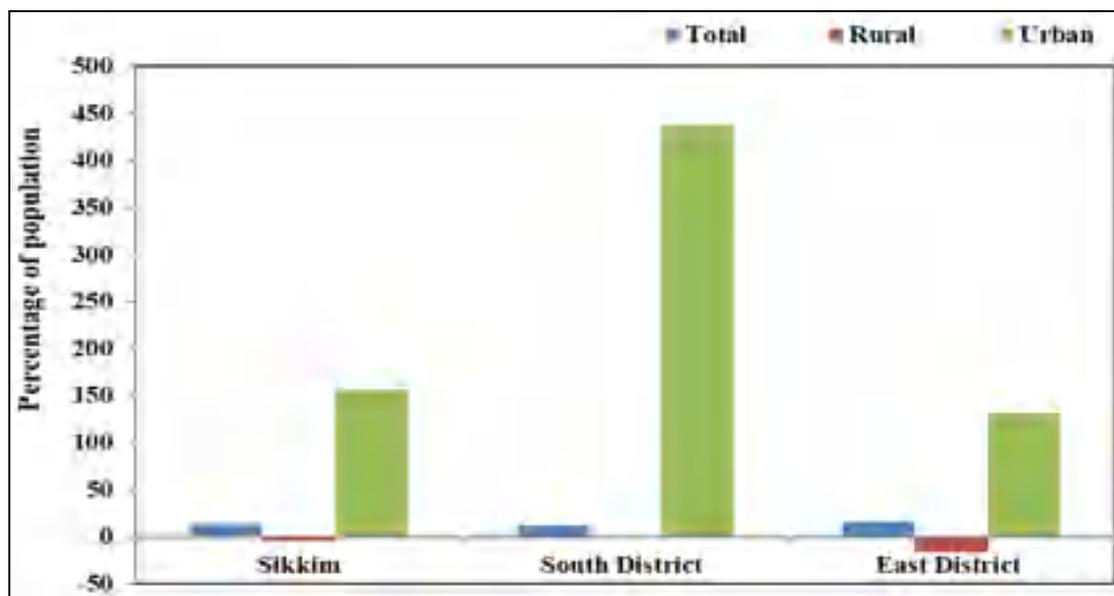


Figure 2.13 Decadal changes of the study by residence (2001-2011)

2.5.5 Density of Population:

The number of persons per sq. km estimates the density of population. The density of population in Sikkim is 86 persons per sq. km which is lower than the national average. The main features of the district showed that density in all the districts has gone up and highest density 297 persons per sq. km is recorded in East district followed by South and West districts which are 196 and 117 persons per sq. km. respectively (Figure 2.14). North Sikkim exhibits 10 persons per sq. km. which could mainly be due to adverse climatic conditions characterized by forest and snow cover.

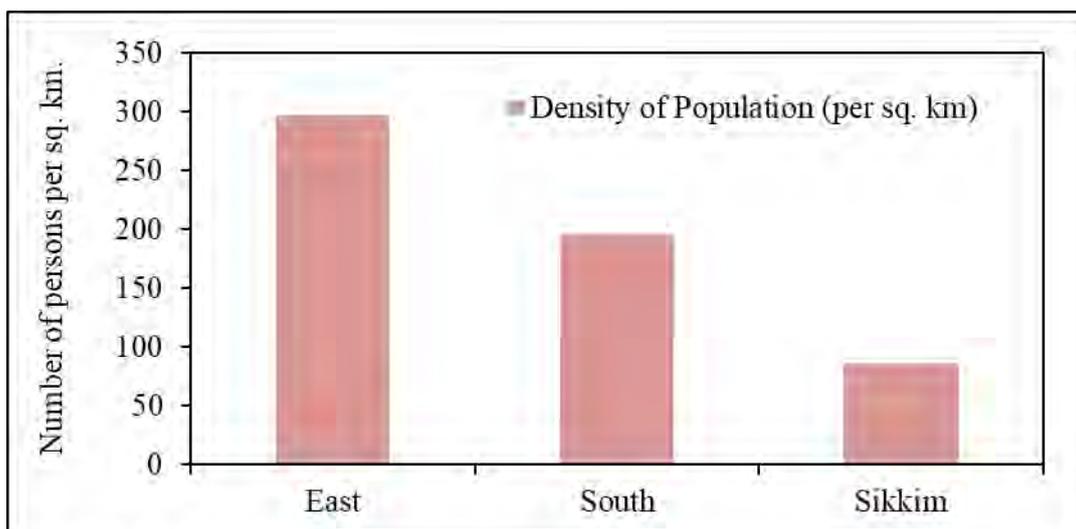


Figure 2.14 Density of population

2.5.6 Distribution of Schedule Caste and Scheduled Tribe population

Distribution of the scheduled caste and scheduled tribe population of Sikkim has a great disparity. Scheduled caste population of Sikkim occupies only 4.6% of the total population; in rural areas it is 4.4% and in urban areas it is 5.2%. Distribution of Schedule Caste population of the state occupies only 4.5% and 4.8% of male and female population respectively (Table 2.11). Schedule Tribe plays an important role in the state. 33.80% population is scheduled tribe population in the state. In the urban areas of the state it is 25.5%, whereas in rural areas 36.60% population belongs to the Scheduled Tribe population. Among the total population of the state 32.60% of the population are male and 35.20% of the state population are female (Figure 2.15).

Table 2.11 Distribution of Schedule Caste and Schedule Tribe population of Sikkim by Sex and residence

Social group	Particulars	Number of persons		
		Total	Rural	Urban
Schedule Caste	Persons	28275	20335	7940
	Male	14454	10496	3958
	Female	13821	9839	3982
Schedule Tribe	Persons	206360	167146	39214
	Male	105261	86059	19202
	Female	101099	81087	20012

Source: Census of India, 2011

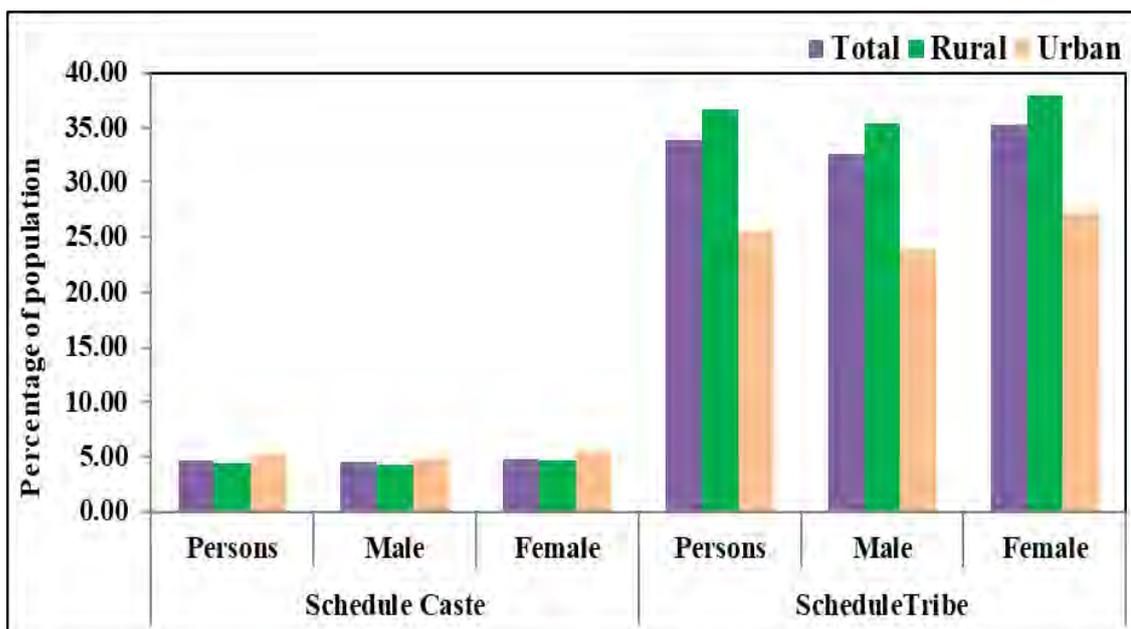


Figure 2.15 Distribution of Schedule Caste and Scheduled Tribe population

In East district of Sikkim, total scheduled caste population is only 5.4% and among them 5.11% is male and 5.72% is female population of the district. On the other hand, the Scheduled Tribe population of the district occupies 27.66% of the district's total population, out of which 26.07% is male population and 29.48% is female population of the district. About 4.12% of the total population in the South district is Schedule Caste, among which 3.99% is male and 4.27% is female population of the district. However, Schedule Tribe population occupies 28.19% of the total district's population, the sex break up being 28.12% male and 28.26% female population of the district (Table 2.11).

2.5.7 Sex Ratio

India has experienced ever declining sex ratio with the only exception years 1901-1911, 1911-1921 and 2001-2011. An uneven sex ratio is recorded in Sikkim. The sex ratio of Sikkim is 890 in 2011 which has slightly increased from 875 in 2001. The district wise sex ratio reveals the record increase of sex ratio in the East district, from 797 in 1981 to 859 in 1991 and from 844 in 2001 to 872 in 2011; South district of Sikkim has recorded slight decline in sex ratio from 909 in 1971 to 854 in 1981 and from 927 in 2001 to 915 in 2011 (Table 2.12). It's mainly due to the more female migrant workers working in the agricultural activities in the south district.

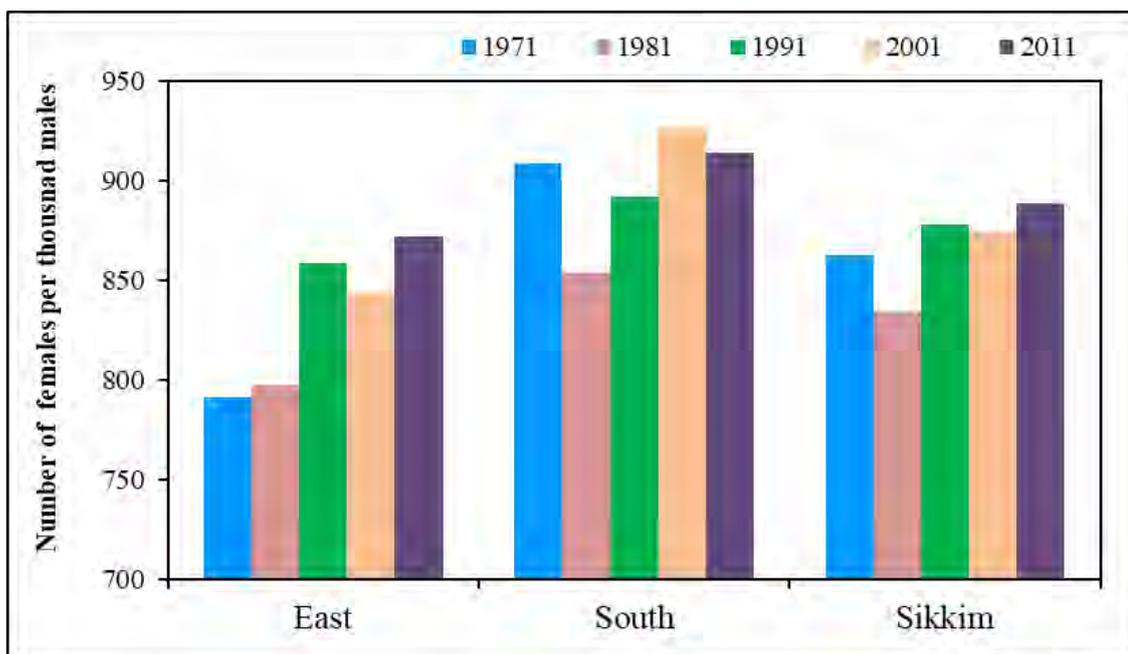


Figure 2.16 Sex ratio of the study area (1971-2011)

Table 2.12 Sex-Ratio for State and the study area: 1971-2011

Sl. No.	Districts	Sex-Ratio (Number of Females per thousand Males)				
		1971	1981	1991	2001	2011
1	East	791	797	859	844	872
2	South	909	854	892	927	914
3	Sikkim	863	835	878	875	889

Source: Census of India, 1971 - 2011

2.5.8 Education

Progress and development of a nation depend on the total number of literates contributing to productive human resources.

