CHAPTER-1

1.1 PHYSIOGRAPHY

The physical landscape connotes natural combination of landforms, hydrology, soil and biota. Landform is a topographic unit of locational ensemble with similar characteristics in structure, relief, pedogenesis and vegetation types\(^1\). High relief, large altitudinal variation, polycyclic landscape, complexity of geomorphic features, dominance of altered rocks and sites of stresses and strains are the main features of the relief of district Doda. The physiography of the earstwhile district mainly consists of mountain ranges (Dhars), river valleys, spurs and snow clad peaks. In other words the area comprises uneven topography having latitudinal extension about 32°-50' and 34°-15' north latitude. The area falls under middle Himalayan range or “Pir Panjal” range which is about 15500 feet. It is surrounded by Anantnag from northern side, Kathua district from southern side, Udhampur district from south-western side, Chamba district from south-eastern side and its eastern border touches Ladakh district. Most of its parts are uninhabited or covered with forests.

There are various large and small valleys in the area which spread from Jawahar tunnel to Kailash, Padri and Paadar, over the middle Himalayan range e.g., Bhaderwah, Thathri and Bhallesa. As the study area lies in the middle Himalayan range or outer hills of the state there are

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numerous valleys and hanging valleys. One of the best examples of this combination is “Bhaderwah and Jai”.

There are numerous peaks of great height which attracts the mountaineers for climbing in different parts of the study area. Three famous peaks in Paadar area are “Bring II” and “Shinling Peak” having height up to 6000 mts, 6200 mts and 6000 mts. Another peak situated in the eastern side of Kishtwar area is “Nageen Shum” which is about 4089 mts in height above mean sea level.

Another five peaked mountain named “Brahma Mountain” is situated in Dachan area. Another famous peak of this area is “Sickle peak” which is about 6575 mts, which is situated in “Kujar Nallah”. Besides that “Aljun Peak” about 6200 mts in height and “Thanter Peak” about 7510 mts in height are also very famous, situated in “Nath Nallah” of Dachan area.

Bhaderwah also called as “Chota Kashmir” due its climatic and physiographic resemblance with Kashmir is famous for “Kailash Peak” which is about 14500 feet in height. This peak is known for its sacred values according to the Hindu belief. It is a good source of attraction for mountaineers and pilgrims. Other famous peaks of Bhaderwah are “Chatter Gal” 3400 feet, “Padri Gal” 10000 feet and “Fetran peak” 11000 feet in height which is situated at the border of Chamba and Gundoh area.

Other peaks of the study area are “Achan Top” of Banihal 11000 feet, “Hara Top” of Marmat 10000 feet, “Margan Top” of Marwah 14665 feet, and “Bhut kul” 14504 feet of Warwan. The highest inhabited area of district Doda is “Samchan” in Paader which is about 11017 feet in height above mean sea level.
Besides peaks, there are numerous passes in the study area like “Haskar Pass” about 14107 feet, which joins Marwah with Kashmir valley. “Brari Baal” 14300 feet joins Dessa with Kashmir valley. “Banihal Pass” 9291 feet in height joins the study area with Verinag.

Slope:

Slope is an important factor in determining the most suitable areas for flood-spreading purposes and is one of the key factors in the selection of flood-distribution areas. Water velocity is straightly related to direction of slope and its depth. On Steep slopes, surface runoff is more erosive which can easily remove loose sediments down slope where infiltration is less and is not applicable to recharge. The slope map of the study area is generated through Digital Elevation Model (DEM). The DEM generate from the digitized topographic contour which can be used through GIS to extract slope morphology. Contours were digitized from the topographic map from survey of India (1:50 000 scale) at an interval of 20 meter and then rasterizing and interpolating the same and DEM of the terrain was prepared. The areas with low percentage of slope, retain water longer where the chance of infiltration and recharge is quite high. Slope map is a raster map with each pixel denoting the degree of slope. The slope map is then sliced for slope category in percentage and the derived slope map is classified into seven categories such as 0-2% is flat, 2-5% gently sloping, 5-8% undulating, 8-16% rolling, 16-30% hilly, 30-45% steep and >45% very steep.
Digital Elevation Model:

It is a digital model or 3-D representation of a terrain's surface commonly for a planet (including Earth), moon, or asteroid, created from terrain elevation data. Based on the digital elevation model we can prepare different topographic maps of slope aspect. The derived DEM map of study area is classified into five different classes such as 2,273 - 2,822 mts, 2822 - 3648 mts, 3648 - 4468 mts, 4468 - 5103 mts and 5103- 8248 mts.

