CHAPTER II

PHYSICAL ENVIRONMENT
LOCATION AND EXTENT:

The western Satpura is situated in the southwestern part of Madhya Pradesh and extends from 74°30' to 79°0' east and in between 21° to 23° north. The study region can be said to be having 5 per cent of population (19,34966 persons) with a geographical area measuring about (97412 sq/Km) of the state of Madhya Pradesh. The area is comprised of three administrative districts of the western Satpura range namely Khandwa, Khargon and Betul. The study area has 9 tahsils namely Sendhwa, Khargone, Bhikangaon, Khandwa, Harsud, Burhanpur, Betul, Multai and Bhainsdehi and also has 31 primary health centres. The whole of the area is located within as many as villages out of which 18 villages of different geographical locations have been enmarked for the instant study. The primary health centres of the study region are 31 in number (1981).

PHYSIOGRAPHY:

The western Satpura ranges are surrounded by the Narmada and Tapti rivers and has taken a trinangular shape; the base of which exists in the east. It extends in north-south direction called the Mahadeo mounts. The Satpura range separates the Narmada from the Tapti.

Its different plateaus are full of flat hills. Starting from west to east from Khargon this landscape starts. Badwani hills, Betul plateau are there. Their average height is from 400 to 600 metres. There are many
hills in between these plateaus. Along with Badwani hills, Bisalgarh hills and Nimar plateau in the east is situated the Maikal plateau.

On the Border of Burhanpur-Bhainsdehi is existing the Asirgarh hill about 600 metres high. In the west of it is Burhanpur where stands the Bijadongri hill.

The Betul plateau is from 400 to 600 meters high. Its peaks existing in the Satpura are high up to 821 meters. Kalibhit hills about 678 meters is situated in the Betul plateau.

Badwani hills about 641 meters high stands in Khandwa tahsil, Bisalgarh hills about 849 meters and Kalibhit hills about 770 meters high are situated in Betul tahsils. Dhoopgarh peak about 1350 meters high is in the Mahadeo hills. The Nimar plateau is high from 150 to 300 meters. In Khargon tahsil the Satpura hills are spreading in rugged form and work as water parting line. It extends up to Chhoti (small or mini) Tava river.

In the southern part there are valleys of the tributaries of the Tapti. The rivers here flow down from the height of 600 meters to a height of 300 meters.

PHYSICAL DIVISIONS:

On the basis of geology and physiography the area has been divided into 7 physical units. These are as follows:

1. The Narmada valley
2. The Tapti valley
3. The main Satpura ranges
4. The southern skirt of the Satpura Range
5. The plateau of Satpura
6. The edge of the Vindhyas
7. The Tawa valley.
The Narmada Valley: The Narmada flows from east to west in the northern part of the Satpura mountain. Chandgarh and Sailani two small areas exist in the north of the river Narmada. There the boundary of the district is made by high basalt rocks. These rocks are covered with thick forests and the perpendicular standing rocks are cut into deep and dark valleys which spread mostly in north south direction. The tributaries of the Narmada coming from the north are the Khari and the Kanar. These rivers flow all the year round. The common height of the Sailani area is about 750' feet and that of Chandgarh area is about 850' feet. The north-south ranges of Sailani and Chandgarh areas have gone across the Narmada in the south. Out of these are sandstone hill specially is marked. In the vicinity this hill is about 500' feet higher than the nearby area. The tributaries of the Narmada coming from the south generally flow northward on in the north-west direction. The direction of the flow of these rivers clearly shows the general slope of the Narmada valley. It is inside the district boundary. The common height of the eastern part is about 900' feet whereas in the western part it is 243 meters.

About 25 miles of south of the Narmada there is a hill range near the tarai hills. There is such a range which starts from the western border of the district and crosses the district towards north-west and meet the Narmada at the confluence of Chhoti Tava. This mountain range divides the Narmada valley into two parts, i.e. the western and eastern parts.