Table 2.13 Literacy of Sikkim and the study area, 2011

District/ State	Rural			Urban			Total		
	Male	Female	Total	Male	Female	Total	Male	Female	Total
East	67501	48390	115891	53844	44594	98438	121345	92984	214329
South	50339	39427	89766	9018	7957	16975	59357	47384	106741
Sikkim	184245	137685	321930	67024	55998	123022	251269	193683	444952

Source: Census of India, 2011

*Literacy rate is the percentage of literates to the total population aged 7 years and above.

The state has 81.42% literates in 2011 which reveals the trend of increase in 1981, 1991 and 2001. The percentage of increase was 22.20%, 46.76% and 69.68% respectively.

The literates in urban centres constitute 84.82% which has increased from 69.85 % and the number of literates in rural areas constitutes 67.67% which subsequently increased from 44.14%. It is revealed that the highest literacy rate is recorded in the East district with 83.85% followed by the South district with 81.42%. Gender wise rate of literacy in Sikkim as well as in the study area is in a far better position. 86.55% and 75.61% among the males and females are literate respectively in the state. 88.47% of males population and 78.5% of females population are literates in the East district, whereas 86.52% of males and 75.82% of females population are literates in the South district (Figure 2.17). High urban and rural literacy rate of the study area as well as the state plays a significant role in the education system and socio-economic development (Table 2.13). Sikkim is positioned better than the national standard in rates of literacy in all the categories.

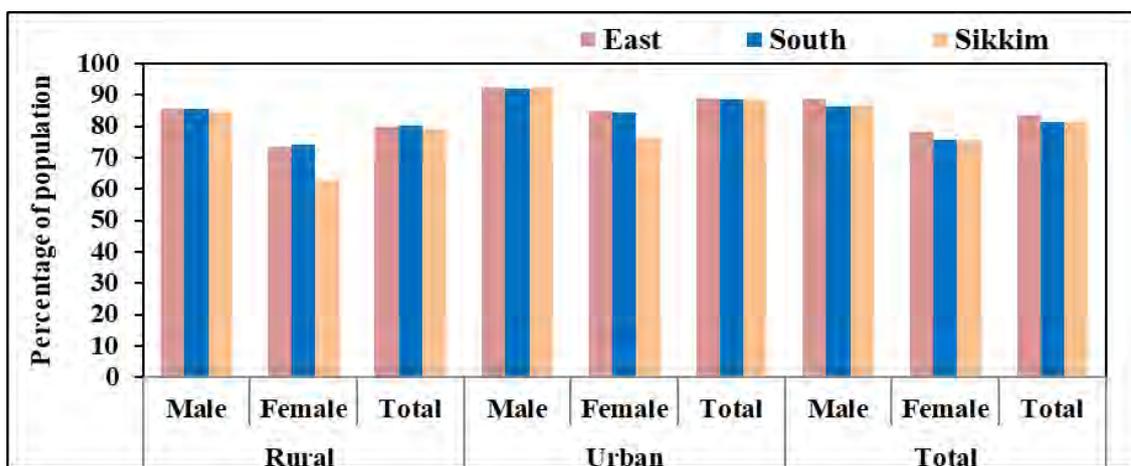


Figure 2.17 Literacy rate of the study area

2.5.9 Occupational structure

The concept of occupational structure is associated with productivity, GDP and economic activities (Datt and Sundaram, 2017). It is an indicator of economic development of a state. The percentage and rate of workforce availability in a given region describe the degree of wellbeing of that region (Agarwal, 2009). Further quality of human resources and its economic importance also are the indicators of development (Grip et al., 1988). Occupational structure of a place may be distinguished as workers and non-workers; the workers can be further classified into main workers and the marginal workers (Chandna, 2006). A person who has worked for a period of 6 months or more is treated as a main worker and the one who has worked for a period of less than six months is a marginal worker. A non-worker is the one who has not worked for any of the above two periods (Maurya, 2014).

Table 2.14 Economic classification of population of Sikkim during 1981 - 2011

Sl. No.	Particulars	1981	1991	2001	2011
1	Population	316385	406457	540493	610577
2	Cultivators	88610	97834	131422	117401
3	Agricultural Labourers	4887	13793	16939	25986
4	Worker in Household Industry	1586	1309	3250	5143
5	Other Workers	52353	55785	111709	159608
6	Non-Workers	163571	237736	277173	302439

Source: Sikkim: a statistical journal, 2013

Note: 2, 3, 4, & 5 = Main + Marginal workers

There are some variations in the occupational structure of the workforce of Sikkim. During 1981 to 2011, the working population of Sikkim in different categories fluctuated in decade by decade. The cultivators, agricultural labourers, household industrial workers and other workers are the main and marginal workers. Table 2.14 shows the total workers along with different class and non-workers of Sikkim during the census 1981 to 2011. The working population of Sikkim in different categories has fluctuated in decade by decade and nature has changed from cultivators to other workers. It is the main reason for in-migrant workers in the study area.

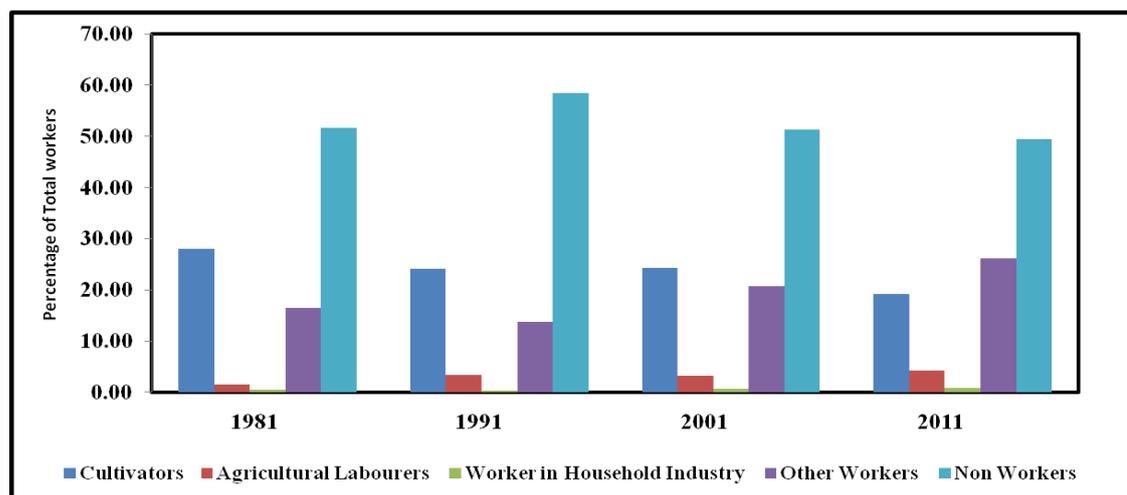


Figure 2.18 Economic classification of population of Sikkim

The total population of East district is 283583 of which 49.25% are working population, out of which 39.16% are main workers and 10.09% are marginal workers. On the other hand, the total population of South district is 146850 of which 50.9% are working population, out of which 34.66% are main workers and 16.24% are marginal workers (Table 2.15). It reveals that the percentage of workers in the East district is below fifty percent which is also below the state average, whereas in the South district

workers are more than fifty percent and also above the state average, which indicates the unemployment is one of the main issues in the East district.

Table 2.15 Distribution of workers and non-workers of the study area, 2011

District/ State	Main Workers		Marginal Workers		Non-workers		Total Population
	Number	%	Number	%	Number	%	
East district	111058	39.16	28620	10.09	143905	50.75	283583
South district	50898	34.66	23855	16.24	72097	49.10	146850
Sikkim	230397	37.73	77741	12.73	302439	49.53	610577

Source: Census of India, 2011



Figure 2.19 Distribution of workers and non-workers

Table 2.16 Distribution of population over different categories of worker in the study area, 2011

District/ State	Total Workers (TW)		Class of total workers							
			Cultivators		Agricultural laboureres		Household Ind. Workers		Other workers	
	Number	%	Number	% to TW	Number	% to TW	Number	% to TW	Number	% to TW
East	139678	49.25	31489	22.54	11483	8.22	2404	1.72	94302	67.51
South	74753	50.9	37802	50.57	4188	5.6	1004	1.34	31759	42.49
Sikkim	308138	50.47	117401	38.1	25986	8.43	5143	1.67	159608	51.8

Source: Census of India, 2011

Different categories of workers in the study area show a peculiar scenario in the occupational structure. Though Sikkim is a hilly state, there are problems faced by the cultivators, but the scenario of the South district reveals that agriculture is the mainstay of the district. Total workers of the South district are 74753 of which 57.17% constitute both cultivators and agricultural labourers, whereas, in the East district it is only 30.76% among the total working population of 139678. The East district of the state

has 67.51% workers who are engaged in other sectors of the economy, whereas in the South district it is 42.49%. As compared to the state, the cultivation sector is more developed in the South district, but in the East district it is below the state average (Table 2.16).