The topography of the study area is rugged with lot of forests. Most of its parts are uninhabited due to rough terrain and some parts remains always covered with snow for more than six months in a year. There are some areas which are not even connected with roads. The area comprises both hard and soft rock beds. In some areas along roads very soft rocks are present and in rainy season these areas are subjected to erosion and landslides which results in road blockade.

1.2 CLIMATE

The area lies in the Pir-Panjal range or middle Himalayas having height up to 15500 feet. The lowest area of the region lies at an altitude of 2442 feet above mean sea level which experiences subtropical climate. All the parts of the study area lies between 2442 feet to 15500 feet, hence there is a great climatic variation. Some parts of the region having low altitude experiences subtropical climate and the areas having high altitude experiences arctic climate. Similarly weather conditions also vary according to the altitude. The study area comprises numerous valleys with tributary valleys or hanging valleys and in summer the weather conditions are very much pleasant. The sky remains clear throughout the day with
some hazy appearance. Days are sunny but nights are cold which helps in
dew formation.

In summers maximum temperature is 26.9°C to 32.0°C and minimum
temperature recorded is 17.9°C to 18.3°C. But in winters the weather
conditions are very much bad having maximum temperature of about
12.1°C to 14.6°C and minimum up to -0.4°C to -01°C.

Table-1.1: District Doda
Temperature and Relative Humidity-2007

<table>
<thead>
<tr>
<th>Months</th>
<th>Mean max tempt in °C</th>
<th>Mean min tempt in °C</th>
<th>Mean R.H in % age at 8:30 hrs</th>
<th>Mean R.H in %age at 17:30 hrs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Jan</td>
<td>14.6</td>
<td>-01.0</td>
<td>071</td>
<td>048</td>
</tr>
<tr>
<td>Feb</td>
<td>13.7</td>
<td>02.1</td>
<td>084</td>
<td>066</td>
</tr>
<tr>
<td>March</td>
<td>17.7</td>
<td>03.4</td>
<td>078</td>
<td>055</td>
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<td>April</td>
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<tr>
<td>May</td>
<td>26.9</td>
<td>11.4</td>
<td>072</td>
<td>051</td>
</tr>
<tr>
<td>June</td>
<td>32.0</td>
<td>15.9</td>
<td>070</td>
<td>048</td>
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<tr>
<td>July</td>
<td>29.7</td>
<td>18.3</td>
<td>083</td>
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<td>August</td>
<td>29.7</td>
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<td>Sept</td>
<td>28.3</td>
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<td>058</td>
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<td>Oct</td>
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<td>06.7</td>
<td>065</td>
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<td>Nov</td>
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<td>04.2</td>
<td>051</td>
<td>039</td>
</tr>
<tr>
<td>Dec</td>
<td>12.1</td>
<td>00.4</td>
<td>072</td>
<td>059</td>
</tr>
</tbody>
</table>

Source: Indian Meteorological Department, Meteorological Centre Rambagh,
Srinagar-190015.
Fig 1.1: District Doda
Temperature and Relative Humidity-2007

Table No-1.2: District Doda
Temperature and Relative Humidity-2008

<table>
<thead>
<tr>
<th>Months</th>
<th>Mean max tempt in °C</th>
<th>Mean min tempt in °C</th>
<th>Mean R.H in %age at 8:30 hrs</th>
<th>Mean R.H in %age at 17:30 hrs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Jan</td>
<td>08.2</td>
<td>-00.7</td>
<td>085</td>
<td>068</td>
</tr>
<tr>
<td>Feb</td>
<td>11.0</td>
<td>-00.9</td>
<td>085</td>
<td>066</td>
</tr>
<tr>
<td>March</td>
<td>21.6</td>
<td>05.9</td>
<td>070</td>
<td>042</td>
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<td>11.2</td>
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<tr>
<td>June</td>
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<td>Nov</td>
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</tr>
<tr>
<td>Dec</td>
<td>15.6</td>
<td>02.8</td>
<td>070</td>
<td>058</td>
</tr>
</tbody>
</table>