North western part of this valley through which the Cavery flows is uneven and covered with thick forest. In the north of the banks of the Narmada in the strip and in the south of the Cavery the slope of south-east hills with very thick forest exists in large quantity. There is an open part in the central areas of the valley.
In the eastern part of the Narmada valley an important tributary of the Narmada Chhoti Tava flows in the left. It joins the Narmada near Bhangarh, ahead of the confluence of Abana, Sukta and Bhama rivers and is known by this name after it. Mayak and Samdevi rivers join the Narmada in the north-eastern part of the Narmada. The river valley of Chhota Tava stands in the northern slope of the Satpura. Near Khandwa the upper valley of Chhoti Tava is an open plane area and is very fertile. It has a rich fertile soil or alluvium.

The Tapti Valley: The river Tapti flows in the southern part of the study area between two parallel ranges of the Satpura in a narrow valley. This valley has its expansion of 50 miles from east-north-east towards west. In Manjrod and Navada areas it is hardly ten miles wide. The upper part of Manjrod and Navada areas was very fertile and good agriculture was carried on there. But now it is mostly covered with dense forest. In the Samardeo valley and to the west of the hills are open area towards Burhanpur. It is about 20 miles wide there. The rich soil is deep and fertile here and it is the best agricultural area and densely populated area of Burhanpur tahsil.

The Satpura Range: Satpura means a mountain with seven folds. This name has been given to the mountain range which is 600 miles long and 100 miles wide. It spreads in the south of the Narmada and beginning right from the western shore of India goes upto Amarkantak hills. This mountain range includes the southern Maikal range in the south or the hills of Salekhedi. The different mountain ranges which form the Satpura have different names in different localities or places.
The northern branch of the Satpura stands in Harsud tahsil in its southern-east part and it runs along with the border of Khandwa and Burhanpur tahsils. It only goes in the western border and really makes the border towards the north of tarai area. Its peak Asirgarh lies in the Burhanpur tahsil. The peaks in the west of Asirgarh are called Rajpipra hills which go upto the Western Ghats in the West. The hills in the east are known as Kalibhit ranges, whose eastern part is divided into two branches and the lower hills in the Betul district joining the water parting line are called real Satpura.

In the East Satpura is spreading from north to south and is about 24 miles wide and about 1250 feet high from the sea level. The main hills about 2000 feet high from the sea level have spread like the two sides of a triangle. The highest peak of the Satpura is about 2543 feet from the sea level. It is the maximum height of the Satpura. The other high peaks of the Satpura are the northern hill near Andea (2244 feet), the south-west hill of Itaria (2324 feet), Gairalatala (2338 feet). In the east of Tava valley Kilandeva (1107 feet) in the west of Tava valley Bhavargarh (893 feet) and in the west of Tava valley Jamgarh (620 feet). They are in one range. The edge of this mountain range spreads in Tava valley as far as 162 meter downwards. An other range of the satpura in the south-west of the Tava has gone upto Badnoor and it makes the northern edge of the Satpura plateau. It stands almost vertically towards the Tava valley. The height of the hills goes on decreasing commonly.

The Hatti Mountain Range: The southern range of the Satpura which has been separated by the Tapti has become another range and is away from the main Satpura range.
It goes along with the southern border of the district. Locally it is called Hatti range. The border of the district goes along with the southern edge of the range. Leaving a few hilly areas whole of the range lies in East Nimar district.

The common height of this range from sea level is about 2000 feet. In the plains of the south Berar and in the north of Tapti its average height is about 1200 feet. In the east some peaks are about 3000 feet high and are the highest points in the district namely Pipardola, Bengarh, Sitoli, Bhigar and Jeelgarh. Its height goes on becoming less and less towards the west. In the end it completely disappears near the southern border of Nimar and that of the eastern Khandesh in Maharashtra.

The Plateau of the Satpura: The plateau of Satpura exists in the whole of south and west border of Nimar district. The plateau is higher than 1000 feet (304.8 meter) and covers about one third of the area. In the Betul district the high parts of the Satpura plateau stand in the eastern part of the district. Here this plateau is even higher than 685 meters. This plateau extends from Betul Bazar in the west of Dunaba in the east and Patan in the south to Shrikot peak tarai area. It was covered a vast area. In the West Nimar the axis of this range is shaped like the Eresent Moon and touches the southern and western border of the district very closely. The upper parts of slopes are of higher degrees. This mountain range is like a standing sheild towards the south and west whereas the slope is less towards north and east. In the Betul district the altitude of the plateau is covered with forest and it is above the sea level by about 762 meters. It has spread from east to west there. The water of its northern
slopes flows into the Vale river which flows towards east. The water of southern slopes flows into the Tapti which flows towards west. The famous sorce of the holy Tapti called Multai stands to the south of the hill about 791 meters above sea level. This hill acts as water parting line between south east and south west parts. The flow of the Parcha and the Tapti in the south-west and that of the Kharva Nalah in the north prove it very clearly. This water parting point or line is called Multai water parting line.