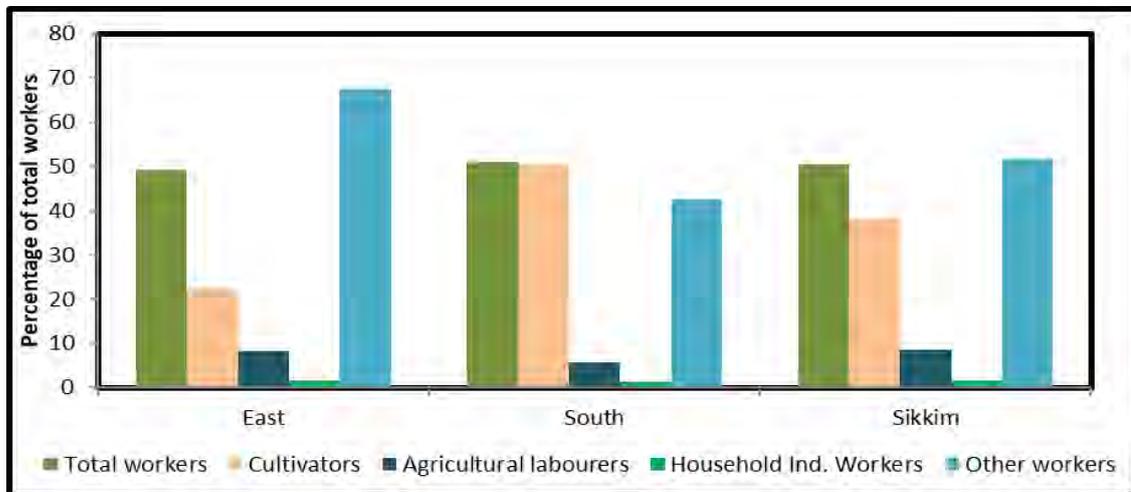


Figure 2.20 Categories of workers in the study area

2.5.10 Ethnicity

The study of specific communities reveals that the developmental activities take place in accordance with their prevailing indigenous knowledge system (Schelling, 1975). An attempt has been made to elucidate the socio-cultural set up of the three communities in Sikkim. Ethnic variations are guided by religious philosophy of an individual. Some communities are nature worshippers and their guardian deities are rivers, mountains etc. that help preserve the mountain environment to a great extent.

2.5.10.1 The Lepchas

"*Rongkup*", denotes *the son of the snowy peak* called by The Lepchas themselves are the indigenous settlers of Sikkim (Gurung, 2011). Anthropologists and historians are still debating regarding the origin of the Lepchas, whether they are belonging to the Naga tribes or are linking with the *Jimdars* and *Mech* (Thapa, 2002). Some academicians have found few likeness between the Lepchas and the tribes in Arunachal Pradesh. However, some others argued that they are associated to the Khasis in Meghalaya (Bhutia, 2015). Lepchas dominated Sikkim around 1425 A.D. (Sinha, 1975). The King of Lepcha society is well known as *Panu* (Dahal, 1984). The Lepchas themselves are convinced that their home has usually been the mythical kingdom of *Mayel* in the region of Mt. Kangchendzonga (Gurung, 2011). In truth, most

Lepcha clans claim to have legendary connections with unique mountain peaks which they worship as their deity. Hence, the mountains Simvo, Siniolchu and Kangchendzonga locate prominence inside the Lepcha tradition (Subba, 2008).

The Lepchas have their personal language and script. The Lepcha language is one of the 11 respectable languages recognized by way of the Sikkim authorities and is taught as much as the high faculty stage. The Lepcha dances, songs and folk tales mirror a superb synthesis among guys and nature (Subba, 2008).

2.5.10.2 The Bhutias

The Bhutias are specially descendants of the early settlers in Sikkim from Tibet and Bhutan who accompanied the ancestors of the first Chogyal, Phuntsok Namgyal (Chhetri, 2010). The members of the previous Namgyal dynasty belong to this ethnic organization (Dahal, 1984). The early Bhutias had distinctive social training-nobility-the aristocracy and the quasi aristocracy – those belonging to the main Bhutia households who have been land holders and have been called Kazis- and the commoners (Shreatha, 2015).

Tibetan Buddhism played a unique function in shaping the Bhutia society. The monasteries and the priests are the pivot around whom their day by day lives revolve (Singh, 1993). Every family ritual, marriage, beginning, death ceremonies and agricultural rites are carried out through the monks from the Gompas which might be prominent in all the Bhutia and Lepcha villages (Subba, 2008). Just like the Lepchas and the Nepalese, the Bhutias love their "chang", the nearby brew. This instruction from fermented millet is served in bamboo boxes (Gurung, 1911).

It has come to be a critical a part of every Sikkimese ceremony, whether or now not spiritual or secular. The Bhutias are famous for their weaving, timber carving and the Thangka painting. The hand-woven rugs, carpets and blankets and the extremely good Thankas displayed in the state Handicraft Centre at Gangtok are evidence of this ability (Arora, 2006).

The critical festivals found with the aid of the Bhutia network consist of Losoong, Pang Lhabsol, Kagyat dance and Saga Dawa (Singh, 1993).

2.5.10.3 The Nepalese

The Nepalese community of Sikkim is itself a conglomeration of various ethnic organizations, some speakme their personal vernacular (Gurung, 2011). Nepali is the

lingua franca of all of the Sikkimese humans (Thapa, 2002). These ethnic groups may be more or less divided between the Tamangs, Limbus, Margars, Gurungs, Murmis, Rais and the Chhetris (Karan and Jenkins, 1963).

Most of the Nepalese are Hindus or Buddhists. a number of them have additionally adopted Christianity. The Hindu Nepali population of Sikkim follows the ethos which governs its opposite numbers someplace else within the country (Subba, 2008).

Each ethnic group among the Nepali community have been known for their courage and a large number of them have served as Indian armies. The major festivals of the Hindu Nepalese in Sikkim are *Makar Sankranti*, *Teohar*, *Dasain* and *Baisakh* (Sharma, 1983).

Sikkim is one of the non-violent states in the country and the ethnic groups with their different languages, dialects, cultural backgrounds stay in general harmony, symbolizing the essence of team spirit in range (Datta, 1992). Just like the rainbow with its stunning multi-coloured shades, the humans on this small Himalayan kingdom have set an example as to how unique ethnic organizations can coexist and mingle with each other in overall peace and tranquillity (Bhasin, 2002).

2.5.11 Health

Prior to its amalgamation with the Indian Union in 1975, Sikkim had only one major hospital - Gangtok Sir Tashi Namgyal Memorial (STNM) Hospital, which was established in 1917 with 50 beds and three doctors and later expanded with some special departments and increased with 330 beds in 2015 (Tamang et al., 2016). The disadvantage with the terrain, which increases the unit cost of service delivery, as well as the constraints of resources also have their impact on unhealthy targets in the state. The progress that has been made since consolidation is still commendable. It must be commended that only 0.04 per cent of the state budget resources were allocated for health in 1980, the allocation was increased to 0.43 per cent in 1990 and another 5 per cent in 1998 (Tamang et al., 2016). Since 1975, there has been considerable expansion of public health infrastructure. It has made Sikkim perhaps the only state in the country to achieve the national standard of establishing 1 primary health centre for 20,000 people and 1 PHSC for 3,000 people (Tamang et al., 2016).

Table 2.17 Number of Health institutions of Sikkim and study area

District/ State	East	South	Sikkim
Total Population	283583	146850	610577
State Referral Hospital	1	0	1
District Hospital	1	1	4
Community Health Centre	1	1	2
PHC	6	6	24
PHSC	48	39	147
District TB centre	2	1	5
Centre Referral Hospital	1	0	1
Total	60	48	184
Health Institution facilities per 10000 population	2.116	3.269	3.014

Source: Department of Health, Government of Sikkim, 2018

The state has established a well-functioning primary health care system through a network of two Community Health Centres, 24 Primary Health Centres and 147 Primary Health Sub centres. Health care provided in the study area is far appreciable. Only 1 State referral hospital (STNM Hospital) is located in the East district of the state. 1 District Hospital (DH) has been established in the East and South districts each. State has only 2 community health centres, which are located in the study area. Each district of the study area has 1 community health centre. Out of 24 Primary Health Centres (PHC) of the state both East and South districts have 6 PHCs each. Out of 147 Primary Health Sub Centre (PHSC) of Sikkim, East district of Sikkim has 48 PHSCs and South district of Sikkim has 39 PHSCs. Among the 5 District Tuberculosis Centres of the state, East and South districts of the state have 2 and 1 number of District Tuberculosis Centres respectively (Table 3.17). Health care in Sikkim is provided almost entirely by the public sector. Except for the Sikkim-Manipal Central Referral Hospital, this is developed at Tadong, Gangtok. It's only the health establishment in the state which developed under Public Private Partnership (PPP) and provides secondary and tertiary care (Department of Health, Govt. of Sikkim, 2019).

Health institution facilities among the citizens of the state are little better in position compared to the national average. Health institutions that are available in the

East district have a proportion of 2.12 per 10000 persons of the district. South district of Sikkim has 3.27 health institutions per 10000 population of the district, whereas in the state of Sikkim, the availability of the health institution is 3.01 per 10000 citizens of the state (Table 2.17).

Table 2.18 Availability of health facilities (bed) in different health institution of Sikkim and study area

District/ State	East	South	Sikkim
Total Population	283583	146850	610577
State Referral Hospital Bed	300	0	300
District Hospital Bed	100	100	400
Community Health Centre BED	30	30	60
PHC Bed	60	60	240
District TB centre Bed	15	30	55
Centre Referral Hospital Bed	500	0	500
Total	1005	220	1555
Health Institutions' Bed facilities per 10000 population	35.44	14.98	25.47

Source: Department of Health, Government of Sikkim, 2018

A total of 1555 hospital beds in the state are available including all the health institutions. Among these 1555 hospital beds of the state 1005 hospital beds are available in the East district of Sikkim and 220 hospital beds are available in the South district of the state. The Government of Sikkim is also constructing its own state-of-the-art tertiary care hospital, with over 575 beds. The hospital compound also houses a nursing college, AYUSH hospital, cancer care and rehabilitation centre within the premises.

Availability of beds in state health institutions is quite appreciable in the study area. In the East district of Sikkim, the availability of beds in the state institutions is far better than the other districts as well as the state. Availability of the beds in the health institutions is 35.44 per 10000 population of the district, whereas availability of beds in the health institutions of the South district of Sikkim is only 14.88 per 10000 population of the district, it is very poor in condition compared to the state average. The availability of the beds in the health institutions of the state is 25.47 per 10000 population of the state (Table 2.18).

Table 2.19 Allopathic and AYUSH doctors in position in Sikkim and study area

District/ State	East			South		Sikkim
Total Population	283583			146850		610577
Particulars	STNM	DH	PHC	DH	PHC	
Chief Consultants/ Specialists	77	16	4	18	3	139
Doctors	41	9	7	15	10	113
MO (Specialists) (Contractual)	0	1	0	3	0	6
MO (Contractual)	1	1	3	1	1	15
MO (AYUSH)	3	3	2	2	1	15
Total	122	30	16	39	15	288
District Total	168			54		
Doctors' facilities per 10000 population	5.920			3.680		4.717
Average no. of persons served by Doctors	1688			2719		2120

Source: Department of Health, Government of Sikkim, 2018

In the whole of Sikkim, 288 doctors are available for the public health service in the state including both Allopathic and AYUSH doctors along with specialists and others. Among the 288 doctors in the state, the East district has 168 doctors including STNM, DH and PHC, whereas the South district of the state has only 54 doctors in DH and PHC including Allopathic and AYUSH doctors. Among these doctors some have served the public health issue on the contractual basis.

The scenario of the doctors in Sikkim is not impressive in numbers. The state of Sikkim has 4.72 Government doctors for the per 10000 population of the state. But it is little better in the East district of Sikkim, which is 5.92 Government doctors per 10000 population of the district. On the other hand, in the South district, the availability of Government doctors is 3.68 per 10000 population of the district, which is far inadequate to the state average.