Source: Indian Meteorological Department, Meteorological Centre Rambagh, Srinagar-190015.
The altitudinal variations are the main factor for these climatic differences in the study area. Higher the altitude lower will be the temperature and lower the altitude higher is the temperature is natural rule. Besides altitude other factors like winds, pressure, humidity, air masses, forests and relief are also responsible for climatic variation. But the climate of kishtwar, Gundoh and Bhaderwah, is comparatively very much milder than that of Srinagar if we talk about the arctic climate. This climatic difference is due to the variation in altitude. Similarly the areas like Ramban, Doda and Thathri experiences mild climate as compare to the Bhaderwah and Gundoh. The study area lies between 2442 feet to 15500 feet; hence, the district lies between the subtropical areas of Ramban and Doda and arctic areas of Bhaderwah and Kishtwar. These territories are as such transitional in climate.

In summers the moisture laden air leaves the moisture after condensation in the form of convectional rainfall. This rainfall is of short duration for 30 minutes to one hour, but it decreases the temperature of the
areas up to a great extent. In higher altitudes the atmospheric envelop is very much thin which gains heat and cool down rapidly. Hence a little down pour reduces the temperature of the areas. The higher altitudes experiences mild summers but winters are very much harsh with heavy snow fall. The snow begins to fall from the month of December up to February. In valley the snow fall is lesser as compare to the surrounding mountains. The fresh snowfall recharges the lofty peaks every year and maintains the hydrological cycle.

The areas having low altitude like Doda, Ramban and Thathri rarely receive snowfall, but the surrounding mountain ranges of these areas receive snowfall. The summers are long and dry but winters are not so much harsh like that of Bhaderwah and Gundoh. If the winters are very severe a little snow fall occurs which doesn’t stands on the surface so longer. The snow fall is only up to 3-5 inches which is very less comparatively than Bhaderwah and Gundoh.

A particular type of climate is found in the study area. The altitude determines the degree of coolness and hotness and the form of precipitation. Monsoon winds are another factor which are responsible for rainfall in the study area. Largely due to variation in altitude, the climatic condition ranges from hot and moist tropical in lower valleys to cold temperate at 1500 to 200 mts. On the higher altitudes the climate becomes progressively colder until an extreme polar type is reached at highest altitudes. The altitude affects not only the temperature but also the amount of precipitation. Usually, south facing slopes are sunnier and receive more rains. Further more in each individual range, the snow line is higher on the southern aspect where there is more incoming radiations. The snow line in
the eastern parts is higher than in the west. Depending upon the broad climatic conditions prevailing over the district, a year can be divided into four distinctive seasons based on the rainfall, number of rainy days, mean maximum and minimum temperature viz.,

a) Winter season (Mid November to Mid March).
b) Hot /Pre-monsoon season (Mid May to Mid June).
c) Rainy/Monsoon season (Mid July to Mid September)
d) Autumn/post monsoon season (Mid September to Mid November)

Winter Season

Winter season sets in mid November and lasts up to end of March. In the first week of December, snowfall takes place on higher peaks, while winter rains occur in the lower parts of the district by the western disturbances. Temperature comes down to minus on higher slopes and near zero in the valley area while the higher alpine zone experiences several cold waves throughout the season. Almost all the economic activities cease in the valley after sowing wheat, barley and grams and winter seasons vegetables. Before snowfall, canopy of the apple and other fruit plants has to be pruned to ensure good quality. Winter season is the dormant season for the fruit plants. Fertilizers with other nutrients enter into the plants steadily because of no immediate photosynthesis and Evapo-transpiration. Similarly, in the higher elevations of alpine zone wheat, barley and potato remain under snow during winter season. However, as soon as snow melts away growth of all crops take very less time for gestation. Because of this agro-climatic variation in the winter season, the gap in harvesting is reduced to only 25 days from lower parts to upper parts.
Summer Season

Summer season start in the mid of May, where temperature remain high (31.2°C) upto middle of June. In the month of July rainfall, takes place and temperature slightly comes down. With occasional pre-monsoon rainfall, budding over different fruit plants is completed. During this season fruit plants and off-season vegetable crops as well as food crops experiences draught spells, as some area along the river has irrigation facility. This season causes extensive damages for new plantation as of one or two year age plants could not withstand too long rainless period.

