Chapter 2

Background and Profile of the Study Area

Introduction

The Sikkim Himalaya is an uplifted and tilted mountainous terrain which is divided into several large elongated sub-parallel tributary valleys like the Rangit, Rangpo Chu, Rang-Rang Chu, Lachung Chu, Ranikhola, Rora Chu, Takchom Chu, Geilkhola, etc. An important feature of the Tista drainage basin is the remarkable way in which geological structure and the character of the underlying rocks are expressed in the landforms. Lineation in the topography has been largely controlled by structural and tectonic elements (Sikkim Study Series, 2004). Sikkim is bounded by high ridges on the North, East and West and gives the appearance of an amphitheatre. To the North, the convex arc of the Greater Himalayas separates the state from Tibetan Highland. A number of peaks, built of crystalline rocks accentuate the demarcation between Tibet and Sikkim. The longitudinal Chola range separates the state from Tibet in the eastern side while the Singalila range, another longitudinal offshoot of the Himalayan arc, marks the boundary between Sikkim and Nepal in the West (Choudhury, 2006;2).

The thumb-shaped state of Sikkim is characterized by wholly mountainous terrain. Almost the entire state is hilly; with the elevation ranging from 280 metres (920 ft) to 8596 metres (28000 ft). The pinnacle of the Khangchendzonga is the highest point. Numerous snow-fed streams in Sikkim have engraved out river valleys in the west and south of the state. These streams combine into the Tista and its tributary, the Rangit. The Tista can be called as the “lifeline of Sikkim”, flows through the state from north to south.

Sikkim, a small Himalayan State lies between 27°00'46" to 28°07'48" North latitude and 88°00'58' 'to 88°55'25"East longitude and is the second smallest State in India. It has a total area of only 7096 sq km. and is just 114 km long and 64 km wide, but bounded by three neighboring countries i.e. China (220 km long border with Tibet), Nepal (100 km border with Nepal) and Bhutan (30 km border with Bhutan). Sikkim occupies only 0.2 percent of geographical area of the country. But in most of the state, the land is unfit for agriculture because of the rocky, precipitous slopes etc. However, some hill slopes have been converted into terrace farms. Agriculture is mostly concentrated in the lower mountain ranges, primarily in the East and South districts *(*www.sikkimsprings).

The study area, i.e. the South district is bounded by the latitude 27°14'20" and longitude 88°18'15" E. The total geographical area of the district is 750 sq. km. South district is the 2nd largest populated district next to East district of Sikkim. South district though with smaller area is more thickly populated *(*www.sikkimsprings).

Geomorphology

Geomorphological features have paramount effects on the agriculture practised in different regions. Agriculture is not well developed in mountainous or hilly tracts. Steep slope, rugged topography, immature soil and inaccessibility have discouraged agricultural practices. Longitudinal valleys, intermountain valleys and gentle slope with terraces are the areas where cultivation of some cereals or cash crops is done. Mainly horticulture, animal rearing, sericulture, plantation and agriculture are practised in mountainous regions (Khan, 2001).

Geomorphologically, the state of Sikkim belongs to the upper part of Teesta Basin. The physical landscape of the state owes much to the work of the river Teesta. The structural slope of the land is from north to south; hence all the major rivers of the state have southerly flow. However, rivulets and streams appear from almost every corner of the state and run to all possible directions. The fine network of streams has dissected the land so intricately that there is no sizeable piece of level land anywhere in the state (Choudhury, 2006:4).

Sikkim encompasses the lesser Himalaya, Greater Himalaya, and the Tethys Himalaya. It is essentially a mountainous state without any flat piece of land. The mountains rise in elevation northward. The northern portion of the state is deeply cut into steep escarpments, and except in the Lachen and Lachung valleys, it is not populated. Southern Sikkim is lower, more open, and fairly well cultivated. The physical configuration of Sikkim is also partly due to geological structure. Major portion of the state is covered by Precambrian rock and is much younger in age. The Northern, Eastern and Western portions of the state are constituted of hard massive gneisses rocks capable of resisting denudation. The Central and Southern portion is formed of comparatively soft, thin, slate and half-schistose rocks which denude very easily. The trend of the mountain system is in East-West direction. However, chief ridges run in a more or less North-South direction. The Rangeet and the Teesta which form the main channels of drainage, run nearly north-south. The valleys cut by these rivers and their chief feeders are very deep. The valleys are rather open towards the top, but usually attain a steep gorge like structure as they approach the bed of the rivers. There are 180 perennial lakes at different altitudes. Sikkim also has many hot springs. The perpetual snowline in Sikkim is at approximately 16,000 ft (sikkim.nic.in).

General Geology and Structure

The area under investigation covers South District of Sikkim; parts of South Sikkim have been mapped geologically by a number of researchers from time to time. Each researcher, over a

period of time brings out his own stratigraphic classifications. They are yet to arrive at a commonly agreeable consensus because of lack of well-documented markers such as fossils, horizons or features characteristic of these areas. The general stratigraphic succession is as under:

Gondwana

Pebbles slate, slates, carbonaceous shale coal, sandstone and shale.

Buxa

Carbon phyllites, slates, calc-phyllite, dolomite/limestone, purple phyllite, dark calcareous slates.

Dalings

Phyllites, varved phyllite, basic instrusives, green quartzite (fuchsite) serictic and chlonitic phyllite, massive and flaggy quartzite, quartz veins (Land Revenue & Disaster Management, 2012; 169). Quartzite, High grade Gneiss, Cal Gneiss, Granulite with bands of biotic/Graphite schist with pegmatite and aplite veins.

Buxa Formation

The main rock types in this formation are Dolomites, Purple Quartzites and variegated Phyllite, Pink and Buff coloured Dolomite and Stromatolite bearing Dolomites which belong to the upper most sequence of this formation, Grey to pink Dolomites are exposed along Phalidara, Bagdara, Salibong, Mamley, Pabong and Wok areas. Stromatalite bearing Dolomites occur along Mamley area (Land Revenue & Disaster Management, 2012: 173).

Gondwana Formation

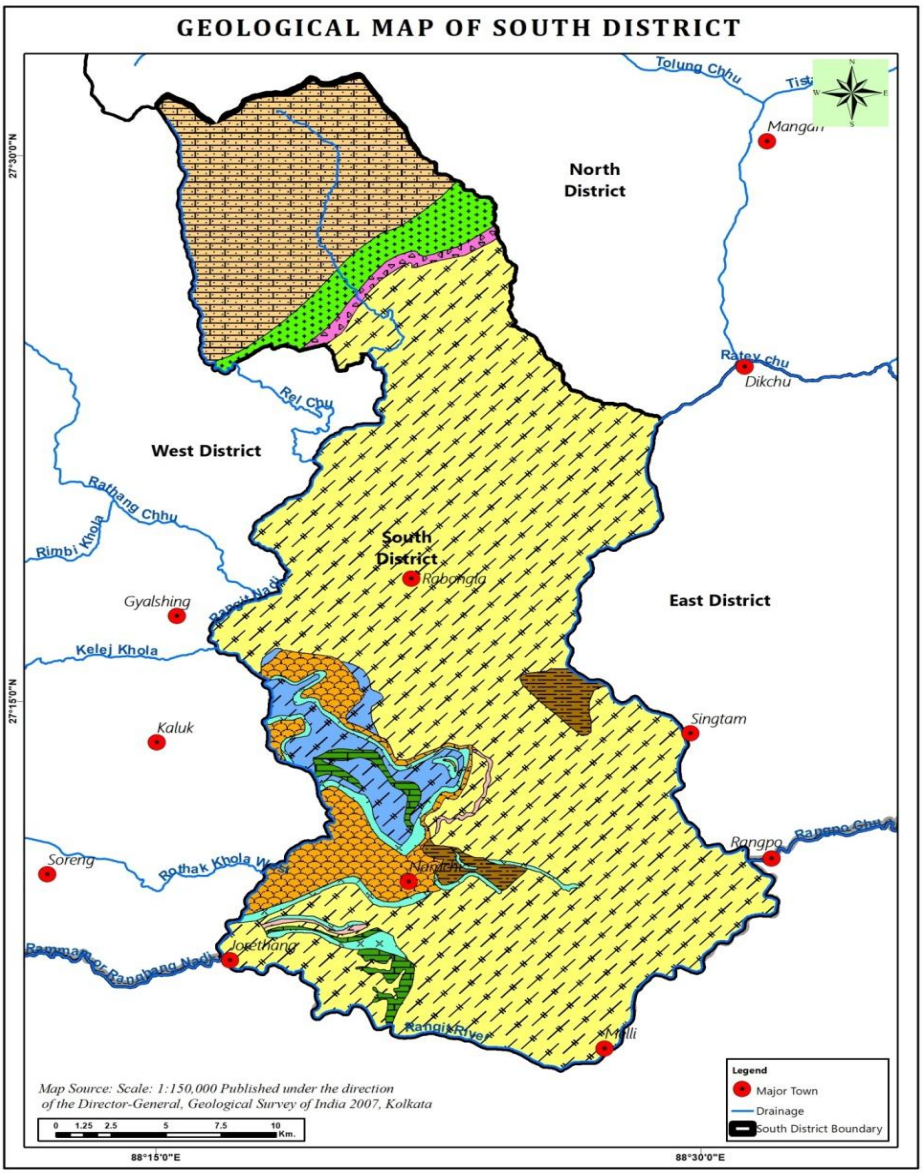
The basal portion of the Gondwana is represented by Pebble bed sequence. The pebbles are mainly of Quartzite, Dolomite, Granite and Phyllite and show sub-angular to rounded shape. The pebble-bed is mainly overlaid by coarse to medium grained sandstone with intercalation of shales with occasional coal seams. The sandstones are massive and well bedded and highly jointed, plant fossils are also found in the shales of Gondwana sequence (Land Revenue & Disaster Management, 2012: 169).

Geologically, the places of South Sikkim like Narak-Jhora, Turung-Bimbong, Kerabari, Turuk, Bul, Jarong, Barfung Hingdam, Kewzing, Ralang, Polot, Borong, and Sada-Phamtam, Mamzing, Majitar to Jorethang comprise of rock sequences belonging to daling series. The rocks are phyllites (ranging from Chloritic, Serictic phyllite to gritty phyllite), quartzite and higher grade metamorphic rocks comprising of Gneisses and Schists.

In South district some of the important minerals have been found like coal, quartzite, base metal, dolomite, etc.

Different types of rocks and minerals have been found in South district. Some of them are quartzite, dolomite, coal, granite, etc. which are not useful for agriculture purpose. The hard rocks in agricultural fields are difficult to break and remove. If there are bands of hard metamorphic rocks on hill slopes the agricultural fields become narrow and difficult to plough. As such, rocky lands are not easy to convert into agriculture land. The soft rock strata, after breaking of materials like phyllites, conglomerates, pebbles/soil etc. are to some extent useful for agriculture. Dolomite is considered as a source of fertilizer in agricultural field. In general, the Buxa formation is better suited for cultivation, compared to the Daling formation.

Map No. 2



Legend

Geology

- 1Interbanded chiorite-sericite schist/phyllite and quartzite,2Metagreywacke,3Pyritiferous black slate,4Biotite phyllite/mica schist,5Blotite quartzite,6Mica schist with garnet,7chicrite quartzits
- 3. Pyritiferous black Slate
- 3. Pyritiferous black slate
- Banded,streaky migmatite,augen bearing biotite gneiss with kyanite,sillimanite with palaeosomes of staurolite kyanite, mica schist
- Dolostone, orthoquartzite,purple phyllite slate, chert
- Granite gneiss(mylonitic)
- Pebble/boulder slate, conglomerate, phyllite
- Pebble/boulder slate, conglomerate,Phyllite
- Quartzite,garnet kyanite sillimanite biotite schist/garnetiferous mica schist,Calc-granulite with intercalations of quartzite, Graphitic schist
- Sandstone,Shale, Carbonaceous Shale with coal

Slope of the Area

The slope has an important place in order to analyse, particularly hilly and mountainous region pertaining to socio-economic aspects, settlement, development of infrastructure, agriculture milieu etc. The gentle slope is favourable for settlement and agriculture.

South district of Sikkim has symmetrical valleys, ridges, summit cliffs etc. According to Wentworth's Method of Slope Analysis, very high degree of slope is found in the Gram Panchayat Units (GPUs) of Perbing Chuba, Tendong Reserve Forest, Damthang, Ben-Namphrik. Likewise, high slope is found in the GPUs of Turung-Mamring, Kateng- Pamphok, Kolthang-Tokday, Sripatam, Neya-Manzing etc. and moderate slope is found in GPUs Tinik-Chisopani, Kitam-Manpur, Salghari, Legship Hingdam, Tingmo, Tinkitam Rayong etc. Lastly, the GPUs of Lingee, Paiyong etc have very low degree of slope.