Average numbers of persons served by Government doctors are quite adorable in the state of Sikkim. As per Table 2.21, 1 Allopathic or AYUSH doctor served 2120 persons in the state. In the East district it is 1688, which is far ahead from the state figure. But, in the South district of Sikkim, the scenario of the health services by the Government doctors is inadequate to the state average, which is 2719 (Table 2.19).

It is found from the above discussion that the study area of the state is much better in position in terms of health facilities in the state. This is one of the main pull factors to attract migrants in the study area. Statistics reveal that in-migrants in the state are large in numbers and the rate of in-migration in the East district is high

followed by the South district of the state. Health infrastructure in the study area is one of the main reasons of in-migration.



Plate 2.1 Health facilities in the study area at a.Singtham b. Namchi c. Jorethang and d. Namchi

2.5.12 Land use

Like different hilly and mountainous areas, the query of land has been relevant to the political financial system of Sikkim, due to the fact it's far scarce and additionally because of historical elements (Rai et al., 1994). the first clinical survey of land in Sikkim changed into accomplished in 1950-58, the usage of the British dimension system of acres and miles. the second survey become accomplished in 1976-83 using a metric gadget of hectares and kilometres and the survey blanketed all the regions of the state (Bhutia, 1996).

Table 2.20 Land use Pattern of Sikkim in 1981 and 1991

Sl.No	Classification of land	1980-81		1990-91	
		Hectares	(%)*	Hectares	(%)*
1	Net Area Sown	78,381	11.04	63,254	8.91
2	Area under current fallow	4,428	0.62	3,906	0.55
3	Other uncultivated area excluding fallow land	4,560	0.64	10,830	1.53
4	Fallow other than current Fallow	9,474	1.34	9,204	1.30
5	Cultivated wasteland	681	0.01	9,807	1.38
6	Land not available for cultivation	11,604	1.64	14,300	2.02
Total		109,128	15.37	111,301	15.69

Source- Human Development Report 2001

* indicates the percentage distribution of different land use particulars.

The total geographical area is 709,600 hectares. The availability of land in under mentioned items in Table 2.20 in 1991 was 15.69% instead of 15.37% in 1981, there was 0.32% increase in availability of land in 1991. But there was decrease in net sown area under current fallow, other uncultivated area excluding fallow land and fallow land other than current fallow because of increase in population and cardamom farming in rural sector, somehow global warming is also responsible for the low snowfall in high altitudes which cause the decrease in net snowfall area. Due to the mountain region the heavy rainfall breaks the formation of step land by landslide which causes the availability of land for cultivation.

Table 2.21 District wise land use pattern of the study area for the year 2005-06

Sl. No.	Particulars	East (in hectare)	South (in hectare)	State (in hectare)
1	Irrigated	2532.14	2104.62	7643.23
2	Un-irrigated land	9475.46	15435.7	39304.5
3	Non-Agricultural Land	3277.15	2754.33	9766.67
4	Forest/Jungle/ Bushes	9112.07	2519.7	16448.9
5	Cardamom Field	3795.76	4515	19587.9
6	Grassland	1652.96	1209.11	4145.1
7	Barren Land	8178.6	2086.54	13817.3
8	Uncultivated Fallow Land	787.21	1003.67	3661.25
Total		38811.4	31628.7	114375

Source: Statistical Profile of Sikkim 2006-07

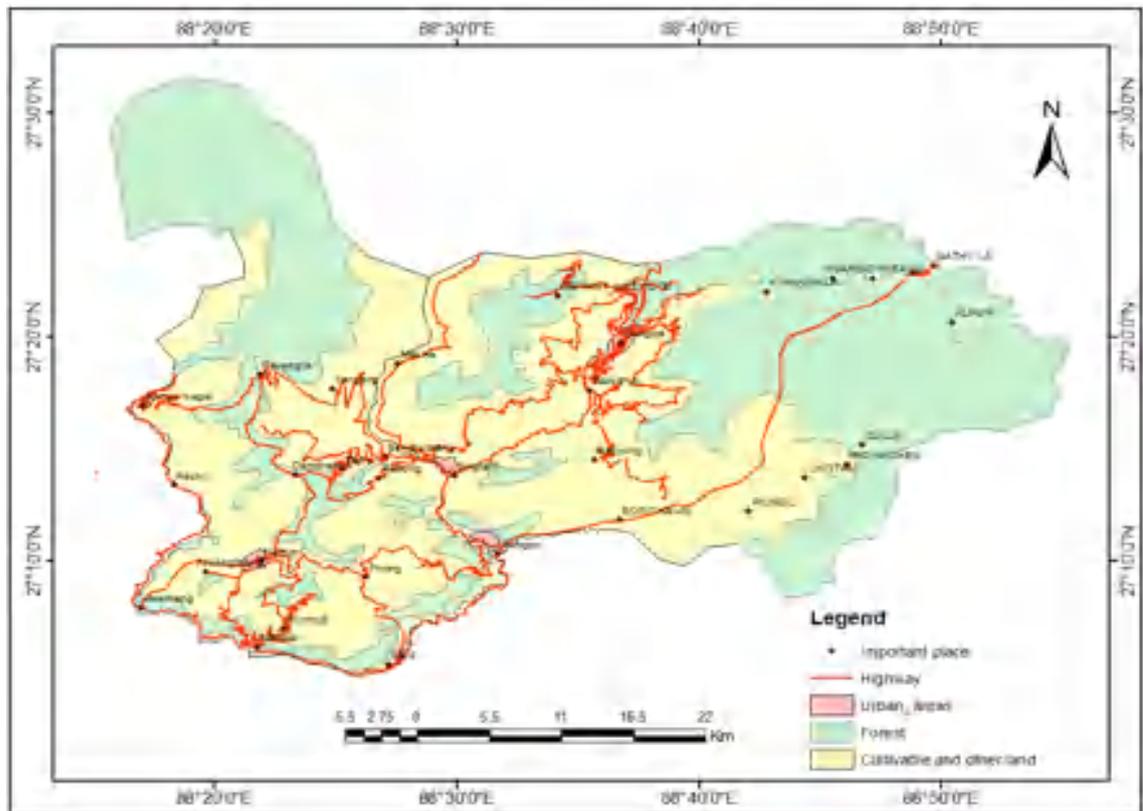


Figure 2.21 Land use map of the study area

According to Table 2.21, the total irrigated area of the state is 7643.23 hectares, while in the East district it is 2532.14 hectares and in the South district it is 2104.62 hectares. Due to mountainous topography of the state, total un-irrigated land is much more than the irrigated land. Total un-irrigated land in the state is 39304.5 hectares, whereas East district and South district occupied 9475.46 hectares and 15435.7 hectares respectively. The next item in the land use pattern is non-agricultural land, which is highest in the East district, this is because of heavy settlement in this district and the next reason is Gangtok which is the capital of the state. Gangtok is the landmark of the East district which pulls the people from different places for better life and for better employment and better education also which further lead to increase in urbanization. Migration is also one of the important reasons for the high non agriculture land. Increase in migration causes an increase in settlement so for that government tries to extend the urban centres that are responsible for low availability of agricultural land. In East and South districts of Sikkim the cultivation of cardamom is practiced by the villagers. The total area of 3795.76 hectares in East district and 4515 hectares in South district are used for the cultivation of cardamom. Migration is also one of the important

reasons for the high non agriculture land in the district. South district of the study area has more cultivable land as compared to the East district for large cultivation of cardamom which leads to in-migration as agricultural labourers in the area.

Maximum forest area is found in East district, which is 9112.07 hectares out of 16448.9 hectares of the state, whereas South district occupied only 2519.7 hectares under forest cover. Grassland, barren land and uncultivated fallow land are playing a significant role in the land use pattern of the study area (Table 2.21 & Figure 2.21).

2.5.13 Mines & Minerals

The country of Sikkim is host to possible assets of ores and minerals. Regardless of efforts of the branch of Mines and Geology, Government of Sikkim and Geological Survey of India, big areas of the nation nonetheless continue to be unexplored. From the 1960s into Nineteen Eighties, Geological Survey of India has conducted investigations for locating occurrences of base metallic in Sikkim and Darjeeling Himalayas (Bhasin and Bhasin, 1995). These days, inside the Himalayas of India, the simplest operating mine producing copper ores is located at Rangpo, Sikkim. a complete of 24 base metal occurrences are positioned in Sikkim (Soni and Kumar, 2002).

Distribution pattern of the regarded occurrences suggests that these are focused in 3 clusters, specifically (i) eastern zone, (ii) significant region and (iii) Western quarter. The maximum important occurrences inside the Japanese area are Rangpo, Pachekhani and Dikchu, positioned to the east of the river Teesta (Basu, 2013). Those deposits are especially strata certain, hosted by using the low-grade rocks of Gorubathan Formation. Inside the important zone lying between the Teesta river in the East and little Rangit river within the West some of occurrences are positioned to the East of Namchi (Basu, 2013). Inside the Western sector, a big wide variety of occurrences are positioned inside the Nayabazar region, many of which had been explored in the early part of the century by using Burn & Co. and in early 60's by GSI. Most of these occurrences are Quartz vein hosted now and aren't of any monetary significance (Basu, 2013). Availability of minerals also accelerate the in-migration as a mining worker in the study area.