Rainy Season

Rainy season set in with the advancement of monsoon in the valley region. Most of the rainfall takes place in this season which mostly sets in the month of July lasts upto September. Abundant rainfall in the season gives instant water, for paddy, maize and little millets. The plantation of fruit plants takes place during rainy season, as the land gets fully soaked. Due to hilly topography and large variation in the rainy season’s downpour, landslides and soil erosion commonly takes place along roads and in the cultivated areas. Fairly distributed rainfall in the valley generally provides substantial water balance and sub-soil moisture for the parallel growth to fruit plants.

Autumn Season

The duration of autumn season in the valley is small. It starts in mid-September and lasts upto mid November. In this season, Kharif crops are harvested and fields are made for vegetable sowing where irrigation facilities are available. This season made suitable for pruning canopies of
fruit plants as almost all the fruit plants shed their leaves in this season. Land around these plants is prepared for fertilization as in this season very little evaporation from orchards takes place.

Table-1.3: District Doda
Seasonal Distribution of Rainfall

<table>
<thead>
<tr>
<th>Seasons</th>
<th>Average Rainfall in mm</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Winter</td>
<td>630</td>
<td>36</td>
</tr>
<tr>
<td>Pre-monsoon</td>
<td>239</td>
<td>13.7</td>
</tr>
<tr>
<td>Monsoon</td>
<td>803</td>
<td>45.9</td>
</tr>
<tr>
<td>Post-monsoon</td>
<td>78</td>
<td>4.5</td>
</tr>
<tr>
<td>Annual</td>
<td>1748</td>
<td>100</td>
</tr>
</tbody>
</table>


Fig 1.3: District Doda
Average Rainfall in Millimeters
Table 1.4: District Doda
Annual Rainfall in mm (2004-2006)

<table>
<thead>
<tr>
<th>Year</th>
<th>2004</th>
<th>2005</th>
<th>2006</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of rainy days</td>
<td>100</td>
<td>119</td>
<td>110</td>
</tr>
<tr>
<td>Rainfall in mm</td>
<td>1193.5(mm)</td>
<td>1597.4(mm)</td>
<td>1407.9(mm)</td>
</tr>
</tbody>
</table>

Source: Meteorological Department Srinagar.

Fig 1.4: District Doda
Rainfall in Millimeters

The average humidity is about 48% in January and up to 66% in August. The annual average humidity is 68%. The average humidity of the area is about 63 cubic meters. The annual recorded rainfall is about 75 cms. The sowing season starts in April and rainfall is important for the growth of crops. Rice, wheat and maize are the main crops in the district.
For rice cultivation rain is must for its growth and better yield. In dry tracts like Doda, Thathri and Ramban maize is the main crop. In the valleys like Bhaderwah paddy is the main crop which requires semi aquatic conditions hence, rainfall is must for paddy cultivation.

However the summers are pleasant throughout the study area particularly in the valleys like Bhaderwah, Kishtwar, Thathri and Gundoh.

1.3 DRAINAGE

Chenab is the mightiest river of the study area that is why it is also called as Chenab valley. According to “Vigne” the river Chenab is derived from “Chand-Aab” which means water of moon, rather than from “China-Aab” which means water of china, as it does flow through the territory of china. The famous geographer “Ptolmey” has described it sandabal, while Greek historians of “Alexender” refer it the “Akesines”. “Forster” mentions the river as “Chuinaum.” These streams after rising in Lahul, combine in Himachal Pradesh to form the Chandra-Bhaga river. After flowing through Chamba district of Himachal Pradesh it enters the state of J&K and is referred as Chenab.

It has its source in the glaciers of middle Himalayas. At the source, the river is in two streams, "Chandra and Bhaga" which rise on the opposite sides of “Baralaccha pass” in Himachal Pradesh at an elevation of about 4891 mts above mts. The Chandra flows at first to the south than sweeps suddenly upto north-west to the junction of Bhaga stream at “Tandi”. From “Tandi” the Chenab flows a north-west course to Kishtwar. Between Tandi and Kishtwar, the Chandra Bhaga receives much snow fed torrents; the largest among them are “Chukam” and “Chatrgarh”. Below the Kishtwar
town, an important tributary from the north, “Maru Warwan” joins the main river. From Kishtwar the river flows through Doda, Reasi and Akhnoor. From Akhnoor, the river assumes the plain stage and is navigable. For most of its course of flow the river flows in the study area through a narrow valley along the interlocking spurs descending from the middle mountains and the Pir Panjal range. Due to number of rapids and falls the river is not navigable in the study area. The river is about 1200 sq kms and its basin sprawls out 26755 sq kms.