The slopes of the 15 GPUs under study are as follows: Namphing (32 degree), Legship (59 degree), Rong-Bul (37 degree), Tarku (32 degree) Turung-Mamring (33 degree), Sadam–Suntaley (35 degree), Tinik-Chisopani (32 degree), Namthang-Maneydara (32 degree), Assangthang (34 degrees), Wok-Omchu (52 degree), Borong-Phamthang (34 degree), Barfung-Zarung (29 degree), Paiyong (36 degree), Tinkitam–Rayong (36 degrees) and Perbing-Dovan (36 degree). The average slope of five GPUs below 300-900 metres (Namphing, Legship, Rong-Bul, Tarku and Turung-Mamring) is 38 degree. Similarly, average slope of five GPUs between 900-1500 metres (Sadam–Suntaley, Tinik-Chisopani, Namthang-Maneydara, Assangthang and Wok-Omchu) is 45 degree and average slope of five GPUs located at 1500-2100 metres (Borong-Phamthang, Barfung-Zarung, Paiyong, Tinkitam–Rayong and Perbing-Dovan) is 33 degree.

Soil

Sikkim enjoys a wide range of climate, physiography, geology and vegetation that influence the formation of different kinds of soils. Soils occurring in different landforms are studied in respect of their morphology, physical and chemical characteristics. In accordance with the physiographic sequence of the terrain features, 78 soil families were identified in Sikkim and mapped into 69 mapping units. Soils of Sikkim belong to 3 orders, 7 suborders, 12 great groups and 26 subgroups. It is observed that Inceptisols (young soils with weakly developed horizons) are dominant (42.84%) followed by Entisols (weakly developed soils) and Mollisols (soils characteristic of grassland, with a thick, originally –rich surface layer) occupying 42.52% and 14.64% respectively (www.sikkimforest.gov.). The soils of the South district in general have been derived from parent rocks such as Sandstone, Phyllite, Schist, Gneisses and colluvial materials. Soils are generally acidic to very acidic in reaction having soil pH between 5.0 and 6.0 (www.sikkimsprings).

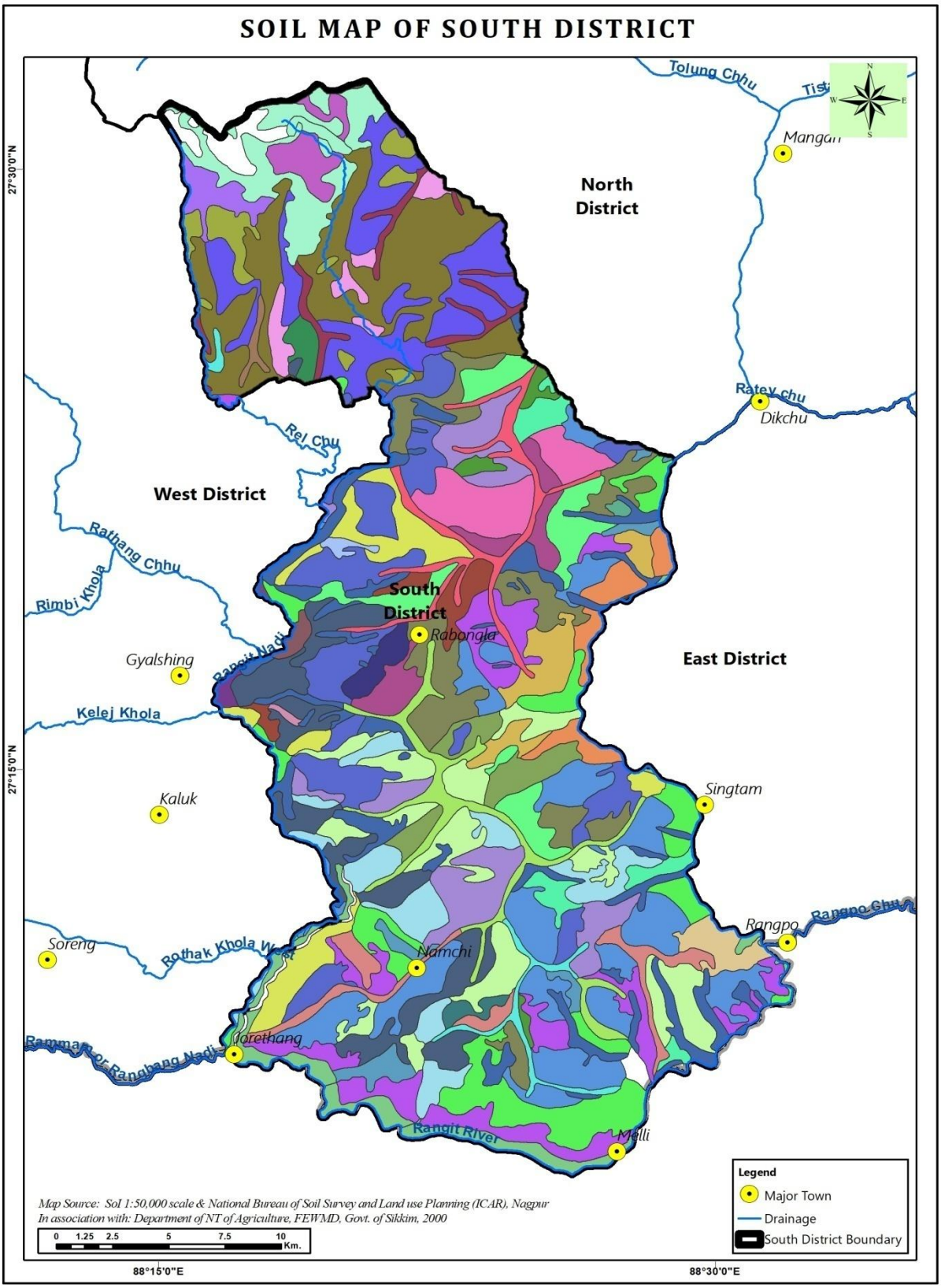
According to National Bureau of Soil Survey and Land Use Planning (Regional Centre, Kolkata), the dominant soils in South Sikkim are Pachic Haplumbretps, Typic Hapludolls, Umbric Dystrochrepts, Typic Argudolls, Entic Haplumbrets, Cumulic Hapludolls, Typic Cryorthents, Lithic Udorthents etc.

Table 2.1: Soil Types and Characteristics

Sl. No	Soil Types	Characteristics
1.	Haplumbretps and Pachic Haplumbretps	Soils developed on ridges of 30% slope are deep, somewhat excessively drained, fine loamy surfaces having slight stoniness and moderate erosion. The soil types are predominantly under forest, paddy, and maize to limited extent, soils are acidic and prone to erosion.
2.	Typic Hapludolls and Umbric Dystrochrepts	Soils on ridges on 15-30% are deep excessively drained, coarse loamy to fine loamy surface with slight stoniness and moderate erosion. Soils are moderately acidic and rich in humus contain. These areas are also predominantly under forest, paddy and maize.
3.	Cumulic Hapludolls and Pachic Haplumbretps	Solis less than 15% slopes are deep well drained, fine loamy soils with loamy surface, slight stoniness and moderate erosion. These areas are under paddy cultivation and some under temperate forest.
4.	Cumulic Hapludolls, Typic Hapludolls etc.	The soils on ridges of steeply sloppy hill sides (30-50%) slopes are moderately shallow to deep, well drained, silty to fine loamy soils with slight stoniness and moderate erosion. The soil is acidic and stony surface. They are largely under temperate forest. Alpine forest and some are under cultivation of cereal crops.

Source: kvkeastsikkim.nic.

Map No. 3


SOIL MAP OF SOUTH DISTRICT
North District
West District
South District
East District
Tolung Chhu
Tista
Mangan
Ratey Chu
Dikchu
Rel Chu
Rathang Chhu
Rimbi Khola
Rabongla
Gyalshing
Kelej Khola
Kaluk
Singtam
Rangpo
Rangpo Chu
Soreng
Rothak Khola
Namchi
Jorethang
Rammam or Ranghang Nadi
Rangit River
Melli
Legend
Major Town
Drainage
South District Boundary
Map Source: SoI 1:50,000 scale & National Bureau of Soil Survey and Land use Planning (ICAR), Nagpur
In association with: Department of NT of Agriculture, FEWMD, Govt. of Sikkim, 2000
0 1.25 2.5 5 7.5 10 Km.
27°30'0"N
27°15'0"N
88°15'0"E
88°30'0"E

Legend

South Soil

TAXONOMIC

- Coarse-loamy over fragmental, mesic Entic Haplumbrepts & Coarse-loamy over fragmental, mesic
- Coarse-loamy, mesic Typic Haplumbrepts & Loamy-skeletal, mesic Lithic Udorthents
- Coarse-loamy, thermic Cumulic Hapludolls & Fine-loamy, thermic Typic Argiudolls
- Coarse-loamy, thermic Cumulic Haplumbrepts & Fine-loamy, thermic Lithic Haplumbrepts
- Coarse-loamy, thermic Cumulic Haplumbrepts & Fine-loamy, thermic Typic Haplumbrepts
- Coarse-loamy, thermic Pachic Haplumbrepts & Fine-loamy, thermic Umbric Dystrochrepts
- Coarse-loamy, thermic Typic Hapludolls & Fine-loamy, thermic Umbric Dystrochrepts
- Coarse-loamy, thermic Typic Haplumbrepts & Coarse-loamy, thermic Umbric Dystrochrepts
- Coarse-loamy, thermic Typic Haplumbrepts & Fine thermic Umbric Dystrochrepts
- Coarse-loamy, thermic Umbric Dystrochrepts & Loamy-skeletal over fragmental, thermic Entic Hap
- Coarse=lomany thermic Typic Haplumbrepts & Coarse lmany thermic Lithic Udorthents
- Coase lomany, thermic typic Udorthents & Coarse lomany thermic Typic Udorthients
- Cross lomany over frafmental thermic Typic Udorthents & cross lomany thermic Lithic Haplumbrep
- Cross lomany thermic Entic Hapludolls & Cross lomany Therrmic Dystric Hapludolls
- Cross lomany thermic Typic Hapludolls & Cross lomany Entic Hapludolls
- Cross lomany thermic Typic Hapludolls & Cross lomany over fragmental thermic Entic Hapludolls
- Cross lomany thermic Typic Hapludolls & Cross lomany, thermic Typic Hapludolls
- Cross lomany, thermic Mollic Udarents & cross lomany thermic Entic Hapludolls
- Cross lomany, thermic Tyoic Haplumbrepts & Cross lomany thermic Dystric Eutrocherpts
- Fine lomany thermic Tyic Haplumbtrpts & cross lomany over fragmental thermic Tupic Udorthents
- Fine lomany thermic pachic Haplumbtrpts & Cross lmany thermic typic Haplumbtrpts
- Fine lomany thermic tyic Dystrocherpts & cross lomany, thermic Haplumbrepts
- Fine thermic Umbric Dystrocherpts & Fine lomany thermic Umbric Dystrocherpts
- Fine, thermic Typic Haplumbrepts & Fine-silty, thermic Typic Haplumbrepts
- Fine-loamy, over fragmental, thermic Typic Haplumbrepts & Coarse-loamy, thermic Mollic Udarent
- Fine-loamy, thermic Cumulic Haplumbrepts & Lomany-skeletal,. Therminc Typic Udorthents
- Fine-loamy, thermic Entic Haplurnbrepts & Loamy-skeletal, thermic Umbric Dystrochrepts
- Fine-loamy, thermic Pachic Haplumbrepts & Coarse-loamy, thermic Entic Haplumbrepts
- Fine-loamy, thermic Typic Argiudolls & Fine-loamy, thermic Cumulic Hapludolls
- Fine-loamy, thermic Typic Hapludolls & Coarse-loamy, thermic Udorthents
- Fine-loamy, thermic Typic Hapludolls & Fine-loamy, thermic Typic Argiudolls
- Fine-loamy, thermic Typic Haplumbrepts & Loamy-skeletal, thermic Umbric Dystrochrepts
- Fine-loamy, thermic Typic Haplumbrepts & Sandy-skeletal, over fragmental, thermic Typic Udorth
- Fine-loamy, thermic Typic Paleudolls & Fine-loamy, thermic Typic Hapludolls
- Fine-loamy, thermic Umbric Dystrochrepts & Loamy-skeletal, thermic Entic Haplumbrepts
- Fine-silty, thermic Pachic Haplumbrepts & Fine-loamy, thermic Typic Dystrochrepts
- Fine-silty, thermic Typic Haplumbrepts & Fine-loamy, thermic Umbric Dystrochrepts
- Loamy-skeletal, isofrigid Lithic Cryorthents & Loamy-skeletal, isofrigid Typic Cryorthents
- Loamy-skeletal, mesic Lithic Udorthents
- Loamy-skeletal, mesic Typic Hapludolls & Coarse-loamy, thermic Mollic Udorthents
- Loamy-skeletal, thermic Cumulic Hapludolls & Coarse-loamy, thermic Typic Udorthents
- Loamy-skeletal, thermic Entic Hapludolls & Loamy-skeletal, thermic Typic Udorthents
- Loamy-skeletal, thermic Lithic Haplumbrepts & Coarse-loamy, thermic Lithic Udorthents
- Loamy-skeletal, thermic Typic Hapludolls & Coarse-loamy, thermic Lithic Udorthents
- Loamy-skeletal, thermic Umbric Dystrochrepts & Loamy-skeletal, thermic Typic Dystrochrepts
- Loarny-skeietal, thermic Lithic Udorthents