The Edge of the Vindhyachal: The Satpura area on the north border is marked by the edge of the Vindhya towards east. Border making water parting line separates the Narmada and its small tributaries from the Chambal river banks. Only three tributaries of the Narmada namely Koran, Choral and Kanar rise from the top of water parting line and the water of northern areas flows into them. The Vindhyachal has slow and gradual slope in the north and is in the shape of a plateau. In the western Nimar the high peaks of the Vindhya ranges have perpendicular slope and enjoy seeing their reflection in the Narmada. These Vindhya hills are 5 miles (8.05 km) wide of the torrid zone. The Vindhya ranges are on an average more than 2000 feet above sea level.

The Tava Valley: The Tava valley is situated between Kilandeva and Bhavargarh peaks and is on an average 1300 feet above sea level. It is surrounded in the north-east, south-east and south-west by the cliffs with vertical slope. The general slope of the valley is towards north-west.
DRAINAGE PATTERN:

The Narmada and the Tapti rivers are main two big rivers of the study area. The rivers take their rise from the Betul plateau and have made the top leaving system of water flow. In the east deep trenches have been made by the Tapti in the Bhainsdehi area. The tributaries of the Narmada flow towards north and the rest of the rivers flow southwards.

THE NARMADA RIVER:

The Narmada river rises from the western side of the Amarkantak plateau in Shandol district. The place of issue is situated at 22.40° north and 81.46° east. It flows about 80 miles westwards and falls into the Arabian sea without making a delta near Bharonch. This river after coming down the hills flows in Mandla and Jabalpur districts and further south if flows through Narsinghpur and Hoshangabad districts. Towards north it makes the border among Raisen, Sihore and Dewas districts. Near Panghat after its confluence with the Machal it enters the Nimar district. In Harsud tahsil Chhoti Tava joins it coming from the western part of Chandgarh pargana south. Further it flows through Khandwa tahsil close to the northern border leaving the Shailani Pargana in the north.

THE TAPTI RIVER:

The real place from where the Tapti issues is near Multai (Betul) about two miles away from it. It is situated at the crossing point of 78.15° E and 21.48° north. It first flows in the Betul district through an open plain area towards west and later on it flows in the Nimar and Hoshangabad districts through Kalibhit mountain range and in Berar through the rocky covers of the
Satpura situated in the centre of chikhalda. It has a rocky bed and the banks are steep. After flowing from its point of issue about 120 miles it enters East Nimar. Among its tributaries the Mora, the Utawali are some big feeding rivers in Amrawati district.

THE CHOTA TAWA:

This river has come into existence as a result of the confluence of the three rivers, namely Aajana, Sukta and Man near Bhangarh. It flows in Harsud tahsil from south to north about 32 miles (49.5 Km) and joins the Narmada. It flows through Betul and Hoshangabad districts. It is an important river and this name has been given to it to differentiate it from the Tawa. The names of the tributaries on its right bank are the Piprar, Gangapar and the Kalamayak. There are

THE AABNA RIVER:

Aabna river rises from near Rajpura in the southwest of Khandwa tahsil. In Khandwa tahsil it flows toward east about a mile away from Khandwa town. It joins the Sukta about six miles ahead near the Kapasth village. The length of this river is about 33 miles.

THE SUKTA RIVER:

The Sukta river rises from the east Khandesh district and enters the tahsil from its northwest border. On that border it flows about 15 miles (24.1 Km) and enters the Khandwa tahsil near Farka. Then it turns towards north and joins the Aabna river in the north. There after it flows towards 30°C and joins Chhota Tava near Holda. In Khandwa district its length is about 50 miles. There is a spring on the border of Khandwa and
Burhanpur tashils near Sukta. This spring is known as Bhimkund.