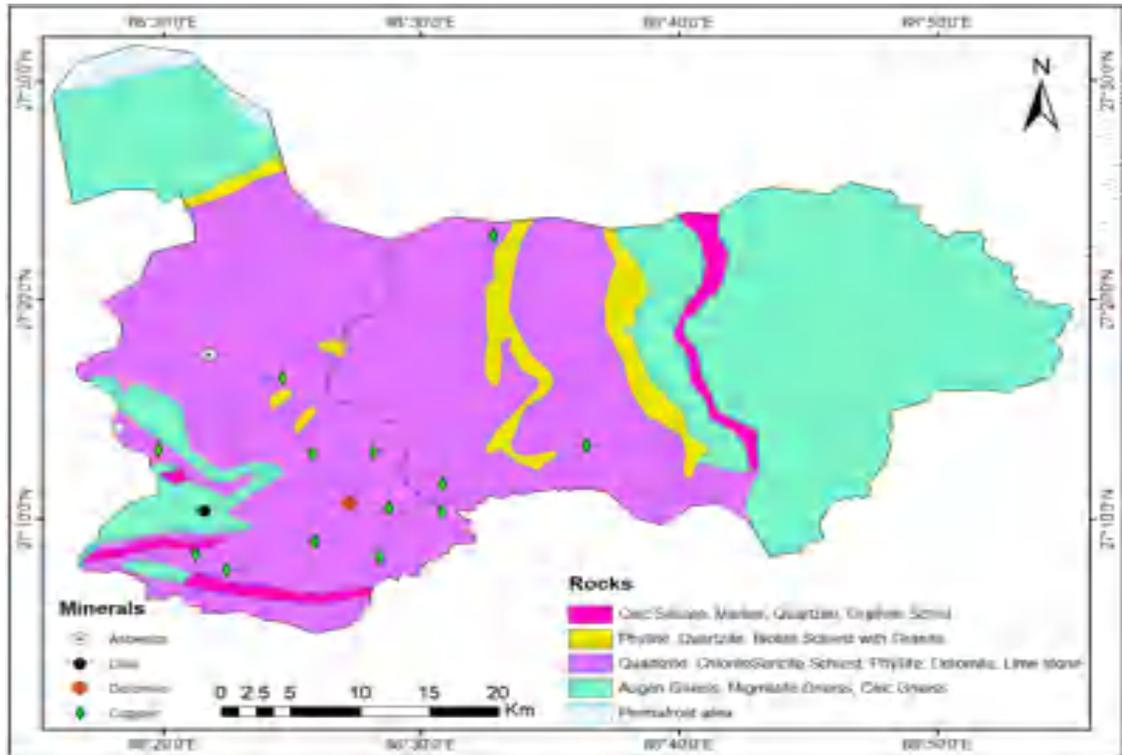


Figure 2.22 Rocks and minerals map the study area

Table 2.22 Locations of Mineral Resources of Sikkim, 2014

Sl. No.	Mineral	Location
1	Copper	Rangpo, Dikchu, Pachey-Khani, Rorathang, Jogdumb near Chakhung, Soreng, Namchi, etc.
2	Coal	Rangit river valley, Namchi area, Patkhola, Roathak Khola and Rinchinpong.
3	Dolomite	Rangit river valley at Rishi (West district) and Bhanjan (South Sikkim).
4	Graphite	Dareli-Chitrey (West district), Bhot near Chungthang (North district).
5	Lead & Zinc	Rangpo, Dikchu, Jugdam in East Sikkim.
6	Limestone	Rishi and Rangit river section, Rinchenpong and Changu.
7	Marble	West Tsango lake and near Chungthang
8	Iron	Bhotang
9	Garnet	Near Pachey-khani

Source: A report published by G.S.I. of Sikkim, 2014

2.5.14 Agriculture and Horticulture

About 80 percent of the population lives in rural Sikkim and agriculture plays a dominant role inside the kingdom financial system with the entire cultivable land through round 72870 hectares (Rahman et al., 2008). Agriculture within the kingdom of Sikkim is practiced under diverse conditions. The location is characterised through large versions in slopes, altitudes (300-3000 m above MSL) and rainfall (200-400 cm). The soil of the whole nation is acidic in nature. The agro-climatic elements have a large effect on the control and productiveness of the crop either in multiple cropping or under a mono-cropping mechanism (Subba, 1984). Moreover, the selection of crop is more often than not consumption oriented and a system of cultivation has hooked up in low input, low chance, low yield generation because the primitive varieties of agriculture is still most dominant (Rahman et al., 2008). Agricultural sports of the look at place appeal to greater in-migrants as agricultural labourers.

2.5.14.1 Cropping pattern

Table 2.23 Cropping pattern of Sikkim

Sl. No.	Altitudes	Zaid/ Pre kharif crops	Kharif crops	Rabi crops
1	1500 – 3000 ft.	Maize, Vegetables, Paddy	Paddy, Maize, Millet, Soybean, Other pulses	Wheat, Barley, Buckwheat, Rice-bean, vegetables
2	3000 – 5000 ft.	NA	Maize, Paddy, Soybean, Others pulses, finger millet	Wheat, Barley, Buckwheat, Rice-bean, Rape and Mustard
3	Above 5000 ft.	NA	NA	NA

Source: Department of Food Security & Agriculture Development, Government of Sikkim.

Table 2.23 shows the cropping pattern of the state in different climatic seasons along with different altitudes. The fundamental crops of the state are maize, rice and finger millet together with soybean raised as intercrops to begin with. Wheat, mustard, buckwheat and huge cardamom also are vital vegetation. Potato, radish, brinjal, tomato, beans, cow peas, rai, pea and gourd are the essential greens crops grown in the country. In latest years wheat crop has been delivered successfully within the double cropping system of rice-wheat rotation in Sikkim.

Table 2.24 District wise area in hectare (,000) under main crops of the study area

SI No.	Crop	East District	South District	Sikkim
1	Rice	4.91	2.1	11.16
2	Buck Wheat	1.17	1.46	3.63
3	Maize	9	14.31	39.93
4	Finger Millet	0.84	0.75	2.96
5	Buck Wheat	1.17	1.46	3.63
6	Pulses	0.76	3.07	6.3
7	Oilseeds	2.57	2.81	7.95

Source: Department of Food Security & Agriculture Development, Government of Sikkim.

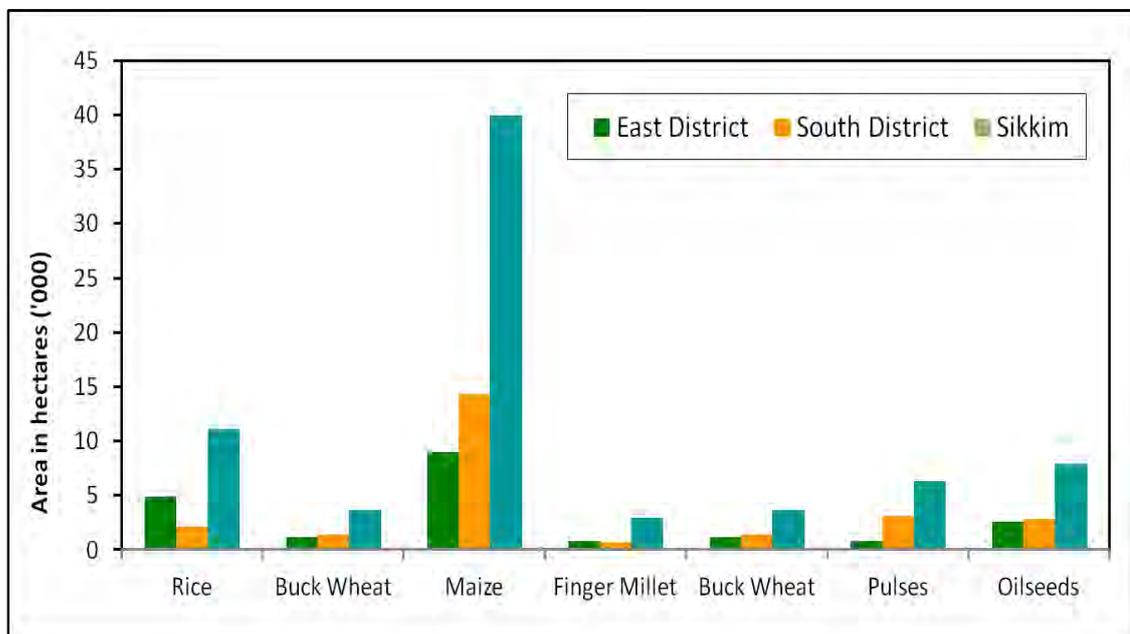


Figure 2.23 Area under different main crops

2.5.14.2 Crop combination of the study area

In the discipline of agricultural geography Weaver became the first Geographer who used (1954) numerical technique to illustrate the crop combination of the Middle West (U.S.A). In his strive for the demarcation of agricultural areas of the Middle West inside the U.S.A. Weaver based totally his evaluation on acreage figures. Weaver computed the percentage of overall harvested cropland engaged through every crop that held as tons as occupying 1% of the cropped vicinity for all of the possibly combination

within the constituent areal gadgets towards a hypothetical standard (Husain, 1996). This method is to be applied in the have a look at location to examine the agricultural regionalization.

2.5.14.2.1 Crop combination of the East district

Among the crops of the East district of the state 5 crops namely, maize, rice, oilseeds, finger millet and pulses occupied the percentage of cropping area over 1% of the district's total cropped area. So, by the using of Weaver's method of crop combination these crops are considered for the crop combination of the district.

After the analysis of the crop combination of the East district it is found that the minimum value of crop combination is 235.923 for the three-crop combination of the district. So, it is concluded that the district occupied by the three crops combination, which are maize, rice and oilseeds (Appendix B.1).

2.5.14.2.2 Crop combination of the South district

Among the crops of the East district of the state 5 crops namely, maize, pulses, oilseeds, rice and finger millet occupying the percentage of cropping area over 1% of the district total cropped area. So, by the using of Weaver's method of crop combination these crops are considered for the crop combination of the district.

After the analysis of the crop combination of the South district it is found that the minimum value of crop combination is 449.289 for the five-crop combination of the district. So, it is concluded that the district occupied by the five crops combination, which are maize, oilseeds, pulses, rice and finger millet (Appendix B.2).

Therefore, it is found from the result of crop combination that the South district has more potentiality in the field of agriculture as compare to East district and that is why South district has attracted more agricultural labourers as in-migrants in the district.

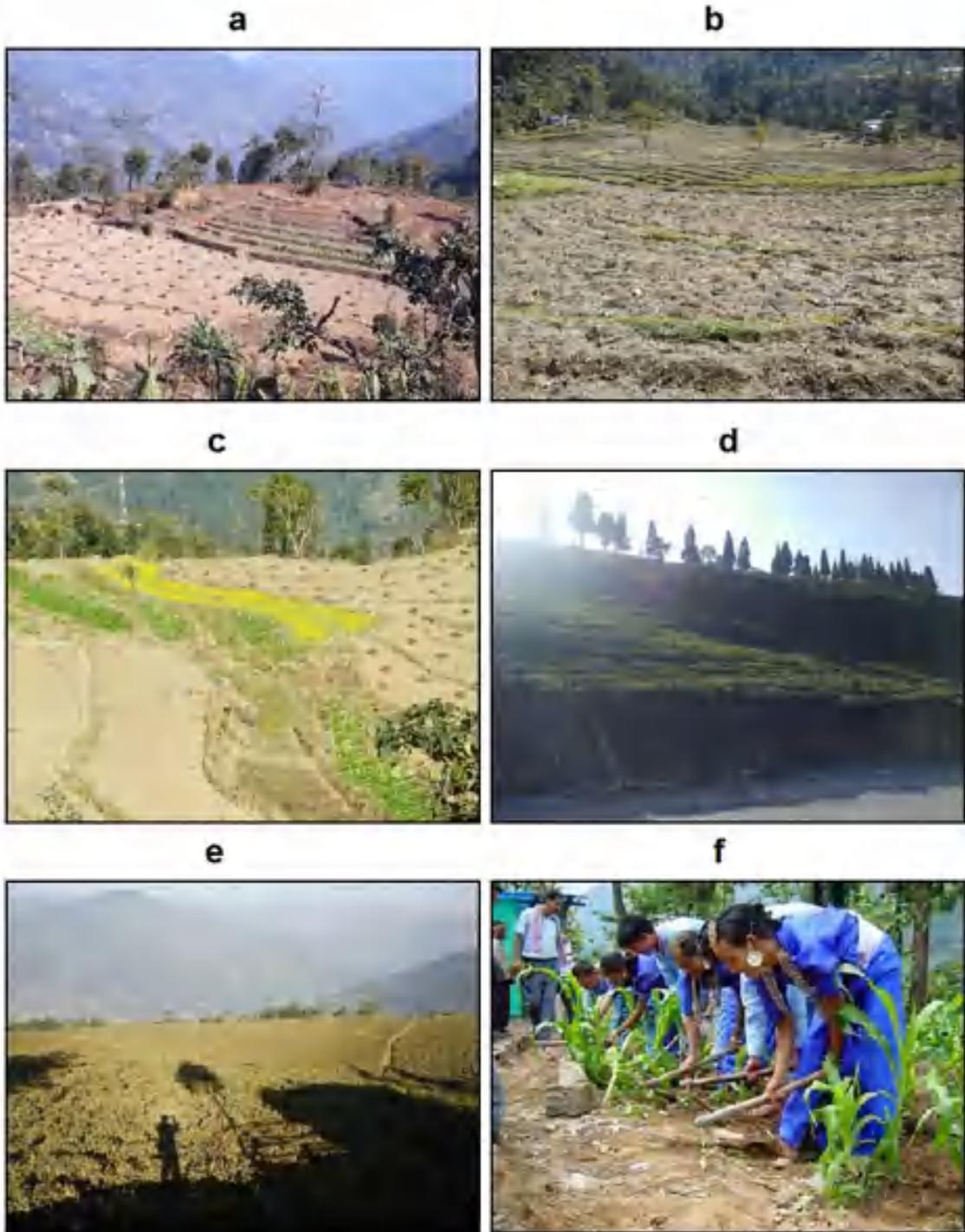


Plate 2.2 Agricultural activities in the study area a. b. and c. in East district
And d. e. and f. in South district