The soil status for the districts of Sikkim is given below:

Table 2.2: Soil pH (Area in percent)

Sl. No	District	Strongly Acidic	Moderately Acidic	Slightly Acidic
1	North	62.4	24.4	6.5
2	East	73.0	18.3	6.5
3	South	37.0	30.8	18.2
4	West	43.9	38.9	14.2

Source: Agriculture Census & EARAS, 2013-14

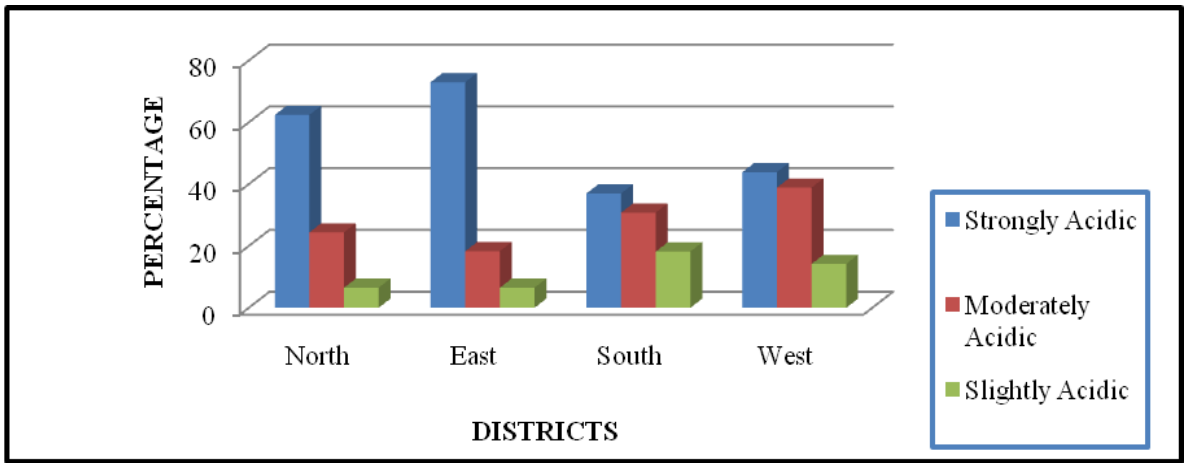


Figure 2.1: District-wise Distribution of Soil pH in Percent

It is evident from the above (figure 2.1) that the proportion of acid content in soil is high in every district of Sikkim. The East district has higher strongly acidic content in soil in comparison with other districts. There moderately acidic content in soil comes second. But the moderately acidic soil is more in West district, followed by the South district. Overall pHs in soil in different districts are as follows: In North district 93.3% area is acidic; in East district 97.8% area is acidic; in West district 97.0% area is acidic and in South district 86.0 % area is acidic, which is the lowest among all districts.

Table 2.3: Organic Carbon (Area in percent)

Sl. No	District	Low (<0.75%)	Medium (0.75-1.5 %)	High (>0.75-1.5%)
1	North	7.7	7.7	84.6
2	East	3.4	9.8	86.8
3	South	7.2	12.6	80.2
4	West	4.4	9.6	86.0

Source: Agriculture Census & EARAS, 2013-14.

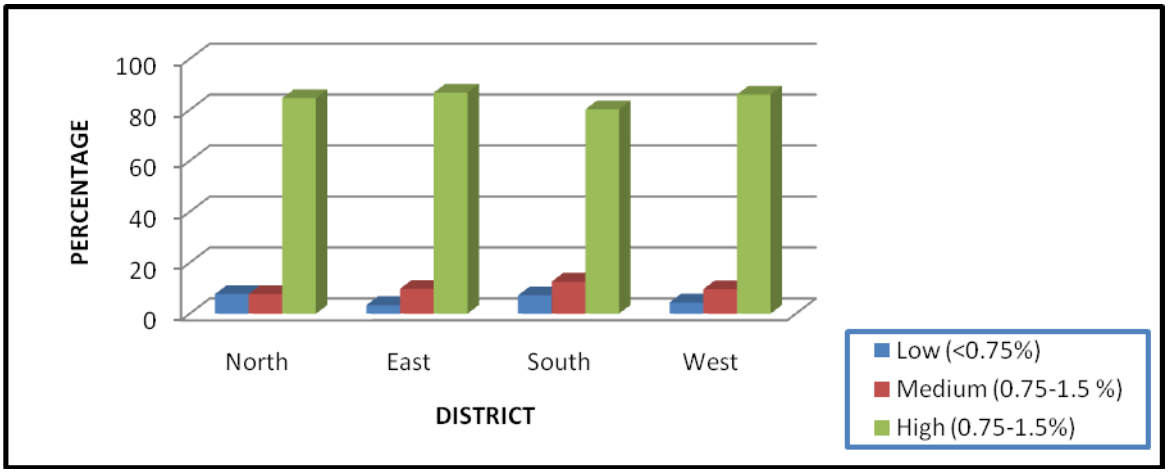


Figure 2.2*:* District-wise Organic Carbon Available in Soil (Percent)

It is evident from the figure 2.2 that the proportion of organic carbon content in soil is high in every districts of Sikkim. In fact, organic carbon content is very high i.e. (>0.75-1.5%) in almost all soil types in Sikkim.

Table 2.4: Available Phosphorous (Area in percent)

Sl. No	District	Low (<34Kg/Ha	Medium (34-68 Kg/Ha)	High (>68 Kg/Ha)
1	North	0.00	29.3	70.7
2	East	5.8	12.1	82.1
3	South	5.1	12.6	82.3
4	West	3.7	17.9	78.4

Source: Agriculture Census & EARAS, 2013-14.

Figure 2.3: District-wise Phosphorous Available in Soil (Percent)

It can be observed in the figure 2.3 that the phosphorous (P) content in soil is very high i.e. (>68 Kg/Ha) in all the districts of Sikkim.

Table 2.5: Available Potassium (Area in percent)

Sl. No	District	Low (<135Kg/Ha	Medium (135-335 Kg/Ha)	High (>335 Kg/Ha)
1	North	7.6	39.3	53.1
2	East	8.3	27.8	63.9
3	South	9.7	37.1	53.2
4	West	5.6	28.1	67.3

Source: Agriculture Census & EARAS, 2013-14.

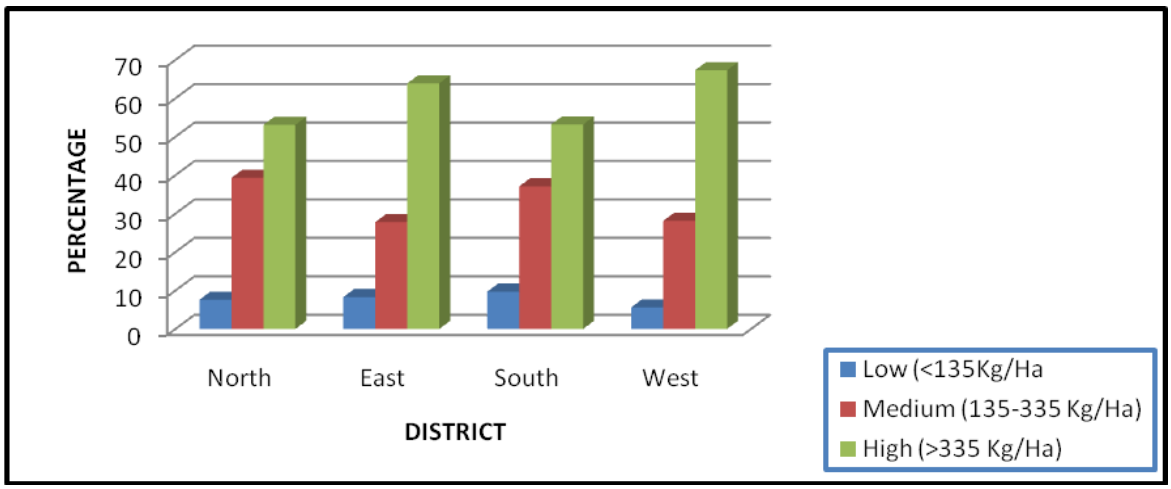


Figure 2.4: District-wise Potassium Available in Soil (Percent)

It is revealed from the above figure 2.4 that the proportion of potassium (K) available in soil is high in every district of Sikkim, i.e. (>335 Kg/Ha) in almost all soil.

The soil data were collected from different places of South Sikkim by Krishi Vigyan Kendra (KVK), Namthang, South Sikkim and three types of soil were found i.e. sandy loam, clay loam and loam. The area has moderately acidic to acidic soil. The places that have sandy loam soil are Namthang, Rateypani, Melli, Jorethang etc; Damthang, Temi, Rabong, Kewzing has clay loam type of soil and the places like Yangyang, Lingmoo etc. have loam soil.

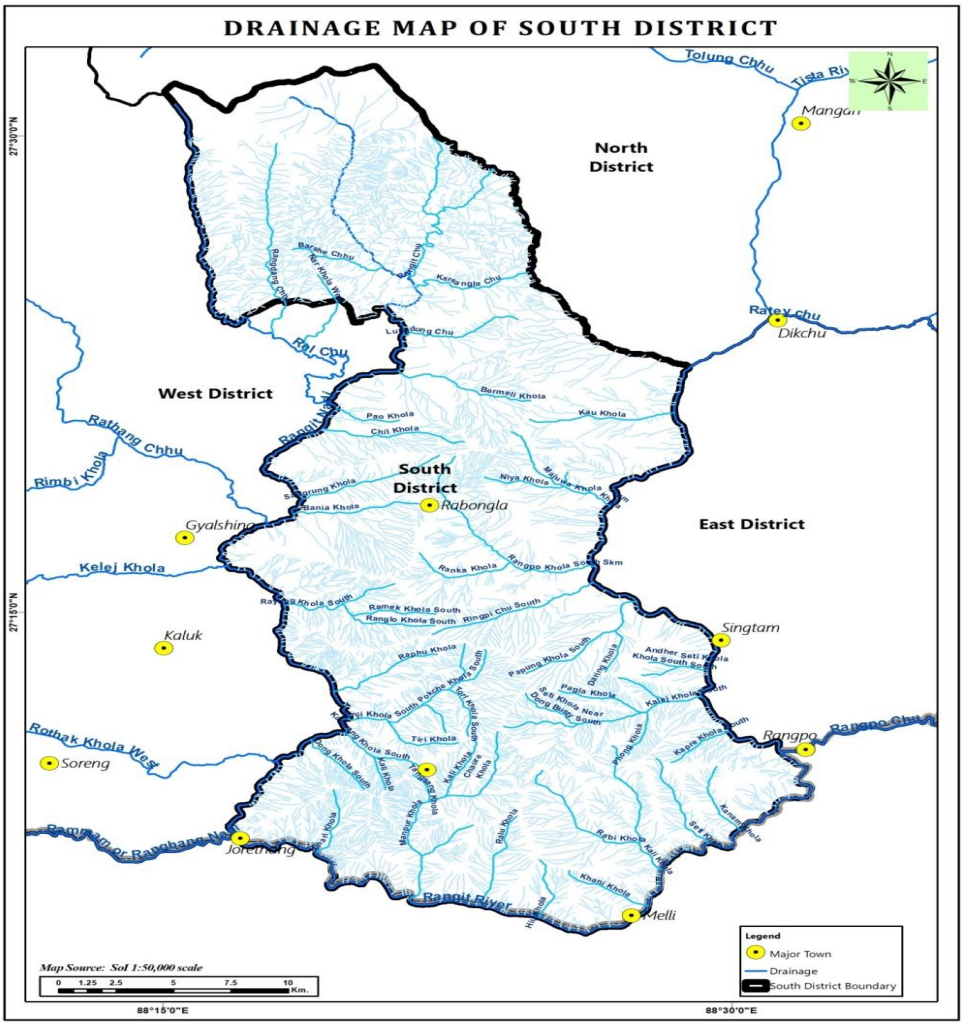
Soil Types Available in Study Areas (15 GPUs)

The soils which are found in the study area are as follows: Namphing (red, black and grey), Legship (sandy, black red and loam), Rong-Bul (grey mixed with stones, red and black), Tarku (black), Turung-Mamring (loam, black), Sadam–Suntaley (sandy, black), Tinik-Chisopani (brown and black), Namthang-Maneydara (sandy loam), Assangthang (black and red), Wok-Omchu (red, sandy and black), Borong-Phamthang (clay, black and red), Barfung-Zarung (sandy, black and red), Paiyong (sandy, brown and red), Tinkitam Rayong (black, clay, and red) and Perbing-Dovan (yellow, red and sandy).