**THE KUNDI RIVER**:

This river has been formed from the confluence of the rivers the Veda and the Khark which rise respectively from the neighbourhood of Mandarwad and Ramgarh temples. Jainpur, Bannala and Gogamba stand on the banks of the river whereas Khargon is situated on the right bank of the river Khark. These rivers fall into the Narmada from south near Mandlewar. The valley or basin of this river is the largest in comparison of other rivers that follow it. Including the length of the Kharak its total length is about 70 miles.

**THE TAWA RIVER**:

This river is an important tributary of the Narmada. It flows in the north-east part of the district. It has issued from the Chhindwara district. At first it flows in between the two mountain ranges of the Satpura for about 32 Kms and then it enters in the district after its confluence with the Wardha Nullah. In this district it flows about 35 Kms towards the west. A few miles in the north near Ghoradongri the Popes and the Dariyakhon drop their water into it. Both these tributaries come from the south. From here the river flows towards north. After 13 Kms the Machana Nullah coming from the west and at 2 miles away Bharangani nullah joint it. After that it flows for about 12 Kms it makes the border of the district. Still further it flows and enters Hoshangabad district. The total length of the river is about 185 kms out of which it covers about 72 Kms in the Betul district.
THE WARDHA RIVER:

This river rises from the southern slopes of the peak (811 meter high) 11 kms away from Multai in the north-east. This peak Dahadthana stands at the crossing of 20°50' N and 78°24' E. It flows in the district about 35 Kms and in south-east inundates a small area. After flowing for about 467 Kms it joins the Benganga near Chandrapur (Plate-4).

CLIMATE:

Climate generally signifies the combined effects of the Sun, the tomosphere and the earth on the biotic phenomena including human life. Its chief elements are: temperature, pressure, humidity, precipitation etc. The combined effect of all these is modified by local conditions such as the distribution of land and water.

Climate has a direct influence on the health of the people. It may provide favourable or adverse environmental conditions. There is a direct relationship between climate and the physical and mental vitality of man (R.P. Misra, 1970).

Climate plays an important role in governing the regional diversification of agriculture, food habits and health conditions in the present area of study. There are 3 climatic seasons viz.

1. The Summer season (March to June)
2. The Rainy season (July to October)
3. The Winter season (November to February)

The cold winter, hot summer and medium rains are the main characteristics of the climate of the region. The average annual temperature recorded in the area is
<table>
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<tr>
<th>DISTRICT</th>
<th>J</th>
<th>F</th>
<th>M</th>
<th>APR</th>
<th>MAY</th>
<th>JUNE</th>
<th>JULY</th>
<th>AUG</th>
<th>SEPT</th>
<th>OCT</th>
<th>NOV</th>
<th>DEC</th>
</tr>
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<td>13.06</td>
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<td>22.16</td>
<td>21.8</td>
<td>21.5</td>
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<td>33.86</td>
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<td>-</td>
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<td>12.00</td>
<td>17.00</td>
<td>21.00</td>
<td>22.00</td>
<td>20.00</td>
<td>21.00</td>
<td>20.00</td>
<td>10.00</td>
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<td>22.13</td>
<td>20.6</td>
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Source: Regional Meteorological Centre, Nagpur
WESTERN SATPURA RANGE
CLIMATE CHART

Source: Regional meteorological office Nagpur
about 28°C. The average annual rainfall as recorded is about 50 to 75 cms.

**TEMPERATURE:**

The temperature starts increasing day by day from March up to June. May is the hottest month of summer. Khandwa has recorded the highest temperature of 44.6°C and Betul the lowest 41.8°C in the month of May.

The days is very hot through out the summer. The winds blowing in this are also very hot and locally they are called 'Loo' or scorching winds. Specially in May and June they are extremely hot. Before the approach of the monsoon by the middle of June the temperature slowly starts going down. But the average temperature recorded during April and March is found to be from 38.37°C to 13.7°C which is comparatively less than that June this month hot winds have not been recorded.

The summer season presents very unfavourable health conditions to population resulting in many environmental health hazards. Month-wise temperature is given in (Table 2.1).