2.5.15 Irrigation

Sufficient supply of water is important for vegetable cultivation. There are two types of water supply in irrigation manner; the natural water supply which is directly dependent on rain and the artificial supply of water through channels (Sharma, 2008). In the hilly region most of the cultivated lands are dependent on natural supply of water through rain. In Sikkim, most of the *Kharif* and off-season vegetable crops do not require irrigation. Rain is sufficient to meet the water requirement of these crops, but an assured irrigation facility is essential for Rabi vegetable production (Subba, 1984). So, for this, the Department of Irrigation Government of Sikkim provides artificial supply of water through channels in possible areas. The East district of the state has more irrigated area (2532.14 hectare) as compared to other three districts; it is because the irrigated facility has flourished in a maximum level. The total irrigated land in the north is only 886.97 hectare which is the minimum area of the state as compared to other parts of the Sikkim. While in the south and west districts the total irrigated land is 2104.62 and 2119.5 hectare respectively. The maximum area which comes under the un-irrigated land is on south district followed by West, East and last one is north with 15435.74 hectare, 10433.45 hectare, 9475.46 hectare and 3959.84 hectare respectively (Irrigation and Flood control Department, Govt. of Sikkim, 2018). The artificial system of irrigation depends on the source of water within the considerable distance, from where the water should follow in sufficient manner. So, it may conclude that in state the main source of water, from where the water should channelize in artificial manner through channels for cultivation (Sharma, 2008).

2.5.16 Industries

In Sikkim, enterprise plays an essential function in the financial system of the kingdom. Sikkim has visible a notable growth within the industries inside the current years. Sikkim has now arisen as an industrial centre (Mishra and Kiranmai, 2007). Sikkim had lengthy been an agro-primarily based society, but situations modified very well inside the latest years. With the acceleration within the socio-political thing of the society of Sikkim, the increase of industry in Sikkim has been outstanding (Debnath, 2009). It is not worth that the increase within the industries of Sikkim is sultan effect of the continuous endeavour of the authorities of Sikkim. The department of Industries in

Sikkim is instrumental in bringing approximately a rapid increase within the industries of Sikkim (Joshi, 2004). The department of Industries has formulated certain regulations including Sikkim commercial advertising and Incentive (SIPI) Act, 2000 and its next Amendments in 2003 and 2007.

2.5.16.1 Industries of the East district

Industrial infrastructure of the district is in a far better position as compared to other districts of the state. There are some large and small-scale enterprises that have been established in recent decades. Large scale industries which are undertaken by public sector are much developed in recent years (Table 2.25).

Table 2.25 List of large-scale industries of the East district

Sl. No.	Category	Name of the Industries
1	Large Scale Industries	Alkem Laboratories Ltd.
2		CIPLA Ltd.
3		Epitome Petrochemicals (P) Ltd.
4		Golden Cross Pharmaceuticals (P) Ltd.
5		M/S Glenmark Pharmaceuticals Ltd.
6		M/S Intas Pharmaceuticals
7		Nextgen Printer (P) Ltd.
8		Sun Pharma Sikkim
9		M/S Torent Pharma-Sikkim
10		Zydus HealthCare
11		Sikkim Breweries Ltd.
12		Sikkim Distilleries Ltd. (Private and State govt. joint venture)
13		Government Fruit preservation factory.
14	Major Exportable item	Pharmaceutical products
15		Distillery products

Source: Ministry of MSME, Government of Sikkim, 2018

Among the large-scale industries of the district, the major exportable industrial goods of the district are 1. Pharmaceutical products and 2. Distillery products.

Micro and small-scale enterprises of the district are the bases of the economy of the state (Table 2.26).

Table 2.26 Details of existing micro & small enterprises units in the East district

Sl. No.	Type of Industry	Number of units	Investment (in Lakh rupees)
1	Agro based	13	212.23
2	Woollen, silk & artificial Thread based clothes.	1	1.00
3	Ready-made garments & embroidery	1	2.55
4	Wood/wooden based furniture	4	234.37
5	Paper & paper products	3	175.42
6	Leather based	1	1.95
7	Chemical based	12	598.46
8	Rubber, plastic & petro based	1	16.50
9	Metal based (Steel Fab.)	3	10.20
10	Electrical machinery and transport equipment	1	3.00
11	Repairing & servicing	8	33.28
12	Others	128	5991.88

Source: Ministry of MSME, Government of Sikkim, 2018

Potential industrial sector of the district is eco-tourism and service sector activities. The district has many beautiful places for tourists' destinations. So, the potential service sector industries are - 1. Tours and Travels, 2. Hotels and Restaurants 3. Transport (DCMSME, Govt. of Sikkim, 2018).

2.5.16.2 Industries of the South district

Industrial position of the South district of Sikkim has been growing rapidly during recent years. Many of the large-scale industries have been set up in the district with some private investment. The large-scale industries of the district along with Temi tea estate under state government tea board are main industrial bases of the district.

Table 2.27 List of large-scale industries of the South district

Sl. No.	Category	Name of the Industries
1	Large Scale Industries	1. Zydus Wellness (Pharmaceutical)
2		2. SICPA India Limited (Printing Ink)
3		3. Yoksum Breweries Ltd.
4		4. IPCA Laboratories Ltd. (Pharmaceutical)
5		5. Esvegee Breweries, Manpur (ENA & Cattle Feed)
6		6. Temi Tea Estate (State Govt. Tea Board)
7	Major Exportable item	Pharmaceutical products
8		Distillery products

Source: Ministry of MSME, Government of Sikkim, 2018

Among the large-scale industries of the district, the major exportable industrial goods of the district are the same as the East district, which are 1. Pharmaceutical products and 2. Distillery products (Table 2.27).

Micro and small-scale enterprises of the district are the bases of the economy of the state (Table 2.28).

Potential industrial sector of the district is eco-tourism and service sector activities. The district has many beautiful places for tourists' destinations. So, the potential service sector industries are - 1. Tours and Travels, 2. Hotels and Restaurants 3. Transport (DCMSME, Govt. of Sikkim, 2018).

Table 2.28 Details of existing micro & small enterprises units in the South district

Sl. No.	Type of Industry	Number of units	Investment (in Lakh rupees)
1	Agro based	9	43.05
2	Woolen, silk & artificial Thread based clothes.	1	0.50
3	Jute & jute based	1	1.00
4	Wood/wooden based furniture	3	0.80
5	Paper & paper products	2	17.56
6	Chemical based	1	97.39
7	Mineral based	1	415.00
8	Metal based (Steel Fab.)	5	3.36
9	Repairing & servicing	1	81.00
10	Others	25	700.36

Source: Ministry of MSME, Government of Sikkim, 2018

2.5.17 Power Infrastructure

The country of Sikkim is blessed with fantastic hydroelectric electricity capacity that has been laboured out at 8000 MW peak and a company base of 3000 MW (Debnath, 2009). About seventy miles North East stretch of Sikkimese territory possesses a land gradient that lies more or less among 500 feet to twenty-eight,000 feet above imply sea degree. Due to this amazing terrain Sikkim homes a number of the maximum turbulent

and swiftest rivulets within the international that is nice ideal for harnessing hydel strength ability (Dukpa et al., 2018).

Sources of power of the state, there are 18 power stations (all are hydel power stations) within the state. Out of 18 power stations of the state 8 power stations are located in the East district, namely Singtam, Ranipool, Sang khola, Nimtar (Two power stations), Gangtok and Rongli whereas in South district only one power station is located at *Manglay* (Sikkim ENVIS, 2018). These power stations are another destination of in-migrant workers.

Energy consumption of the state in 2014-15 is 119.88 MU in rural areas and 74.12 MU in urban areas. Per capita consumption of the state is 262.33 kwh in rural areas and 482.63 kwh in urban areas (Table 2.29).

Table 2.29 Rural-urban Energy consumption and Per capita energy consumption of Sikkim

Sl. No.	Year	Energy Consumption (MU)		Per capita consumption (Kwh)	
		Rural	Urban	Rural	Urban
1	2010-2011	130.54	69.17	271.41	1155.40
2	2011-2012	136.89	71.37	299.54	464.73
3	2012-2013	126.68	79.49	277.19	517.61
4	2013-2014	135.10	78.06	295.62	508.61
5	2014-2015	119.88	74.12	262.33	482.63

Source: Sikkim Energy and Power department, Government of Sikkim, 2018

Electricity consumption in different sectors in the state in 2014-15 (Table 2.30) shows that the out of total 248.75 Kwh consumption highest electricity consumed by HT industrial sector, which is 110.49 Kwh per annum followed by 78.93 Kwh consumed in domestic purpose per annum, while commercial sectors of the state consumed 35.43 Kwh electricity per annum. Other sectors consumed very little proportion of electricity per annum.

Table 2.30 Sector-wise Electricity consumption of Sikkim (in Kwh per annum)

Sl No.	Category of sector	2012-13	2013-14	2014-15
1	Agriculture	0.00	0.00	0.00
2	Domestic	78.98	83.98	78.93
3	Commercial	38.26	35.43	35.33
4	Public lighting	0.43	0.35	0.29
5	Temporary supply	0.09	1.61	1.36
6	HT industrial consumers	91.96	97.11	110.49
7	LT industrial consumers	1.15	1.15	1.37
8	Bulk supply	16.23	17.74	20.98
Total		226.90	237.37	248.75

Source: Sikkim Energy and Power department, Government of Sikkim, 2018

Total energy consumed by the state is much more than the energy produced within the state. State consumed 5920 MW of energy from other states and country neighbouring to state. 1650 MW from West Bengal, 3000 MW from Bihar, 1000 MW from Orissa and 270 MW from the neighbouring state of Bhutan (Sikkim ENVIS, 2018).