Drainage

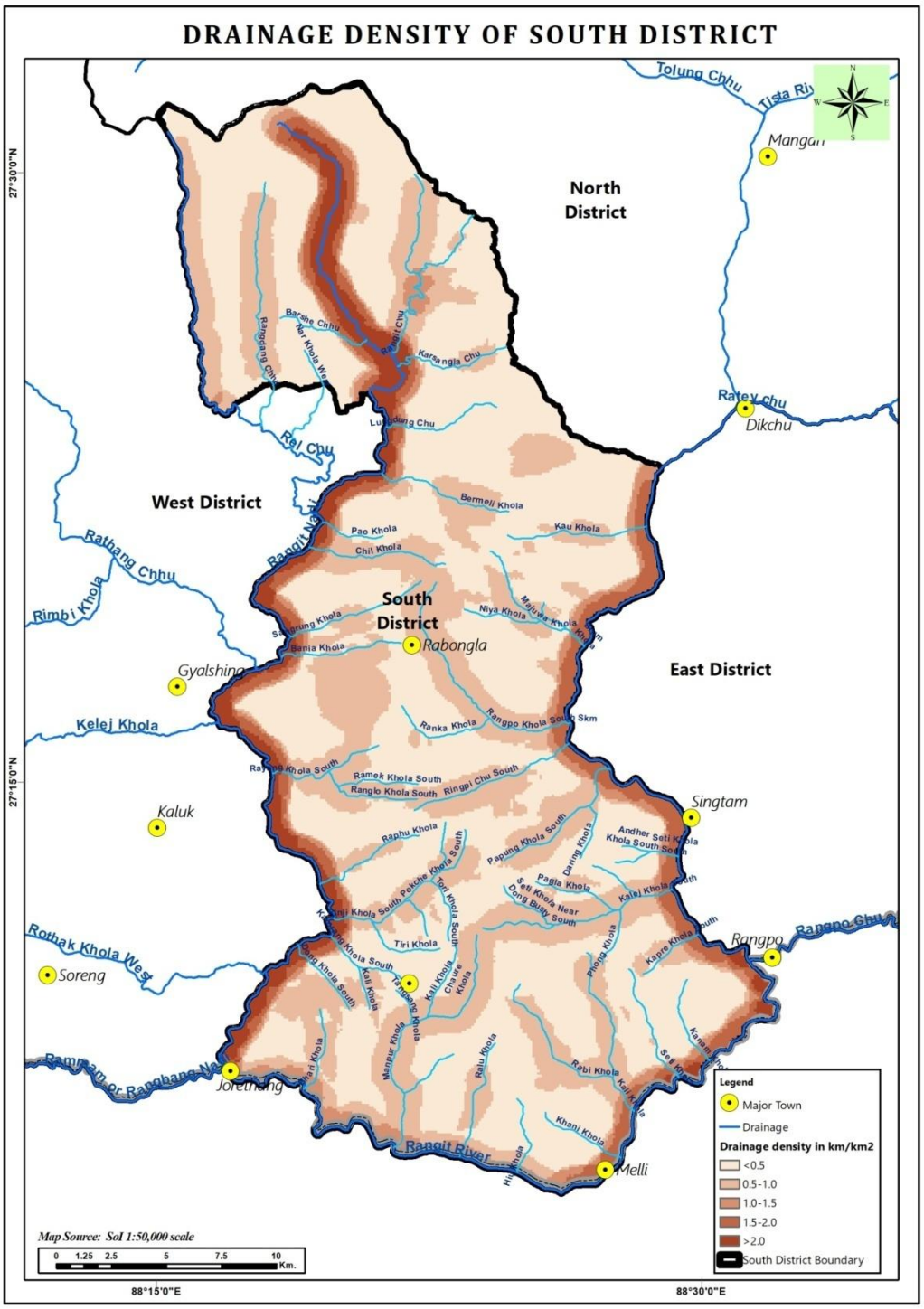
The drainage of the district is controlled by the perennial Teesta and Rangit rivers along with their tributaries. Teesta, the main river that passes through the area originates from the central crystalline zone defined by high mountain ranges which is covered by glaciers. The Teesta and its tributaries drain different parts of the area. The rivers are perennial in nature as they are fed by both snowmelt water and rain water. Rangit, another major river originates from West Sikkim. During its southerly course it receives Melli, Namlong Khola, Rathong Chhu, Kalig Chu, Rayong Chhu, etc. The southerly flowing Teesta is joined by Rangchap Chhu at the extreme north of the South District of Sikkim. The type of drainage is trellis and dendritic. Most of the Kholas have originated from the higher altitudes and flow down by cutting deep gorges in lower altitude where they ultimately join with the main river Teesta (www.sikkimsprings).

Map No. 4



The major tributaries and Sub-tributaries of Teesta in the South district are Kayam Chhu, Rangit Chhu, Lungdung Chhu, Barme Chhu, Rangphap Chhu, Kau Khola, Niya Khola, Ben Khola, Katlej Khola, Kanam Khola, Seti Khola, Rabi Khola, Ralu Khola, Rayong Khola ,Pirchu Khola, Tre Khola, and Manpur Khola. (Choudhury, 2006).

Map No. 5



Drainage Density

The drainage density is anisotropic within south district. The very high density (above 2 km/km2 Dd) is found in the North Eastern part of Ravangla Sub-division. The high density (1.5-2.0 km/km2 Dd) occurs both in Namchi and Ravangla Sub-division having streams like the Kalej khola, Kau khola, Rangit chhu, etc. The medium density (1.0-1.5km/km2 Dd) is found in most part of South Sikkim from upper belt to lower belt. The low drainage density (0.5-1.0km/km2 Dd) is found mostly in western part and to some extent in the southern part of the district and very low drainage density (below 0.5km/km2 Dd) is found in northern part around Sakkyag and southern part like Mamring, Turung, Jorethang, Sikkip, Kamrang etc.

Climate

Sikkim is a land of great climate contrasts within very short distances. Latitudinally, the state is located within sub-tropical climatic regime. But due to the presence of high mountains, here one can experience climates as varied as temperate, alpine and even arctic types. Elevation plays the prime role in fashioning the climatic types of the state. The differences in climatic types may be imagined from the fact that the altitude of Sikkim ranges from mere 300m to 8,000m above mean sea level (amsl).The climatic diversity is due not only to the differences in altitude but also the configuration of neighboring mountain ranges, which largely affects air movement, precipitation and temperature (Choudhury, 2006).

The climate of Sikkim may broadly be classified into the following types:-

i.) Subtropical Humid Type: The areas lying below 1500m above mean sea level (amsl) experience subtropical humid type of climate. The temperature ranges between 16°C and 33°C in winter and summer respectively. The average annual rainfall is high, but it varies from place to place (1,500mm to 3,500mm) due to variations in aspect. While Tadong in east Sikkim receives more than 3,000mm of annual rainfall, Namchi in South Sikkim, located at about same elevation, receives only 1,550mm.

ii.) Semi-temperate Type: This climate is experienced in areas located between 1,500m and 2,000m amsl. Here mean monthly temperatures range from 8°C in winter months to 26°C in summer. Rainfall is usually heavy with a mean annual of 2,400mm.

iii.) Temperate Type: The hill slopes lying between 2,000m and 3,000m amsl have temperate climate. Here the mean monthly temperatures range from 0°C in winter to 15°C in summer.

iv.) Snow Forest Type: This climate is experienced between 3,000m to 4,000m amsl. Here temperature ranges between near or below the freezing point to 10°C in winter and summer respectively.

v.) Tundra Type: This area is having elevation of more than 4,000m but less than 6,000m amsl. Here the temperature is always very low, night temperature often dropping below the freezing point.

vi.) Arctic Type: The arctic type of climate is prevalent only in the extreme northwestern part of the state where a number of peaks soar high above 6,000m amsl (Choudhury, 2006 :11-13).

Most of the inhabited regions of Sikkim experience a temperate climate, with temperatures seldom exceeding 28°C in summer. The average annual temperature for most of Sikkim is around 18°C.

The habitable areas extend up to 2,100m, which cover about 23.9% of the total geographical area; settlements are mainly confined to the area lying below 1,800m and are generally concentrated in the southern part of the state, mostly along the wide river valleys and sometimes reaching up to the adjoining ridge tops. Due to the absence of any sizable flat land the distribution of population is sparse throughout the slopes, without forming any village in true sense (Boot, 1988). The population of Sikkim comprises conspicuously three ethnic communities i.e. Nepalese, Lepcha and Bhutia. Sikkim's economy is mainly dependent on agriculture. Almost 85% of the population of Sikkim lives in rural areas and only the improvement in agriculture can better their lot. Agriculture, horticulture, livestock, fisheries and agro-forestry can be integrated to give viable farming systems to farmers (Lama, 2003).

The temperature varies according to altitude and slope. In South district maximum temperature ranges between 15°C and 30°C during July and August and the minimum between 2°C and 10°C during December and January. The annual rainfall varies from 2,000mm to 3,000mm. The South district is predominantly agricultural with gross cropped area of 75,000 ha. The irrigated area of the district is about 5,270.14 ha. Maize is the main crop followed by rice, wheat, pulses, potato and vegetables that are predominantly grown in hill terraces. In addition to these, a few cash crops play an important role in the economy of the district.

The South district of Sikkim is divided into three Agro-Ecological Situations (AESs) based on altitude, temperature and type of irrigation like channel, spring irrigation and rain fed situation.

Table 2.6: The three AESs (Agro-Ecological Situations)

Agro-Ecological Situations	Altitude (in metres)	Temperature	Irrigation System/Facilities
AES I	High Altitude (1501m - 5000m)	Low Temperature (2°C - 20°C)	Rainfed
AES II	Medium Altitude (801-1500m)	Medium Temperature (10°C - 25°C)	Spring Channel
AES III	Low Altitude (300-800m)	High Temperature (12°C - 30°C)	Channel Irrigation

Source: Agriculture Census & EARAS, 2013-14.

Table 2.7: Rainfall Calendar

Rainfall	Normal Rainfall (mm)	No. of Rainy Days	Normal Onset	Normal Cessation
SW Monsoon (June-Sep)	658.40	66	2nd week of June	4th week of September
NE Monsoon (Oct-Dec)	56.32	14	3rd week of October	2nd week of November
Winter (Jan-March)	22.72	14	1st week of January	3rd week of March
Summer (April-May)	151.80	19	3rd week of April	3rd week of May
Annual	889.24	113		

Source: agricoop.nic.in.