The river Chenab has enormous potential for generation of electricity with an average of 500 mw per year. Several Hydal Projects are situated on this river like Baglihar, Dul Husti and Salal Hydal Project with the power generating capacity of 900 mw, 390 mw and 345 mw. The project Baglihar is in two phases with power generating capacity of 450 mw each. The first phase of this project is completed under Jai Prakash Cop Pvt Ltd. First two projects are situated in study area.

Two huge canals i.e., Ranbir and Pratap Canal which were constructed for irrigation purposes get water from Chenab and supply it to most fertile areas of Jammu like R S Pura and Akhnoor. Besides power generation, the river is used for irrigation purposes and transportation of timber logs. But due to number of rapids and falls in its upper course it is not navigable. Next to Chenab is the river “Warwan” which originates from Warwan and enters in Marwah. Various tributaries of this river are Renai, Kyard, Nath, Pinjarari and Chatru Nallah. After flowing through “Tagood and Dachan” it joins river Chenab near “Bandarkot” (kishtwar).

In Bhaderwah “Neeru” is the main river and its tributaries are Haloon nallah, Halian Nallah, Kalgandi nallah, Chakka nallah and Chinote
nallah. All these streams have their source from “Ashapati” and “Kailash” glaciers. These rivers and streamlets irrigates the crops especially paddy fields of Bhaderwah through canal irrigation. The Neeru nallah joins river Chenab near Pull Doda.

Another nallah named Bunkund joins Neeru nallah at “Bhala” block. In Gundoh, main rivers are Kalnai, Chilly and Kalguni nallah. Other important rivers and streamlets which join Chenab are Baghu, Nashri nallah, Raggi nallah and Kandhari nallah. Besides surface flow the river water begins to flow downward by seepage process which recharges the water table. This ground water forms different hot and cold water springs as the study area is mountainous. The area consists numerous fresh cold water springs which provides water to the inhabitants of these areas. Throughout the year the hot water springs locally called as “Tatta pani” are famous for the treatment of joint pain and skin treatment as they contain sulphur. These hot water springs are located at Kishtwar. Famous springs are Kundhali, Gurdas Naag, Kani Naag, Dammar Naag, Sangram Bhata Naag etc. In Kashmiri dialect springs are called as Naag. As the topography of the area is mountainous there is no such large lake except “Kailash Lake” which is basically the crater of an extinct volcano. The streamlets from the surrounding glaciers fill up that crater and results in the formation of a beautiful fresh water lake. The occurrence of basalt rock in the study area is the true representative of the occurrence of extinct volcano in that area. According to the Hindu belief it is the sacred lake of Hindu community. This lake is worshiped every year and it is a famous pilgrimage of Hindus where a dip is necessary to shun the sins according to their religious faith. This lake is about 1.5 kms in length and 1 km in
breadth and more than 60 feet in depth. There are 5-7 such lakes in the upper reaches, but smaller in size than ‘Kailash Lake’.

**Drainage Density:**

The drainage density expressed in terms of length of channels per unit area indicates the expression of closeness and spacing of channels. It thus provides a quantitative measure of the average length of stream channels with in different portions of the whole basin of the study area. The drainage analysis suggests up to 5th order drainage in the study area. The drainage frequency and drainage density are normally used to characterize the drainage texture of an area. Drainage density is the ratio between the cumulative lengths of channel segments of all orders within a basin to total area of basin where Drainage frequency is the ratio between the numbers of streams within a basin to the total area of basin. Horton (1932) noted higher drainage densities in areas with higher precipitation and very low densities in basins with great permeability. In other words, finer/higher drainage texture indicates lower infiltration capacity and vice versa. The drainage frequency map of the area has been prepared from the drainage map using ARC GIS software. There are five classes of drainage density map in the area viz., 0-0.5, 0.5-1.0, 1.0-1.5, 1.5-2.0, and >2.0 as shown in the (Figure).