2.5.18 Transport and Communication

2.5.18.1 Road

Transport and communication are the most important factors for industrial development and economic progress of the State especially in a hilly region like Sikkim. The absence of a rail network or commercial air services means that motor transport is the only means of getting around (Choudhury, 2006).

Table 2.31 District-wise Road Classification of Sikkim, 2019

District	Road Classification				Total
	NH	SH	MDR	ODR	
North	0.00	0.00	67.77	34.64	102.41
West	14.78	261.86	424.42	78.29	779.35
East	38.00	203.73	244.96	101.76	588.45
South	124.00	197.50	348.11	168.70	838.31
Grand Total	176.78	663.09	1085.26	383.39	2308.52

Source: Road and Bridge Department, Govt. of Sikkim, 2019

*(Length of the Roads in km.)

The public facilities for the residents are also scattered in different villages in the hills. Many of the rural villages are not integrated in the national road network due to the absence of rural road networks or poor condition of the existing roads. It is therefore difficult to get to public services and participate in economic and social activities

resulting in low quality of life for the rural residents. The public facilities for the residents are also scattered in different villages in the hills. Many of the rural villages are not integrated in the national road network due to the absence of rural road networks or poor condition of the existing roads. It is therefore difficult to get to public services and participate in economic and social activities resulting in low quality of life for the rural residents.

The road facilities for the habitat in the hilly terrain are scattered in nature. Many of the remote areas in the region are not connected to the main township or main road of the region (Shrestha, 2018). The state of Sikkim also has faced some difficulties in connection with road networks in the region. The whole state has depending on a single National Highway (NH 31A) which passes through the East, South and West districts of the state. This road is the main transport link with other states of the country. Sikkim has four types of road connectivity in the state according to their importance of connectivity such as National Highway (NH), State Highway (SH), Major District Road (MDR) and Others District Road (ODR). Total length of the National Highway in the state is 176.78 km of which 124 km passing through the South district and 38 km passing through the East district of the state. The whole state has a total 663.09 km of State Highway, out of which 203.73 km passing through the East district and 197.50 km passing through the South district of the state.



Figure 2.24 Transport network of the study area

East and South districts of Sikkim occupying 244.96 km and 348.11 km of MDR out of 1085.26 km of the state and 101.76 km and 168.70 km of ODR out of 383.39 km of the state respectively (Table 2.31). It reveals that the East and South districts of Sikkim are much more developed than the other districts of Sikkim in terms of road connectivity facilities. This is one of the main reasons for in-migration in the study area (East and South districts of Sikkim). Total 718 km of roads including 40 km of National Highway are maintained by BRO due to international border with Nepal, Bhutan and China. The rest of the NH maintained by the CPWD and the rest of the roads of SH, MDR and ODR of Sikkim of 1453.74 km maintained by the SPWD of Govt. of Sikkim (Road and Bridge Department, Govt. of Sikkim, 2019).

2.5.18.2 Railway

There is no railway facility in the study area till now. Siliguri and New Jalpaiguri of West Bengal are the nearest rail stations from the study area, which are 114 km and 125 km far from the study area. A railway booking facility is available at the SNT bus terminus in Gangtok for the residents of the state. A proposed railway tracks already been initiated by the Indian Railway which link Rongpo of East district of the state to Siliguri rail station of West Bengal. Besides this, another proposed linking of 75 km railway between New Jalpaiguri in West Bengal with Jorethang in the South district of Sikkim by broad-gauge Trans-Himalayan railway is under active consideration by the central and state governments. (NEDFi databank, 2019).

2.5.18.3 Air Services

There is a regular 5-seater helicopter service in the state from Gangtok to Bagdogra airport of West Bengal, which covers 124 km. of air distance and is approximately 4 hours' drive from Gangtok. The State Govt. of Sikkim signed a memorandum with the Airport Authority of India (AAI) for construction of an Airport at Pakyong of East district, which has been sanctioned by the Govt. of India (NEDFi databank, 2019).



Plate 2.3 Road network in the study area a. Singtham b. Jorethang c. Paykong d. Namchi e. Sambuk and f. Ravangla

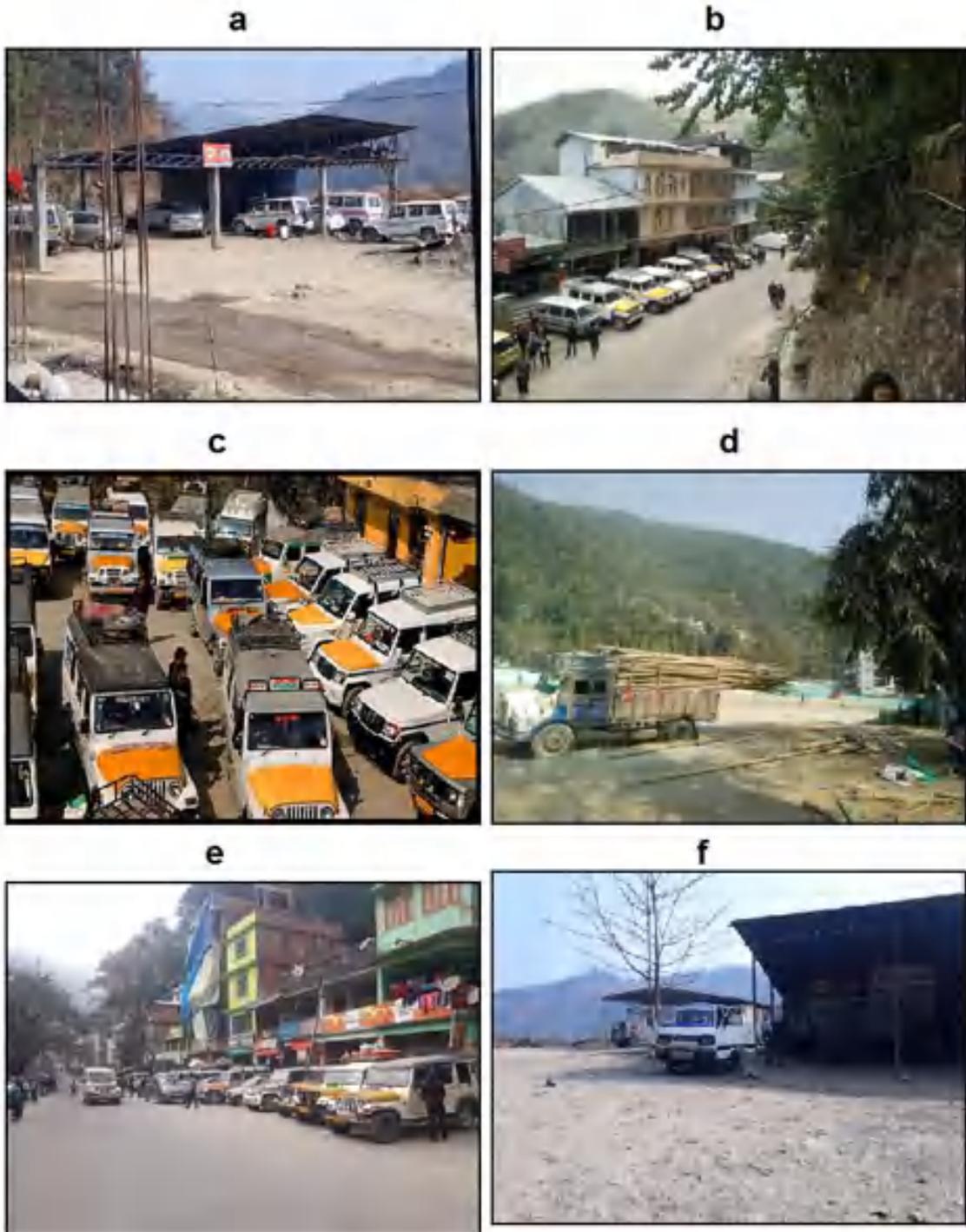


Plate 2.4 Transportation facilities in the study area at a. Jorethang b. Rongpo c. Gangtok, d. Singtham e. Namchi and f. Sambuk

2.5.18.4 Communication

Sikkim has the highest density of telephone networks among the other states of the country. The state has very poor telecom facilities up to the decade of 1990s. But, when the state had setting up the Sikkim Telecom Department under the West Bengal Circle of Bharat Sanchar Nigam Limited (BSNL) in 2000, telecommunication facilities of the state have expanded rapidly. Numbers of landlines increased from 3000 in 1999 to 49350 in 2004. The Telecom Department of Sikkim has set up Village Public Telephones (VPTs) in 374 of the 427 revenue villages. The remaining villages are too remote for cable or wireless in local loop (WLL) systems. However, the Telecom Department tries to link them through satellite. Mobile telephone services of the state have grown rapidly from its beginning in 2004. Almost all the areas of East, South and West districts of the state cover the mobile network connectivity. But, in the North district of the state mobile services are only available as far as Mangan. Good telecommunications services in the study area can help to overcome some of the barriers imposed by the hilly terrain by increasing access to information, goods, and social and economic services especially for those living in remote areas (NEDFi databank, 2019).

2.5.19 Tourism

Sikkim is a hilly country nestled in the lap of Eastern Himalaya. The kingdom takes delight in its natural beauty manifested via the snow-clad mountains, landscape dotted with perennial streams & waterfalls, lush inexperienced forests, picturesque villages, natives in traditional dresses and indigenous structure (Rizal and Ashokan, 2013). The crime unfastened society provides to the natural sights of the kingdom, making it one of the most sought-after vacationer destinations within the kingdom.

Tourism is one of the priorities and important sectors of the nation and its miles to turn out to be the principal economy of the country development. it's far a non- polluting, low fee and excessive return-oriented industry for the kingdom subjective to positive precautions (Chakraborty, 2010). For this, the nation has adopted integrated development for making the Tourism most possible region.

Sikkim is a visitor friendly country in the genuine feel of the phrase. for the duration of crises along with natural calamities, mishaps and even during road blocks due to moves, the Tourism department, people and groups have played a chief role in

assisting the tourists to conquer those troubles by co- coordinating with diverse other corporations for the safety of the travellers (Anjan, 2014).

Sikkim is a land of festivals and fairs. All of the ethnic groups have exceptional and wonderful a laugh- stuffed fairs, that are celebrated all over the state (Chaudhuri, 2012). The Tourism branch is gambling a first-rate role in selling those festivals so one can show off our subculture and heritage to the world.