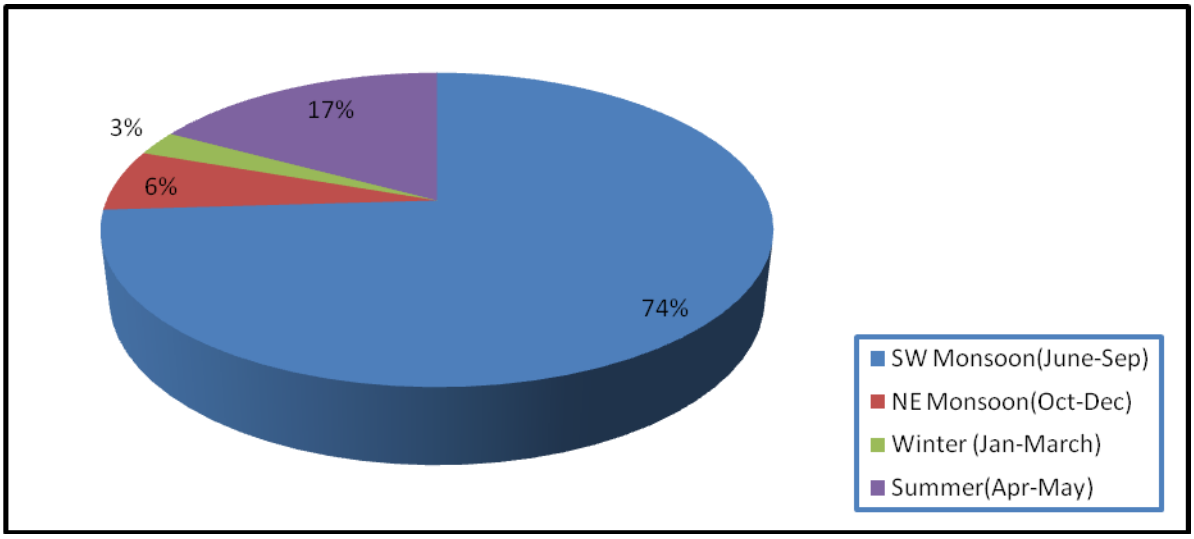


Figure 2.5: Normal Rainfall (mm) in South District (in Percentage)

Fig. 2.5 reveals that in South District, South West monsoon which occurs in the months of June to September brings 74% of rainfall, while summer rainfall before monsoon amounts to

17%. The North East monsoon that occurs during the months of October to December contributes 6%, while the winter months from January to March bring only 3% of rainfall.

South district is the most drought prone district in Sikkim. The Darjeeling hills render this area into a rain shadow area where rainfall is sparse and scare. As such, the Rural Management and development Department, Government of Sikkim along with its flagship programme MGNREGA, has taken various initiatives to preserve and develop water resources, of the state under its Dhara Vikas or Springshed Development Programme (www.indiawater.org).

Demography

The demographic pattern of an area reflects the level of development in the area concerned. The development of any region, city, town etc. depends largely on the physical and socio-economic factors. Some of the factors which determine the population assume significance in the future pattern of progress and development. Further, the factors like altitude, slope, drainage and sub-soil water table affect population distribution at local level.

Sikkim has four districts according to administrative convenience i.e. East, West, North and South districts. The headquarters of four districts are Gangtok (East), Gyalshing (West), Mangan (North) and Namchi (South). These four districts are further divided into sixteen (16) subdivisions; Gangtok, Pakyong, Rongli and Rangpo are the sub-divisions of East district, Gyalshing, Soreng, Yuksam and Dentam are the sub-divisions of West district, Kabi, Dzongu, Mangan and Chungthang are the sub-divisions of North district. South district has four sub-divisions namely – Namchi, Ravongla, Jorethang and Yangang. These four sub-divisions are further supported by a network of eight Block Administrative Centres. The district has 148 Revenue Blocks, 452 villages, 47 Gram Panchayat Units and 271 Panchayat wards. According to 2011 census the total population of Sikkim is 6, 10,577 and South district has a total population of 1, 46,850; the male population is 76,670 and female 70,180; rural population is 1, 25,651 and urban 2, 11, 99. The density of population is 196 inhabitants per square km and decadal population growth rate from 2001 to 2011 is 11.57%. The district has a sex ratio of 915 females per 1000 males while the literacy rate is 81.4.

Out of the 47 Gram Panchayat Units, 15 Gram Panchayat Units (GPUs) have been selected for study according to agro-climatic zones. The distribution of GPUs according to elevation bands (300-900m, 900m-1,500m, and 1,500-2,100m) is as follows:

1) Gram Panchayat Units which fall under 300-900 metres elevation are Namphing, Legship, Rong-Bul, Tarku and Turung-Mamring**.** The total population of these five GPUs according to 2011 census is 15,339 out of which male population is 7,815 and female population is little less than male population i.e. 7,524. The total number of households of five GPUs is 3,401. The average literacy rate of the GPUs is 82.22 and

average sex ratio of females per 1000 male is 963. The total area of these GPUs is 2817.43 ha.

2) Gram Panchayat Units which fall between 900-1500 metres elevation are Sadam-Suntaley, Tinik-Chisopani, Namthang-Maneydara, Assangthang, and Wok-Omchu. The total population of these GPUs according to 2011 census is 13,422 out of which the male population is 7,332 and female population is little smaller in comparison to male i.e. 6,090 .The total number of households of five GPUs is 2,655. The average literacy rate is 83.78 and average sex ratio of females per 1,000 male is 830. The total area of these GPUs is 3,261.43 ha.

3) Gram Panchayat Units which are located above 1500-2100 metres elevation are Borong-Phamthang, Barfung-Zarung, Paiyong, Tinkitam-Rayong and Perbing-Dovan. The total population of these GPUs according to 2011 census is 14,076 out of which the total male population is 7,298 and female population is little smaller in comparison to male i.e. 6,778. The total number of households in five GPUs is 2,919. The average literacy rate is 77.88 and average sex ratio of females per 1,000 male is 928. The total area of these GPUs is 5785.78 ha.

Workforce Profile

Work is always related to productivity, profitability as well as economic efficiency of the workers themselves or the various sectors, which they represent. A workforce profile would serve to provide sufficient indication of the economic development of a state, as it is essentially the ground level workers who contribute to the production of goods and services and help to sustain a satisfactory life standard for one and all. On the basis of what one is doing or not doing, the population of a place may be distinguished as workers and non-workers, the workers being further grouped as the main workers and the marginal workers. A person who has worked for a period of six months or more is treated as a main worker and the person who has worked for less than six months is a marginal worker. The whole range of cultivators, agricultural labourers, industrial workers and all others engaged in regular form of activities comprise the main workers while the non-workers include students, household dependents, pensioners and casual workers. The main workers are categorised as cultivators, agricultural labourers, workers in the household industry and other workers (Subba, 2008).

Table 2.8: Distribution of Workers of South District – 2011

Sl. No.	Workers Group	Number of Workers Mean ±S.D.	Standard Error
1.	Main Workers	50898±37.6138	15.3557
2.	Marginal Workers	23855±38.9512	15.9017
3.	Cultivators	37802±24.1080	9.8420
4.	Agricultural Labourers	4188±38.1837	15.5884
5.	Others Workers	31759±31.1319	12.7095
	Total	148502±36.0388	14.7128

Source: DESME, 2013.

The data in table 2.8 show distribution of workers in South district and a comparative data of Main Workers, Marginal Workers, Cultivators, Agricultural Labourers and Others Workers showing the significant mean ±S.D and standard error. It is obvious that topmost workers group is Main Workers which has highest mean ±S.D, i.e. 50898±37.6138 and standard error is calculated as 15.3557. Cultivators come under second position which has significant mean ±S.D. of 37802±24.1080 and standard error is calculated as 9.8420. The other workers groups such as Others Workers and Marginal Workers have significant mean ±S.D of 31759±31.1319 and 23855±38.9512 respectively, and standard errors are 12.7095 and 15.9017 respectively. According to above data Agricultural Labourers are much less in comparison to other workers group (mean ±S.D. 4188±38.1837).

Map No. 6

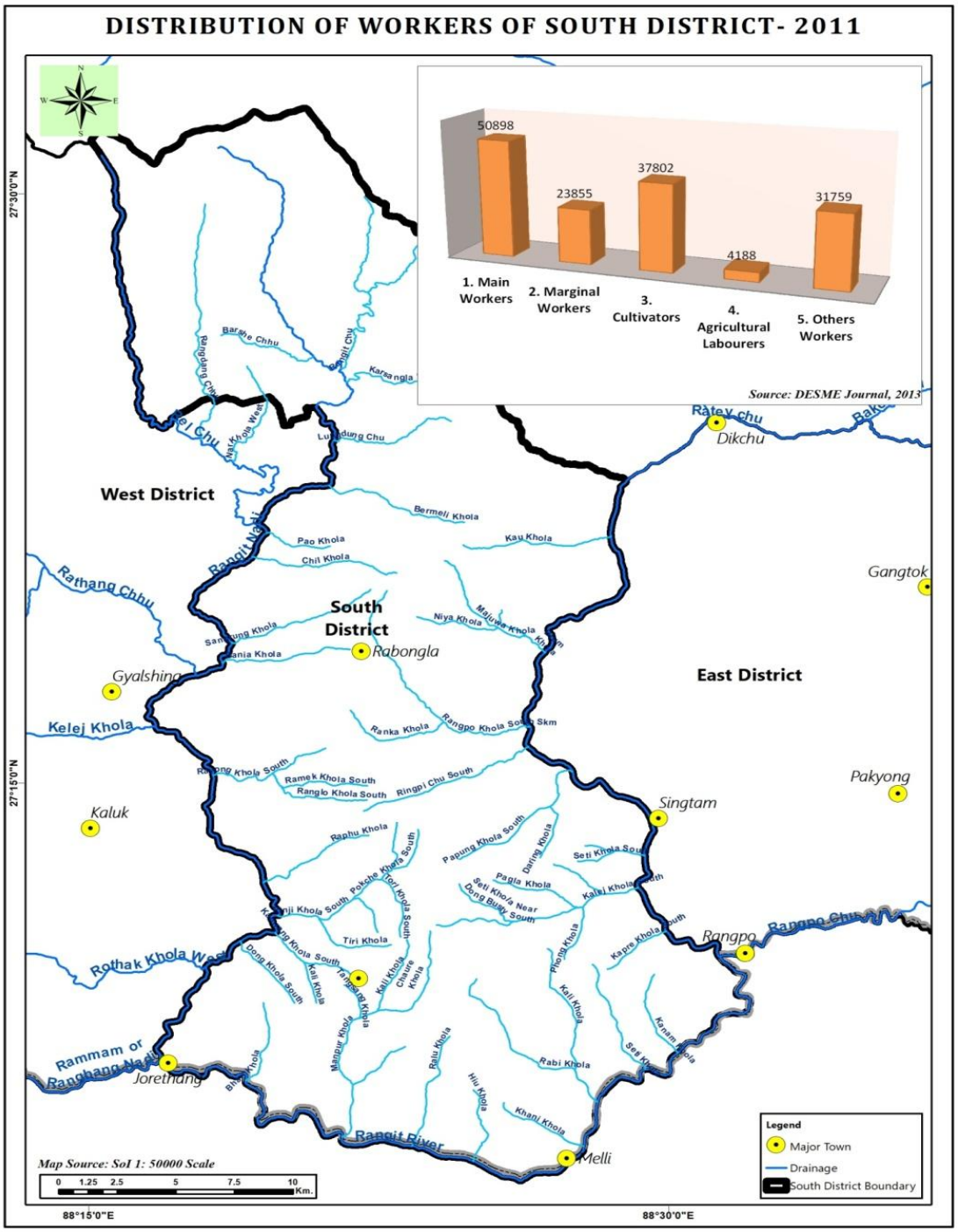

DISTRIBUTION OF WORKERS OF SOUTH DISTRICT- 2011
50898
23855
37802
4188
31759
1. Main Workers
2. Marginal Workers
3. Cultivators
4. Agricultural Labourers
5. Others Workers
Source: DESME Journal, 2013
West District
South District
East District
Rabongla
Gyalshing
Kaluk
Dikchu
Gangtok
Pakyong
Singtam
Rangpo
Jorethang
Melli
Rathang Chhu
Kelej Khola
Rothak Khola West
Rammam or Rangbang Nadi
Rangit River
Rangpo Chhu
Ratey Chu
Rangit Nadi
Bermell Khola
Pao Khola
Chil Khola
Kau Khola
Niya Khola
Ranka Khola
Ramek Khola South
Ranglo Khola South
Ringpi Chu South
Raphu Khola
Papung Khola South
Daring Khola
Pagla Khola
Tiri Khola
Phong Khola
Rabi Khola
Khani Khola
Legend
Major Town
Drainage
South District Boundary
Map Source: SoI 1: 50000 Scale
0 1.25 2.5 5 7.5 10 Km.
88°15'0"E
88°30'0"E
27°30'0"N
27°15'0"N

Table 2.9: Distribution of Male and Female Workers of South District-2011

Workers	Rural	Urban	Total
Male	39645	5655	45300
Female	27162	2291	29453
Total	66807	7946	

Source: DESME, 2013.