As per as the irrigation is concerned Chenab river is not harnessed for irrigation purpose due to its high velocity and its course through rapids and falls in the district, but other tributaries of Chenab are all well used for irrigation purposes. The water of Chenab is also not used for drinking purpose as it carry silt which always remain in suspended form due to very high velocity of river.
1.4 SOILS

Soils in fact are the weathered materials (Heaps of boulders, pebbles, coarse sand, silt and clay) of parent rock which takes a longer time to accumulate and form the finer material referred as soils. The main constituents of soil are air, nitrogen, oxygen, CO2, water, organic matter and inorganic matter. The soils vary in colour, structure and texture. The soil structure refers to the arrangement in which soil grains are grouped together i.e., blocky, granular, columnar, prismatic, crumb and platy. Soil texture signifies the size of particles i.e., gravel, sand, silt and clay. It also determines the ability of soil to retain water and to drain it to lower parts. Humus is an important chemical constituent of the soil. It is the dead organic matter and is developed through the slow oxidation of the vegetative matter. Humus is the decayed remains of plants and animal matter. The soil is dark brown or black in colour due to the presence of rich humus material. It also adds fertility to the soil.

Soil is the medium that supports the growth of vegetable kingdom. Agriculture entirely depends upon the composition of soil. According to the revenue records, the land is classified on the availability of water resources i.e., land depends upon the rainfall is called as “Barani”. The land which is watered by wells is called as “Chahi”. The land which is irrigated by canals is called “Nahari” and the land moistured by rivers is called as “Sailabi”.

Agriculture is the main occupation of the people in the study area though it is scattered and carried on small patches. The study area is drained by Chenab and its tributaries, hence alluvial soil is found in the shape of narrow strips and terraces along the tributaries of Chenab. Alluvial
soils are found by the consolidation of rock material i.e., gravel, sand, silt and mud which is brought down by rivers during their flow and is deposited on the temporarily submerge land. The alluvial soils are not fertile soil on which 2-3 crops can be raised during a year. Geologically the alluvium is differentiated into “Bhangar” having old alluvium and “Khadar” having new alluvium. In the valleys like Bhaderwah and Gundoh, paddy cultivation is practiced due to the presence of alluvial soil in such areas. These soils are very fertile if irrigated. In the mid mountain regions the soils are mainly formed of decomposed rock and peat. Decayed vegetation provides nitrogenous material on higher elevations, which supports large forests growing oak, pine, spruce and fir trees. Bhaderwah and the slopes of lower hills comprise sub-mountain and mountain meadow soils where rice, wheat and maize are cultivated. Other types of soils found in the district are sandy, clayey loam and peat, but these are found in small patches.

The study area is known for its forest cover and ranks first in the case of forested area of the state. The evergreen, pine, spruce and fir covers the higher altitudes like a green blanket. This richness is due to the presence of mountainous soil. These soils cover the entire mountainous tracks of the study area. The steep slopes affect the runoff and drainage and runoff washes the weathered rocks on the steep slopes. These soils are shallow, immature and highly susceptible to soil erosion. These soils are acidic in character and deficient in phosphate, potash and nitrogen. But the soil is rich in organic content and it varies from place to place. These soils are ideal for the cultivation of maize, wheat, barley, pulses, oilseeds and fodder. However, temperate fruits i.e., apple peach and pears are suited to
such soils. The high ground areas are reserved as Alpine forests where Gujjars and Bakarwals rear their flocks during summer season. Scarcity of water, leaching, landslides and avalanches are common features of the mountain soils, due to man induced activities.

Soils found in the study area are:-

1. Mountainous soils.
2. Alluvial soils.
3. Clayey soils.
4. Loamy soils.
5. Sandy soils.
6. Peat soils.

**Characteristics:**

**Mountainous soils:-**

a. These soils are shallow and immature.
b. These are highly susceptible to soil erosion.
c. These are acidic in character, deficient in potash and nitrogen.
d. These are good for cultivation of maize, wheat, pulses, fodder and oil seeds.
e. Mountainous soils also support growth of forest trees like pine, spruce, deodar and fir.

**Alluvial soils:-**

a. Alluvial soils are rich in alluvium.
b. These are formed by the consolidation of gravel, mud, sand, silt and clay.
c. These are most fertile soils if irrigated.
d. These are best suited for paddy cultivation
e. Alluvial soils are further divided into Bhangar and Khadar.

Clayey soil:-

a. The soil has predominance of clay.
b. It has high water retaining capacity.
c. It is formed due to floods which deposits clay along the banks of river.
d. It also contains silt which makes it fertile.

Loamy soil:-

a. It is light black in colour.
b. It is locally called as “Bahil”
c. It is rich in humus contents and needs less manuring.
d. It is good for rice cultivation.

Sandy soil:-

a. It is locally called as “Sekil”.
b. It contains high percentage of sand with less percentage of loam.
c. It is fertile soil but needs proper irrigation.