Similarly the winter season is also fairly dry but in the month of January and February some rains occur which reduce the temperature in the study region. The cold waves blowing from north also reduce the temperature in this season. This character of climate influences the health and economy of the people in this area.

**RAINFALL:**

The rainy season of the region starts from the middle of June and continues up to the end of September. Most of the rain falls in July and August in this season.
<table>
<thead>
<tr>
<th>MONTH</th>
<th>KHANDWA</th>
<th>KHYARGAON</th>
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<tbody>
<tr>
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</table>

Source: Regional Meteorological Centre, Nagpur
In the region the highest rainfall of 24.5 cm was recorded in Khargon district in the month of July and the lowest of 16.54 in Khandwa district. The highest rainfall in July 53.10 centimeter was recorded in Betul district and the lowest in Khandwa district. In the middle of June when the rainy season begins the highest rainfall of 26.62 cm has been recorded in Betul district and the lowest of 5.68 cm in Khandwa district. The annual average rainfall of the study is 117.41 cm and the maximum rainfall has been recorded in Betul district. It is 173.31 cm and in Khandwa district 62.32 cm being the lowest. The average rainfall indicates that the rain goes on changing it place in every month. Month-wise rainfall is given in Table-2.2(Plate-5).

In the study region it has been marked that rainfall generally goes on decreasing from north to south and east to west. Betul district which is the eastern part of the study area has recorded the heighest rainfall of 173.31 cm. The monsoon winds blow from the south-east and have their great effect on the eastern part of Satpura. The annual average rainfall in Betul district is 173.31 cm, in Khargon district 116.6 cm and in Khandwa district it is 62.32 cm.

HUMIDITY:

The term atmospheric moisture covers a wide variety of climatic factors. Moisture in vapour or gas form of water is known as humidity. It is always present in the atmosphere. The amount of moisture which air can hold depends upon its temperature. Humidity may be expressed as absolute humidity or relative humidity. Absolute humidity is the weight of water vapour in a unit volume of air and relative humidity is the percentage of moisture present in the air. Humidity has an effect on
physical health although it definitely has an effect on comfort but if the relative humidity exceeds 65 per cent the air inside the room feels sticky and uncomfortable. Relative humidity below 30 per cent is also unpleasant. Month-wise relative humidity is given in Table-2.3.

**TABLE - 2.3**  
**AVERAGE RELATIVE HUMIDITY (1982-84)**

<table>
<thead>
<tr>
<th>MONTH</th>
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</tr>
</tbody>
</table>

Source: Regional metrological centre, Nagpur

The highest relative humidity is recorded in the months of July, August and September in rainy season. At that time it is found to be between 80 and 90 per cent. The main characteristic of the rainy season is the sky overcast with clouds, whereas in other months the sky is clear and there is bright sunshine. The percentage of humidity changes in every month. The lowest percentage
of humidity is recorded in April and the highest in August. It is very low between 15 to 30 in the summer. After the end of November and in the beginning of December it is between 50 and 60 per cent.

NATURAL VEGETATION:

Difficulty of means of transportation, scanty population and natural obstacles in the expansion agriculture have saved the vegetation from destruction.

About 45 per cent of the Satpura region is covered with forest. In the western part dry monsoon trees are present in a large quantity. The trees of natural vegetation here are teak, salai and bamboo. The vegetation of the western Satpura region has been classified as given below.

1. Teak trees
2. Humid or damp leaf shading teak forest
3. Dry leaf shading teak forest
4. Salai forest
5. Anjan forest.

Teak Forest: This type of forest exists in the whole of West Nimar district and in East Nimar district and also in Kalibhit vegetation area as they are under western Satpura forest area. These forests are limited to the above areas only. Such teak forest in West Nimar district cover an area of about 800 sq. miles. It includes the ranges of Badwah, Sanavad, Bhikangaon and many parts of Jainpur range. These forests are found in the western parts of Kalibhit ranges of East Nimar. The tree tribes related to teak found in area are, saj, dhawda, landiya, tinsa, shisham, tendu, salia, manen, kher, halduo, bija etc.
Damp leaf shading teak: This type of forests are existing only in the eastern part of the west Satpura region in Betul district. Here these forest are present mainly in the southern part of Bhanvargarh range. The whole of Machana valley are full of them. In the middle part of Ajla range, in the south east of Sanbealigarh and near Nadda and Gaharwar of west Tapti range also this type of natural vegetation is found. The main tribes of trees generally found with teak here are saj, landiya dhawda, haldu, amla, tinsa, salai, mahua, jamun etc.