The number of workers in rural areas of South district is much higher than in urban areas. In urban areas people are engaged in secondary and tertiary activities, but in the rural areas most of the people are indulged in different farm and non-farm activities for their livelihood. The percentage of workers in rural areas is 59 percent of male and 41 percent of female. The percentage of workers in urban areas is 71 percent of male and 29 percent of female. The male working group constitutes 61 percent and female 39 percent only. That means overall female working population is less in both rural and urban areas.

Map No. 7

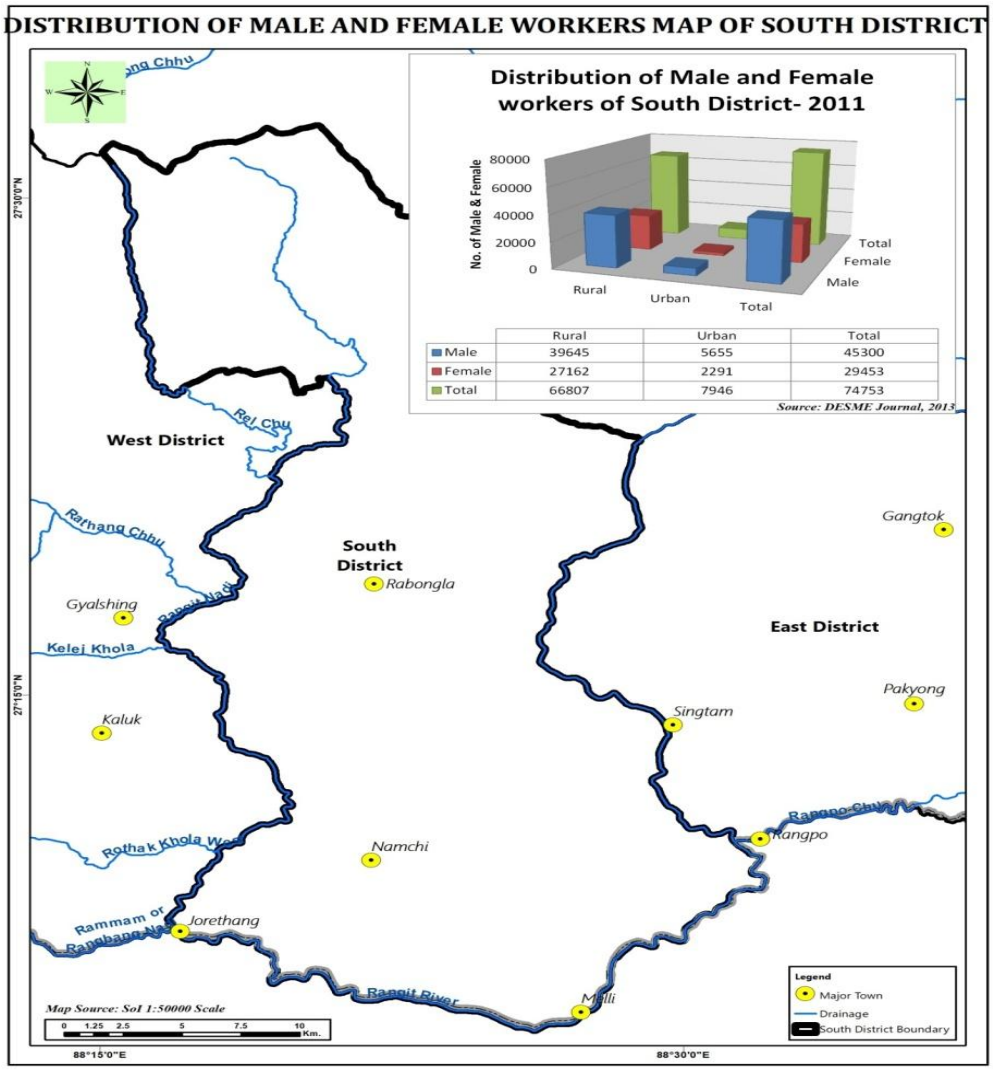


Table 2.10: Distribution of Male Workers of South District -2011

Sl. No.	Workers Group	Number of Workers Mean ±S.D.	Standard Error
1.	Main Workers	35271±44.1225	18.0129
2.	Marginal Workers	10029±19.4833	7.9540
3.	Cultivators	20808±15.4660	6.3140
4.	Agricultural Labourers	2116±14.4222	5.8878
5.	Others Workers	21813±19.2353	7.8528
	Total	90037±25.6515	10.4721

Mean ±Standard Deviation has been calculated by using Duncan Multiple Range Test for six data to each group.
Source: DESME, 2013.

The data in table 2.10 show distribution of Male workers group of South district and a comparative data of Main Workers, Marginal Workers, Cultivators, Agricultural Labourers and Others Workers which shows the significant mean ±S.D and standard error. It is found that highest number of workers is in the group of Main Workers which has the significant mean ±S.D of 35271±44.1225 and standard error is calculated as 18.0129. The group of Other Workers comes in second position with the significant mean ±S.D is 21813±19.2353 and standard error is calculated as 7.8528. The remaining workers groups such as Cultivators and Marginal Workers have significant mean ±S.D of 20808±15.4660 and 10029±19.4833 and standard error is calculated as 6.3140 and 7.9540 respectively. According to above data Agricultural Labourers is less in comparison to other workers group (mean ±S.D. 2116±14.4222).

Table 2.11: Distribution of Female Workers of South District – 2011

Sl. No.	Workers Group	Number of Workers Mean ±S.D.	Standard Error
1.	Main Workers	15627±25.6671	10.4785
2.	Marginal Workers	13826±22.9695	9.3772
3.	Cultivators	16994±34.7735	14.1962
4.	Agricultural Labourers	2072±15.9749	6.5217
5.	Others Workers	9946±39.2784	16.0353
	Total	58465±36.1275	14.7490

Source: DESME, Journal, 2013.

The data illustrated in table 2.11 show distribution of female workers group of South district. The table shows Main Workers, Marginal Workers, Cultivators, Agricultural Labourers and Others Workers to show the significant mean ±S.D. and standard error. It is found that the

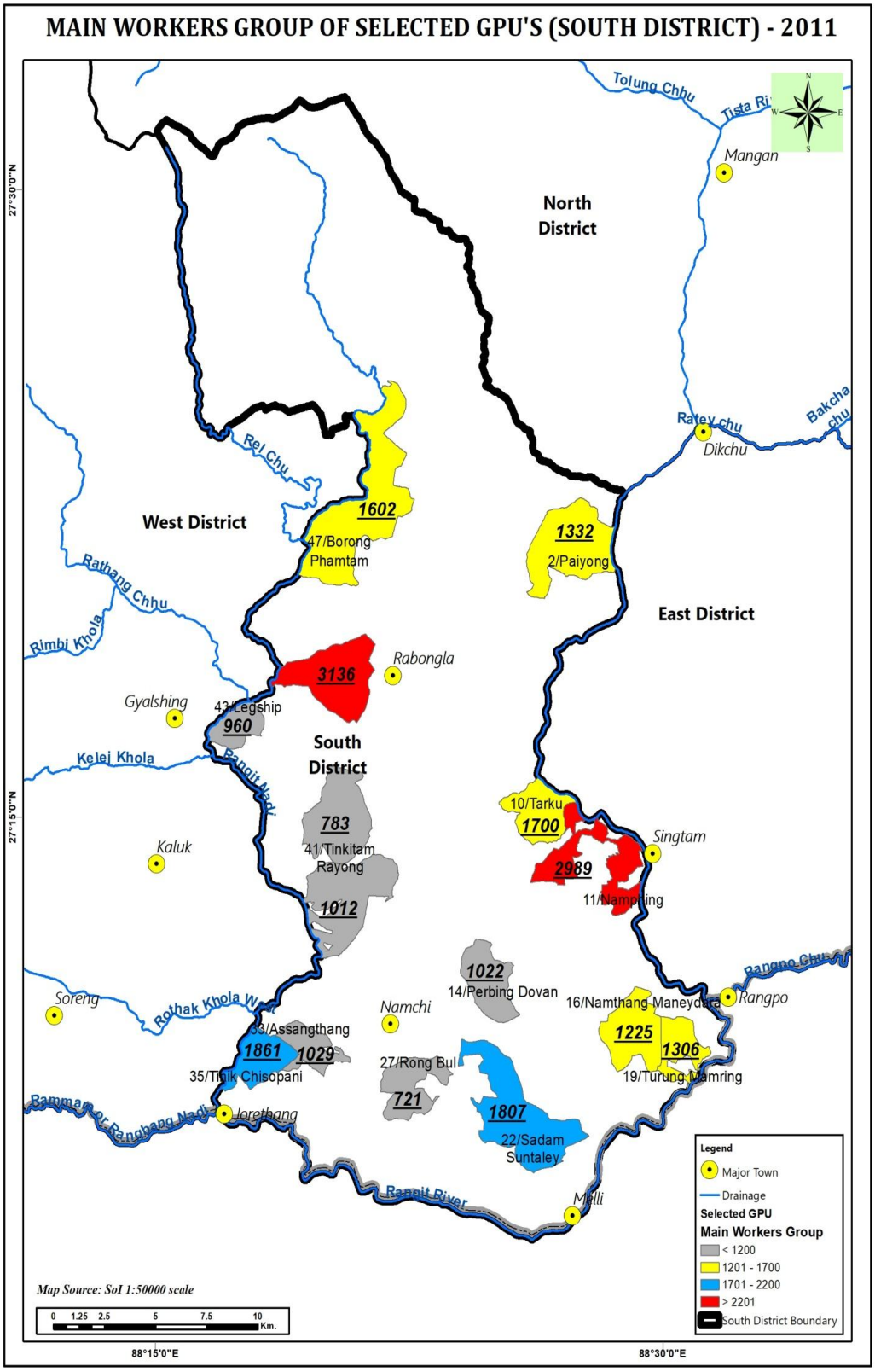
highest number of workers group is Cultivators which show the significant mean ±S.D of 16994±34.7735 and standard error is calculated as 14.1962. The Main Workers group comes second with the significant mean ±S.D. of 15627±25.6671 and standard error is 9.3772. This is followed by the Marginal Workers and Other Workers and their mean ±S.Ds are 13826±22.9695 and 9946±39.2784, while standard errors are 9.3772 and 16.0353 respectively. The female agricultural labourers group has the lowest mean, i.e. ±S.D. 2072±15.9749 with standard error of 6.5217.

Table 2.12: Main Workers Group of Selected GPUs

Sl. No.	Gram Panchayat Units (GPUs)	Main Workers Mean ±S.D.	Standard Error
1.	Namphing	2989±28.1992	15.5123
2.	Legship	960±36.3097	14.8234
3.	Rong-Bul	721±47.0871	19.2232
4.	Tarku	1700±36.0721	14.7263
5.	Turung-Mamring	1306±28.1069	11.4746
6.	Sadam-Suntaley	1807±39.0486	15.9415
7.	Tinik-Chisopani	1861±39.3649	16.0706
8.	Namthang-Maneydara	1225±26.3969	107765
9.	Assangthang	1029±28.2418	11.5296
10.	Wok-Omchu	1012±28.1069	11.4746
11.	Borong-Phamthang	1602±29.0172	11.8462
12.	Barfung-Zarung	3136±24.8112	10.1291
13.	Paiyong	1332±30.2787	12.3612
14.	Tinkitam-Rayong	783±42.7551	17.4547
15.	Perbing-Dovan	1022±37.2290	15.1986
	Total	22485 ±27.5027	11.2279

Mean ±Standard Deviation has been calculated by using Duncan Multiple Range Test for six data to each group.
Source: DESME, 2013.

Map No. 8


MAIN WORKERS GROUP OF SELECTED GPU'S (SOUTH DISTRICT) - 2011
North District
West District
East District
South District
Tolung Chhu
Tista Ri
Mangan
Ratey chu
Dikchu
Bakcha chu
Rel Chu
1602
47/Borong Phamtam
1332
2/Paiyong
Rathang Chhu
Rimbi Khola
3136
Rabongla
Gyalshing
43/Legship
960
Kelej Khola
783
41/Tinkitam Rayong
1012
Kaluk
10/Tarku
1700
2989
Singtam
11/Mamring
1022
14/Perbing Dovan
16/Namthang Maneydara
Rangpo
Soreng
Rothak Khola
Namchi
63/Assangthang
1861
1029
35/Tinik Chisopani
27/Rong Bul
721
1807
22/Sadam Suntaley
1225
1306
19/Turung Mamring
Jorethang
Rangit River
Melli
Legend
Major Town
Drainage
Selected GPU
Main Workers Group
< 1200
1201 - 1700
1701 - 2200
> 2201
South District Boundary
Map Source: SoI 1:50000 scale
0 1.25 2.5 5 7.5 10 Km.
27°30'0"N
27°15'0"N
88°15'0"E
88°30'0"E

The Barfung-Zarung and Namphing GPU's have higher size of Main Workers because of large number of population. Tinik-Chisopani, Sadam-Suntaley and Tarku GPUs have the almost same number of Main Workers and other GPUs barring two are almost in the same range. The numbers of Main Workers are much smaller in Tinkitam-Rayong and Rong-Bul due to small population and also due to increase in school going children, increase of casual workers, involvement in govt. sector, reluctant to engage in agriculture etc. The percentage of main workers of Sikkim decreased by 6.10 % between 2001 (80.90%) and 2011 (74.80 %) while the non-worker population has been increasing which is a perturbing factor for the State at present. Similarly in rural areas Main Workers reduced by 8.60% from 79.8% in 2001 to 71.20% in 2011.