Peat soil:-

a. It is locally called as “Nambal”.
b. It is good for cultivation of fodder and maize.
c. It also supports paddy cultivation.
d. It needs moderate rainfall during cultivation.
e. It is rich in lime.

Karewa soil:-

a. These are Fluvatile and Lacustrine deposits found on elevated plateaus or low flat mounds.
b. These soils are best suited for the cultivation of saffron which is locally called as “Zafran or Kaiser”.

1.5 VEGETATION

Millions of years ago, our earth was a barren land. First trace of life was found in oceans and the first form of life was plant kingdom or natural vegetation cover which includes, forests, grass lands and scrub fields. The study area is known for forests and has a great diversity in flora, ranging from deciduous forests and evergreen conifers to alpine pastures.

Forests provide habitat to a variety of animal species in the district like Snow Leopards, Musk Deer, Brown Bear, Hangul (Bara Singha) and Neel. The forests of the study area are the most valuable resource as it boosts the economy of the area. They do not only enhance the revenue of the area but also provides employment to a large chunk of the nation. Forests have many productive, protective and bio-aesthetic functions. Various forest products have medicinal values and are used in pharmaceutical industries e.g. Belladonna, Datura, Kuth, Hyoscyanus, Discorea, Podophyllum, Digitalis, Artemisia, Pyrethrum etc.

Forests are one of the important natural resources available to mankind and are considered as one of the valuable asset to mankind. Forests conserve the soil, reduce intensity of floods and maintain the temperature of the earth. They also influence the weather and climatic conditions of an area. Besides that forests are a rich source of timber, medicinal plants and firewood. The study area is rich in forest resource and timber production that is why the forests are also called as “Black Gold” of the district.
The thick soil cover and humus content support different variety of tree. The vegetation of the area varies according to altitude. In the study area subtropical forests, temperate forests and alpine vegetation is found having a variety of trees like Chir, Deodar, Pine, Birch, Fir and Kail. The distribution of vegetation depends upon the factors like altitude, soil, humidity, rainfall and insolation. In a systematic study the vegetation zone of the area may be classified under following types:-

1. Subtropical forests.
2. Temperate or evergreen forests.
3. Alpine vegetation.

**Subtropical Forests:-**

These forests are found in the areas having subtropical climate like Assar, Doda etc. These forests are found at an elevation of 900-1500 mts. Chir is the main variety of forests which is a good source of timber and resin.

**Temperate forests:-**

Temperate forests are dominated by coniferous variety of trees like deodar, pine, spruce, fir, birch etc. These are evergreen trees which can standby in harsh climatic conditions also. These forests are found at an altitude of 1500-3350 mts.

**Alpine vegetation:-**

This zone lays in 3350 to 4570 mts and experiences very cold climatic conditions. The low temperature supports shrubs like birch and juniper. This alpine zone comprises lush green pastures and meadows.
which are locally called as “Margins”. These pastures and meadows are used by nomads of the study area (Gujjars and Bakkarwals) to graze their livestock. In summers they migrate to these “Margins” along with their flocks for six months and in winters they return back to the warmer regions. This seasonal migration is called as transhumance.

**Importance of Timber Trees:**

**Deodar:-**

It is very strong, termite resistant and water resistant that is why it is used for manufacturing of house boats and shikaras. It is also used for making railway sleepers, doors and windows in house construction. The excellent deodar variety is found in upper reaches of the Chenab valley. The deodar logs extracted from the forests of Kishtwar, Bhaderwah and Doda are floated down the Chenab and collected at Ramban on Srinagar-Jammu national highway. The timber logs are kept in water for a long time for seasoning which enhances the beauty of wood.

**Pine (Kairu):-**

It is a good source of timber which is used in building material for construction and has long life. It has good medicinal values and produces great flame when burnt.

**Fir:-**

It is of inferior quality as compared to deodar and pine. The tree attains a great height up to 110 feet and the wood is not good as a cooking fuel. But this plant has medicinal values. The study area lies in the middle Himalayan range and almost all parts comprises thick vegetation and are rich in forests. The higher altitudes
comprise variety of timber trees. As the study area is rich in forest resources and timber production, there is a good scope of opening many forest based industries like sport goods industry, resin and turpentine industry, paper and match box industry etc. These industries can provide employment to a number of persons and also helps in removing industrial backwardness of the area.