Dry leaf shading teak forest: This type of forest exists only in the eastern part of the west Satpura range in about half of this area. This type of natural vegetation is found in the northern part of Sanwali range in the northern and western part of Tapti range in the eastern part of Dakkana range in south Sawalmaken of Chocue range and Kikum forests.

The forests on high altitude of Betul and Amla range and in unfertile land is Asir range also come under this category of vegetation.

Salai Forest: The Salai forests are found through out the Satpura range in Khargon, Khandwa and Betul districts. In Khargon district these forests are present on plateaus of the Satpura and in the North on the ridge of the Vindhya. They are found in thick groups. These forests cover an area of about 300 square miles. Salai forests exist in long strips in Badwah, Badwani, Sendhwa and Barla ranges.

It is found in abundance in Burhanpur and western Kalibhit part of Khandwa district. In Betul district there is a wide extent of Salai forest only. In the forest ranges of Kewal, Kaska, Salai, Megha and Tapti
generally Dhawada, Moin, Ganer, Mirara and Kulu also are found among Salai trees. Teak also grows with it somewhere. Bamboo generally does not grow in Salai forest.

Anjan Forest: Anjan forests are found in only two districts in west Satpura range. In Khandwa district these forests are limited in the patan, Gastalpatan and Asirgarh ranges in some particular areas only. In Burhanpur district they are found in some particular areas and in the some parts in Samardeopatana range, Kirgaon, Titgaon, Deolan and in Maura patahan ranges. They are also found in some unsurvival areas of Khandwa range and Chandgarh range in a large quantity. Anjan trees are in abundance in Punasa and Chandgarh ranges.

These forests and also found in Badwani range and in Morani and Bakevai parts of Khargon distrist and in Bhikangaon ranges, in Pista range near Barun and Bhatwali range. In Sanawad range these forests are also in a large quantity present in Bedia, Badwah, Bhikangaon and Sendhwa ranges. They also exist in smaller patches in chapo range.

Bamboo Forests:

They are found only in Betul district on the western part of Satpura range. It has grown in so thick in the forests of Bakur and Lodia ranges of Amla range of the said district that they are included easily in the Bamboo forest area. The well spread bamboo forests are present in the Bhanwargarh range of Betul district.
SOIL

The attractiveness of a region to settlers depends partly upon the quality of soil because it determines efficiency of the land to support the population. The soils of the area under study are deficient in nitrogen and phosphorus (Raichoudhary, 1963).

The western Satpura region, being in the Deccan Trap, is an area of black soil. Many other types of soils are also found in this region.

(i) Black soil: Khargon district lies mainly in black soil area. In about 40% part of the study region black soil is present. The layers of these soils are not very deep. The depth is from 0.3 meter to 1.5 metre. The soils are mainly suitable for the crops of wheat, jowar, groundnut sugarcane and cotton. It is also known as black cotton soil.

(ii) Green soil: Green soil is found as thin layers in Pipri, Burjan, Nakhera hills, Gayapanda hill and Cansel. It is found about 1 to 3 meteres thick at the bottom and about 100 meteres long strips. This type of soil is somewhat hard and of good quality but these lower stratas are covered with unerossedioned basalt rocks. Hence it is of no use for cultivation.

(iii) Multani Soil: This soil is found in Mongawa, Siwani about 16 Km away from Sanawad. This is yellowish. Multani soil is used by the washerman to wash clothes with it.

(iv) The Clay or Smooth Soil: It is present in the reserved forest of Chandgarh. This clay is used in making pipes for different uses.
(v) **Mixed Soil**: In the metamorphic rocks of marble rocks are present in very thin layers. In the Deccan Trap area there are the patches of fine and fertile black soils. It makes a very thin layer of Sandy soil in the rocks of Gondwana with some earth. It is not at all useful for cultivation of crops. It can only by used for growing small trees and grass for cattle.