Table 2.13: Periodical Workers Involved in Agricultural Field (in Percentage)

Sl. No.	Months	No. of Farmers
1.	Below 3 Months	6.92
2.	3 Months - 6 months	33.08
3.	6 Months - 9Months	45.36
4.	Above 9 Months	14.64
	Total	100.00

Source: Field Survey, 2015-16.

The data given in table 2.13 show the periodical workers in agricultural field of study areas. The farmers engaged in agricultural field for 6 months to 9 months are found to be highest because they have to devote time for land preparation, sowing, transplanting and even harvesting etc. of different crops. If people cannot give their labour in their field for at least 6 to 9 months then it is difficult to produce good crop. From the above table it is understood that 3 to 9 months people of study area remain fully dedicated to agriculture field. In the rest 3 months involvement is less because of dry land.

Table 2.14: Number of Households Engaged in Rearing of Cattle

Households' Response in Rearing of Cattle	Percentage
Yes	89.46
No	10.54
Total	100.00

Source: Field Survey, 2015-16.

Most of the farmers are engaged in cattle rearing, (89.46 percent), but some farmers (10.54 percent) do not rear cattle due to fewer family members, less time etc.

Table 2.15: Categories of Livestock Reared by Households

Sl. No.	Item/Categories of Livestock	No. of Households engaged in Cattle Rearing Mean ±S.D.	Standard Error
1.	Cow (In Milk)	203±34.0470	13.8996
2.	Cow (Drought)	62±35.6089	14.5373
3.	Ox	38±27.7200	11.3166
4.	Goat/Sheep	169±34.0646	13.9068
5.	Pig	139±37.0243	15.1151
6.	Poultry	889±42.3792	17.3012
	Total	1500±34.9342	14.2618

Source: Field Survey, 2015-16.

The data of the milk, drought (dry milk) cows, ox, goat/sheep, pig and poultry of study areas are shown in table 2.15 along with the significant mean ±S.D and standard error. The highest number of livestock reared by households is poultry having mean ±S.D. of 889±42.3792 and its corresponding error is calculated as 17.3012. This result indicates that the inhabitants of study areas depend on poultry farming to supplement their income/food. The second highest number of livestock reared by households is cow (in milk) and the mean ±S.D value is 203±34.0470 while standard error is 13.8996. Third and fourth come goat/sheep and pig and their mean ±S.Ds are 169±34.0646, and 139±37.0243, and their corresponding errors are calculated as 13.9068 and 15.1151 respectively. Very few households rear cow (drought) and ox. Animal husbandry is one of the mainstays of a large portion of population in Sikkim. However, due to spatial-temporal changes animal rearing differs from place to place.

. **Table 2.16: Purpose of Rearing Livestock (in percentage)**

Sl. No.	Purpose	No. of Households
1.	Self Consumption	1,265
2.	For Sale	186
3.	Other Purposes	49
	Total	1,500

Source: Field Survey, 2015-16.

The table 2.16 illustrates the main purpose of livestock rearing in the study areas. The farmers rear livestock either for self consumption or for sale and other purposes. Most of the households i.e. 1,265 rear livestock for self consumption only. To overcome economic problems in the rural areas some people rear livestock for sale which constitutes 186 households. Other purposes include rituals, festivities, etc. for which they rear livestock. However, its quantum and involvement of households are less.

Table 2.17: Normal Distribution of Income and Expenditure of Villagers per Annum

Sl. No.	Intervals (In Rs.)	Income (%) Mean ±S.D.	Standard Error	Expenditure (%) Mean ±S.D.	Standard Error
1.	Below 10,000	13.88±8.5557	3.4928	4.96±3.0331	1.2382
2.	10,000-20,000	5.08±3.6393	1.4857	4.04±2.7871	1.1378
3.	20,000-30,000	22.13±12.3612	5.0464	22.21±11.6875	4.7714
4.	30,000-40,000	55.85±33.4966	13.6749	61.77±39.5062	16.1283
5.	Above 40,000	3.06±2.3367	.9539	7.02±4.7010	1.9192
	Total	100.00±25.3456	10.3473	100.00±25.3456	10.3473

Source: Field Survey, 2015-16.

The table 2.17 shows the normal distribution of Income and Expenditure of farmers per annum and the mean± S.D. and standard errors. Most of the farmers have income between Rs. 30,000-Rs.40,000 and its significant mean ±S.D. is 55.85±33.4966 and standard error is calculated as13.6749. The income group of Rs.20, 000-30,000 comes second with significant mean± S.D. of 22.13±12.3612 and standard error is calculated as 5.0464. The income groups of below Rs.10,000, Rs.10,000-Rs.20,000 and Above Rs.40000 have comparatively lower significant means at ±S.Ds (13.88±8.5557), (5.08±3.6393) and (3.06±2.3367) and standard error is calculated as (13.88±8.5557), (1.4857) and (.9539) respectively.

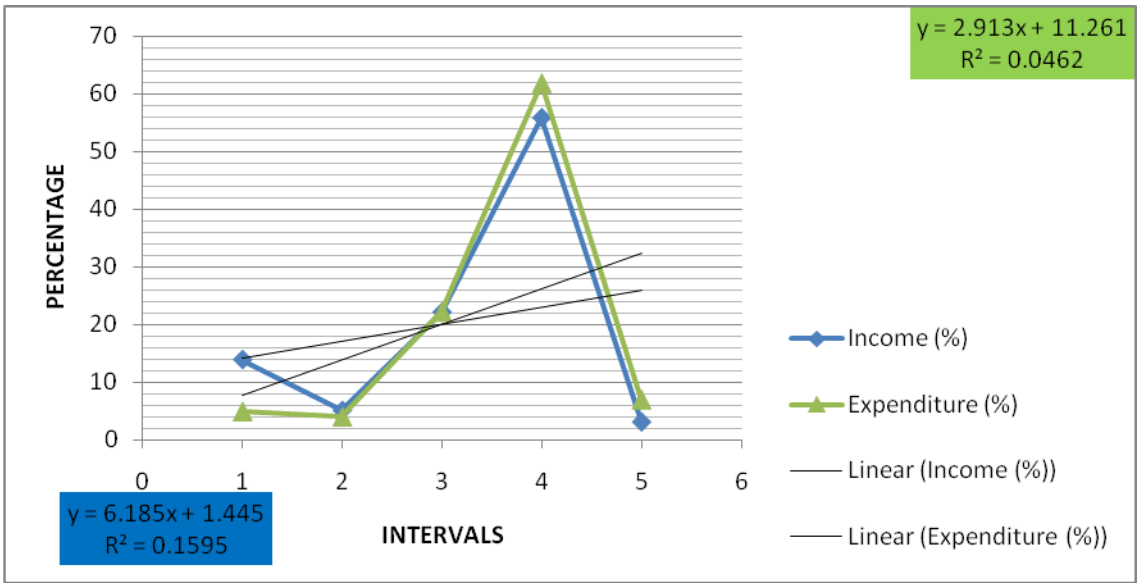


Figure 2.6: Normal Distribution of Income and Expenditure of Villagers per Annum

The figure 2.6 shows the income and expenditure of farmers per annum in different intervals. It is clear that the linear 1 and 2 show the regression lines corresponding to different intervals such as Below Rs.10,000, Rs.10,000-Rs.20,000, Rs.20,000-Rs.30,000, Rs.30,000-Rs.40,000 and Above Rs.40,000. The both regression curves show the positive relation in the case of income and expenditure. These intervals show the positive order between income and

expenditure and corresponding straight line equations are y=6.185x+1.445 & R^2 =0.1595 and y=2.913x + 11.261 & R^2=0.0462 respectively.

Table 2.18: Annual Income per annum before and after MGNREGS Programme

Sl. No.	Intervals (In Rs.)	Before (Income) Mean ±S.D.	Standard Error	After (Income) Mean ±S.D.	Standard Error
1.	Below 10,000	32.83±14.0427	5.7329	6.96±4.8513	1.9805
2.	10,000-20,000	7.13±4.4271	1.8073	29.14±16.1061	6.5753
3.	20,000-30,000	13.41±8.4380	3.4448	4.99±2.6076	1.0645
4.	30,000-40,000	45.49±25.2903	10.3247	54.16±33.8998	13.8395
5.	Above 40,000	1.14±.7173	.2928	4.75±3.0331	1.2382
	Total	100.00±25.3456	10.3473	100.00±25.3456	10.3473

Source: Field Survey, 2015-16.

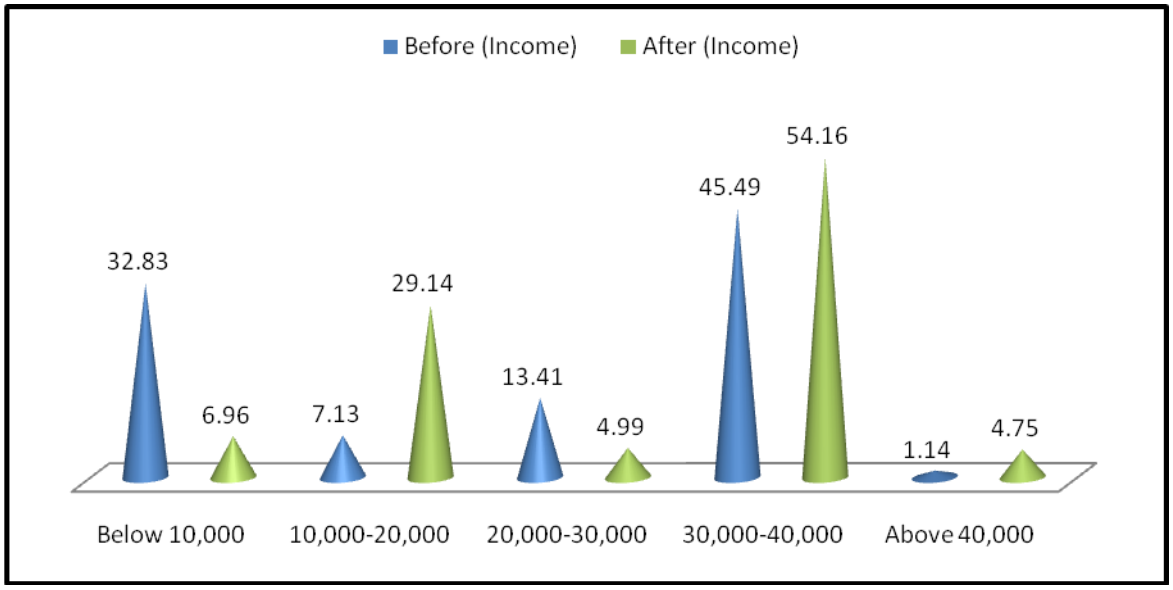


Figure 2.7: Annual Income Before and After MGNREGS Programme per annum

The income group between Rs. 30,000 to Rs. 40,000 was increased by 8.67 percent which increased after the implementation of MGNREGS programme. Similarly, income group between Rs.10, 000 to Rs. 20,000 had also increased by 22.01 percent after the implementation of this programme. Other groups show fluctuation in their incomes before and after this programme. The marginal workers are more benefitted in this programme. These workers are disguised types of workers and the implementation of this scheme has ensured job for at least one hundred days in a year.

Table 2.19: Annual Expenditure per Annum (in Percentage) of Beneficiaries before and after MGNREGS Programme

Sl. No.	Interval (In Rs.)	Before (Expenditure) Mean ±S.D.	Standard Error	After (Expenditure) Mean ±S.D.	Standard Error
1.	Below 10,000	12.33±8.3810	3.4215	15.19±11.6790	4.7679
2.	10,000-20,000	19.89±12.5698	5.1316	21.13±11.1534	4.5533
3.	20,000-30,000	5.10±3.5777	1.4605	4.11±3.0331	1.2382
4.	30,000-40,000	56.78±37.3737	15.2577	58.35±36.4965	14.8996
5.	Above 40,000	3.09±2.1838	.8915	4.03±1.2372	.5050
	Total	100.00±25.3456	10.3473	100.000±25.3456	10.3473

Source: Field Survey, 2015-16.