Table 2.32 Domestic & Foreign tourists of Sikkim during 2011-2017

Year	Number of Domestic tourists	Annual growth rate (%)	Number of foreign tourists	Annual growth rate (%)
2011	552453	NA	23945	NA
2012	558538	1.10	26489	10.62
2013	576749	3.26	31698	19.66
2014	562418	-2.48	49175	55.14
2015	705023	25.36	38479	-21.75
2016	740763	5.07	66012	71.55
2017	1375854	85.73	49111	-25.60

Source: Tourism and civil aviation department, Govt. of Sikkim, 2018



Figure 2.25 Annual growth rate of tourists

Numbers of domestic tourists of the state gradually increase year by year from 2011 – 2017 except 2014, whereas numbers of foreign tourists of the state gradually increase in every year from 2011 – 2017 except 2015 and 2017. The numbers of domestic tourists drastically jumped in 2017 from 2016, which increased by 85.73%, whereas numbers of foreign tourists decrease by 21.75% in the year 2015 from 2014 and 25.60% in the year 2017 from 2016 (Table 2.32 & Figure 2.25).

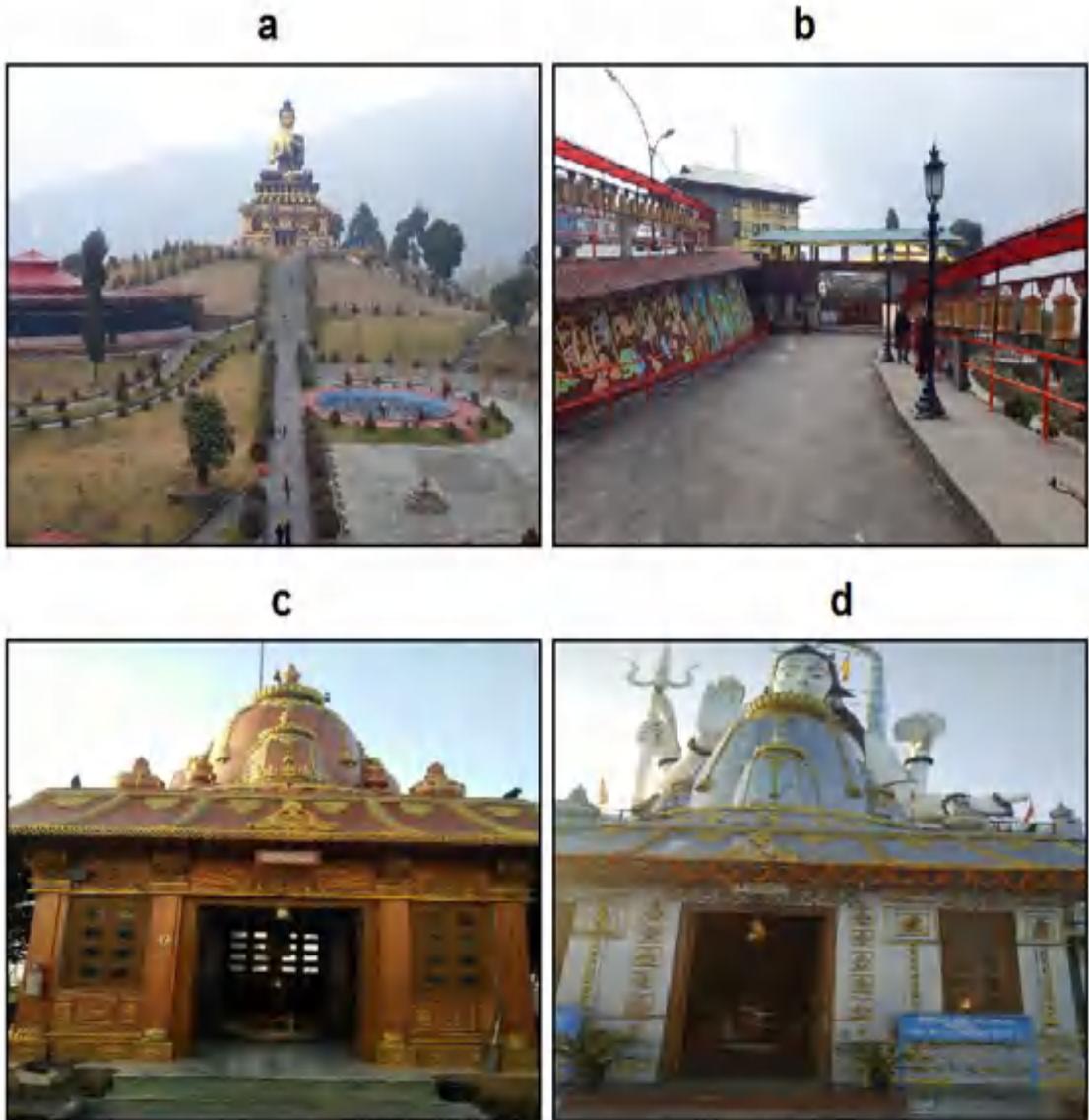


Plate 2.5 Holy place in the study area at a. and b. Ravangla c. Singtham and d. Namchi

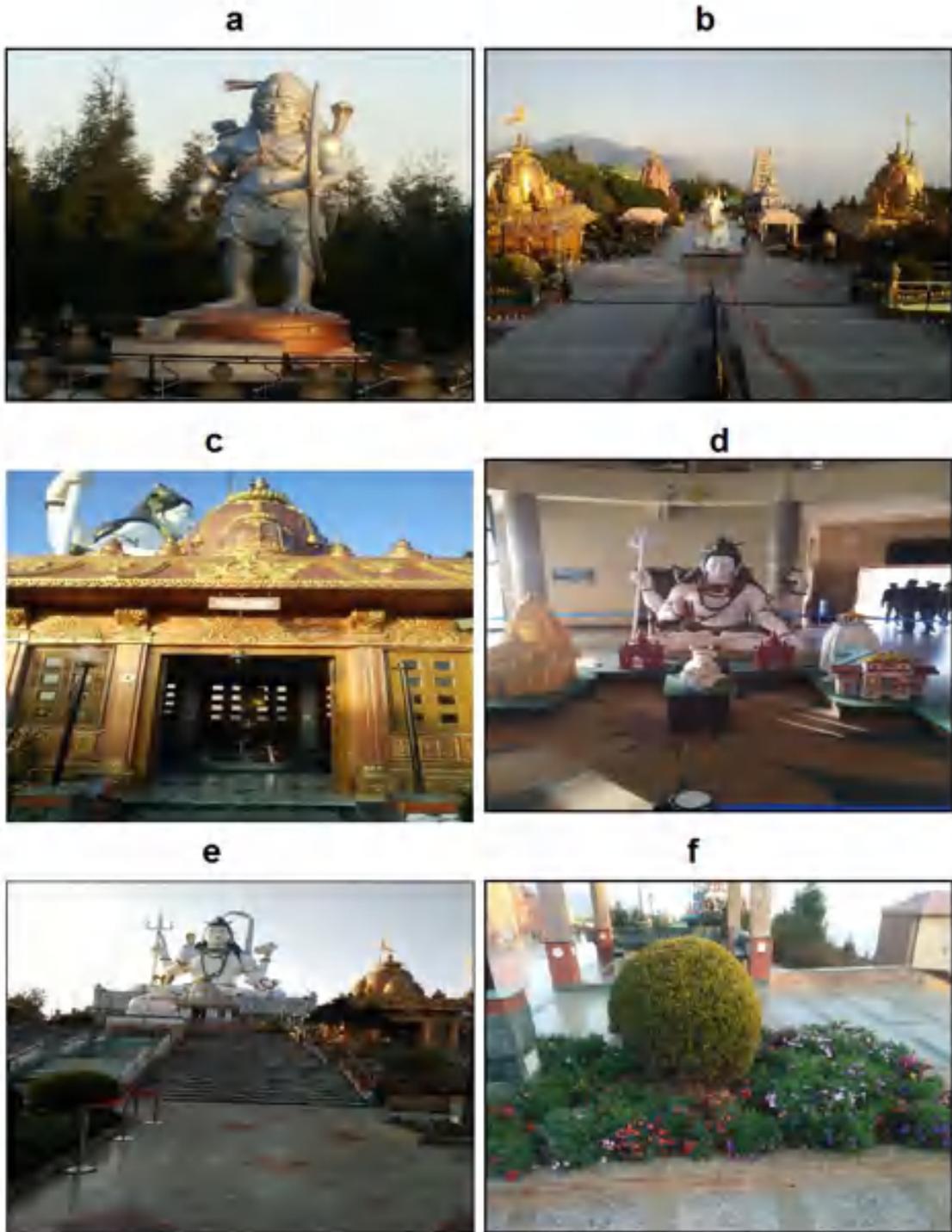


Plate 2.6 Tourist place in the study area at a. b. c. and e. in South district and d and f. in East district

Numerous tourist places of attraction are located in the study area both in East and South districts of Sikkim. The East district of the state has various tourist places like *Tsongo* lake (famously known as '*Changu* lake'), Baba Mandir, Nathula pass with the border with China, and Rumtek monastery. Gangtok town, which is the capital of Sikkim, also provides an enormous tourist attraction for domestic as well as foreign tourists. Different florae are the main attraction for the tourists in Gangtok town (Tourism and Civil Aviation Department, Govt. of Sikkim, 2018).

South district of Sikkim is the ideal conditions for both the domestic and foreign tourists. *Tarey Bhir*, Temi tea garden, *Samduplse* (The tallest statue of Guru *PadmaSambhava* in the world with a height of 135 ft built above Namchi town), *Siddheswar Dham* (famously known as '*Char Dham*'), Buddha Park (*Tathagata Tsal*) at Ravangla sub-division of South district of Sikkim are the main tourist places of attraction. Rather than a physical scenario, the district also provides the best of tourism (Tourism and Civil Aviation Department, Govt. of Sikkim, 2018).

2.6 Summary

The study area East and South districts of Sikkim are located in the lap of eastern Himalayan region of India. The study area essentially has hilly topography with no flat or plain surface. The geological structure of the area is the composition of massive gneisses rocks and soft, thin and schistose rocks. The rivers of the study area are formed from the different glaciers of the Himalayan Mountain. There is enormous vegetal cover throughout the area with the maximum of coniferous forest. The climatic conditions of the study area are a humid mountainous type of climate with the huge rainfall in the rainy season and occurrences of snowfall in the winter season along with mild summer season. The soil of the area is composed of (a) clayey loam and sandy loam soils and (b) hill soils or residual soils. The growth of the population of the area has drastically increased in the last three decades along with increase in urbanisation. Educational status of the area is better than the national average. Agriculture is the main occupation of the inhabitants of the area. Irrigation system is not so good due to scarcity of water in mountainous topography. The area is enriched with some minerals in negligible amounts. Industrial sectors are developing with some Government and private investments. Economy of the area has been growing day by day in the last two decades. Maximum proportion of the population of the area is economically independent. Health facilities of the area are not so appreciable, but it is also in a better

position than the time of merger with Indian Union. Tourism is the main source of the economy of the area. The area has a diverse ethnicity and cultural assimilation. Different fairs and festivals of different ethnic groups have taken place in the different parts of the area throughout the year. The transport network of the area is not so good due to the hilly tract of the area. The migrants of the study area are attracted with its growing development in agriculture, industrial as well as economic prosperity. The study area is of massive significance to the policy makers, Planners, academicians and above all the administrations for the future planning of the area. The findings of this chapter will go a long way in formulating plans and policies for the overall development of the region.

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