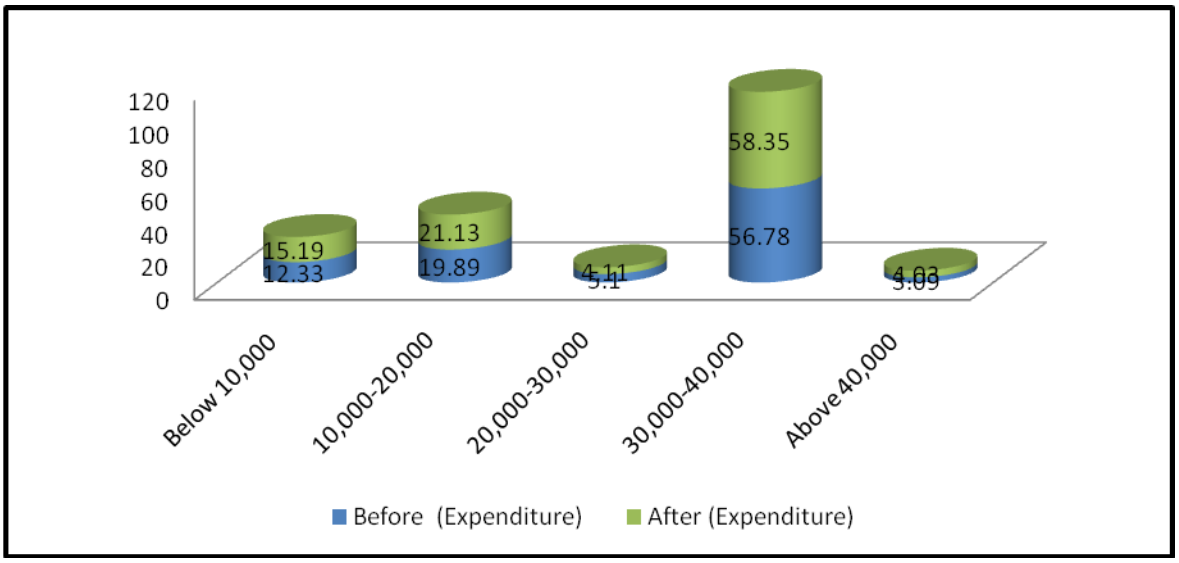


Figure 2.8: Annual Expenditure Before and After MGNREGS Programme per annum

There was not much difference in expenditure before and after the introduction of MGNREGS in villages. The interesting point is that whatever income is there juxtapose of expenditure, the income and expenditure has been seen maximum at Rs. 30,000 to 40,000. Therefore, there is a reciprocal relationship between income and expenditure. In the villages expenditures are controlled by income, thus people cannot afford to purchase based on their family requirements and as a consequence they tend to remain satisfied with what they possess at home.

Profile of Respondents

Table 2.20: Age Group of Respondents (in Percentage)

Sl. No	Age Group	Percentage Mean ±S.D.	Standard Error
1.	Below-30	12.33±8.3810	3.4215
2.	30-45	36.61±19.3804	7.9120
3.	45-60	27.89±15.6588	6.3927
4.	60-75	13.14±9.0994	3.7148
5.	Above-75	10.03±7.3484	3.0000
	Total	100.00±25.3456	10.3473

Source: Field Survey, 2015-16.

The age group of respondents' of the study area and the mean ±S.D. and standard error are shown in the above table. The age group between 30-45 years has the highest significant mean ± S.D. i.e. 36.61±19.3804 and standard error is calculated as 7.9120. The second age group between 45-60 years has the significant mean ± S.D. 27.89±15.6588 while the standard error is calculated as 6.3927. The respondents between 60-75 years and 15-30 years are almost same in number and their significant mean ±S.Ds. are 13.14±9.0994, 12.33±8.3810, and standard errors are calculated as 3.7148 and 3.4215 respectively. The lowest number is seen in the age group of above-75years with mean ± S.D. of 10.03±7.3484.

Table 2.21: Respondents' Sex Group

Sl. No.	Sex Group	Percentage
1.	Male	78.36
2.	Female	21.64
	Total	100.00

Source: Field Survey, 2015-16.

Table 2.22: Religion of Respondents

Sl. No.	Religions	Percentage
1.	Hinduism	60.25
2.	Buddhism	27.11
3.	Christianity	11.59
4.	Others	1.05
	Total	100.00

Source: Field Survey, 2015-16.

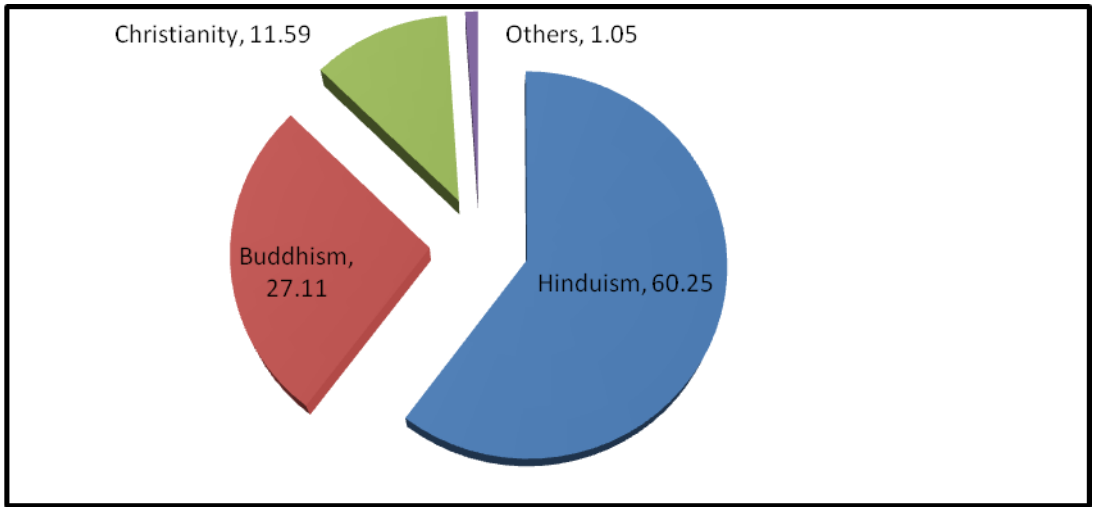


Figure 2.9: Percentage wise Distribution of Religion

Hindus are more than other religious followers in study area.

Table 2.23: Caste Category (in Percentage)

Sl. No	Caste category	Percentage Mean ±S.D.	Standard Error
1.	ST	31.49±23.2206	9.4798
2.	BL	11.16±7.3484	3.0000
3.	SC	8.06±5.2153	2.1291
4.	CENTRAL OBC	15.13±8.1240	3.3166
5.	STATE OBC	32.01±19.7180	8.0498
6.	GEN	2.15±1.2724	.5194
	TOTAL	100.00±25.3456	10.3473

Source: Field Survey, 2015-16.

The table 2.23 illustrates the Caste categories in the study area along with their significant mean ±S.D. and standard errors. The caste category of State OBC has the highest percentage and it has significant mean ± S.D. of 32.01±19.7180 and standard error is calculated as 8.0498. The second category belongs to ST and it has significant mean ± S.D. of

31.49±23.2206 and standard error is calculated as 9.4798. The State OBC and ST have almost same percentage. The Central OBC is in third position and it has significant mean ± S.D. of 15.13±8.1240 and standard error is calculated as 3.3166. The BL, SC and General categories have significant mean ± S.D. (11.16±7.3484), (8.06±5.2153) and (2.15±1.2724) and standard errors of 3.0, 2.1291 and .5194 respectively.

Table 2.24: Status of Education (in Percentage)

Sl. No	Educational Qualification	Percentage Mean ±S.D.	Standard Error
1.	Illiterate (Non-literate)	13.92±7.3484	3.0000
2.	Primary	34.52±20.0499	8.1853
3.	Secondary	26.18±16.8166	6.8653
4.	Higher Secondary	16.21±12.9151	5.2725
5.	Graduation	7.98±5.4772	2.2360
6.	Above Graduation	1.19±.5918	.2416
	Total	100±25.3456	10.3473

Source: Field Survey, 2015-16.

The Educational Status of the study areas and the significant mean ±S.D. and standard error are shown in above table. As for the overall literacy level among the respondents, Primary education is higher and it has significant mean ± S.D. of 34.52±20.0499 and standard error is calculated as 8.1853. It can also be observed that Secondary level of education comes second after Primary and it has significant mean ± S.D. of 26.18±16.8166 and standard error is calculated as 6.8653. In the third, fourth and fifth levels are Higher Secondary, Illiterate (Non-literate) and Graduation with significant mean ± S.D. of 16.21±12.9151, 13.92±7.3484 and 7.98±5.4772) respectively. The lowest percentage of respondents is that of above Graduation. Literacy and schooling are important indicators of the quality of life, which help to measure the poor's ability to take advantages of the income-earning opportunities, which in turn, may influence food intake and health-seeking behavior (Radha, 2009).

Table 2.25: Marital Status (in Percentage)

Sl. No	Marital Status	Percentage
1.	Married	82.10
2.	Single	11.76
3.	Widow	6.14
4.	Divorcee	0.00
	Total	100.00

Source: Field Survey, 2015-16.

Majority of the respondents are married (82.10 percent). Second comes the respondents who are single (11.76). In the third place are the widows. There is no divorcee among respondents.

Table 2.26: **Sex Group (in Percentage)**

Sl. No	Sex Group	Percentage
1.	Male	53.67
2.	Female	46.33
	Total	100.00

Source: Field Survey, 2015-16.

The above data show that the number of male member is higher (53.67) than the females in the family of respondents (46.33 percent).

Table 2.27: Age Group of the Respondents' Family Members (in Percent)

Sl. No	Age Group	Percentage Mean ±S.D.	Standard Error
1.	Below-15	15.56±11.5238	4.7046
2.	15-30	44.13±21.9636	8.9666
3.	30-45	18.46±11.0995	4.5313
4.	45-60	14.69±10.4307	4.2583
5.	Above-60	7.16±5.5497	2.2656
	Total	100.00±25.3456	10.3473

Source: Field Survey, 2015-16.

The age composition of the members of the respondent families affects the maintenance of the household. A "bulging age distribution" may exert an influence by its effect on the ration of dependents to productive elements in the working population" (Radha, 2009). The age group of respondents' family members and the significant mean± S.D. and standard errors are shown in table 2.27. The highest population is in the age group of 15-30 years and the significant mean± S.D. is 44.13±21.9636 and standard error is calculated as 8.9666. The population between 30-45 years age group is second highest and significant mean± S.D. is 18.46±11.0995 and standard error is calculated as 4.5313. Next comes age group of below 15 years and it has significant mean± S.D. of 15.56±11.5238 and standard error is calculated as 4.7046. A very small population is above 60 years of age in sample areas.

Table 2.28: Educational Status of Respondents Family Member (in Percent)

Sl. No	Educational Qualification	Percentage Mean ±S.D.	Standard Error
1.	Illiterate (Non-literate)	2.11±.1574	.0642
2.	Primary	16.03±12.9460	5.2852
3.	Secondary	22.95±12.6491	5.1639
4.	Higher Secondary	30.71±19.8191	8.0911
5.	Graduation	18.27±14.5327	5.9329
6.	Above Graduation	9.93±6.8410	2.7928
	Total	1000±25.3456	10.3473

Source: Field Survey, 2015-16.

The table 2.28 illustrates the Educational Status of members of respondents' families in the study areas and the significant mean ±S.D. and standard errors. The table shows the overall literacy level among the respondents' family members, and it is observed that the higher secondary education has significant mean ± S.D. of 30.71±19.8191 and standard error is calculated as 8.0911. It can also be observed from the above data that secondary level of education obtained by respondents' members comes second after higher secondary and its significant mean ± S.D. is 22.95±12.6491 and standard error is calculated as 5.1639. In third, fourth and fifth literacy level of the respondents family members such as graduation, primary and above graduation and it has significant mean ± S.D. are (18.27±14.5327) (16.03±12.9460) and (9.93±6.8410) respectively. The illiterate (non-literate) category has the lowest percentage in the sample area.

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