

# CHAPTER - ONE

## PHYSICAL ENVIRONMENT

It is an established fact that environment has a direct impact on the physical, mental and social well-being of those who live in it. The environmental components, physical and biological are so inextricably linked with one another that it is realistic and fruitful to view the human environment into when we consider the influence of environment on the health status. If the environment is favourable to the individual, he can make full use of his physical and mental capabilities.

The term physical environment is applied to non-living things and physical factors - air, water, soil, climate, heat, light, noise, housing etc., with which a child is in constant interaction. In most developing countries, defective environment continues to be the main health problem. Man has altered practically every thing in his physical environment to his advantage. He has created for himself a host of new health problems such as air pollution, water pollution, urbanisation etc. Child is living today in a highly complicated environment, which is getting more complicated as child is becoming more ingenious.

It is also a well-established fact that physical environment has a nexus over physical, mental and social well being of men. First of all man tries to encounter with the environment, though he may in doing so face the problems of diseases. Physical environment influences nutritional status to a great extent in many ways. Physical factors, such as climate and weather conditions, soils and hydrology play an important role in influencing the choices related to the cropping priorities and animal husbandry.

Physical environment plays an important role in ensuring the working capability of the people in a region and the area under study is not exception to this fact. If the physical environment is unfavourable, the physical condition of people is very likely to be adversely affected with the result that man would encounter many health hazards, which in turn would weaken his working strength.

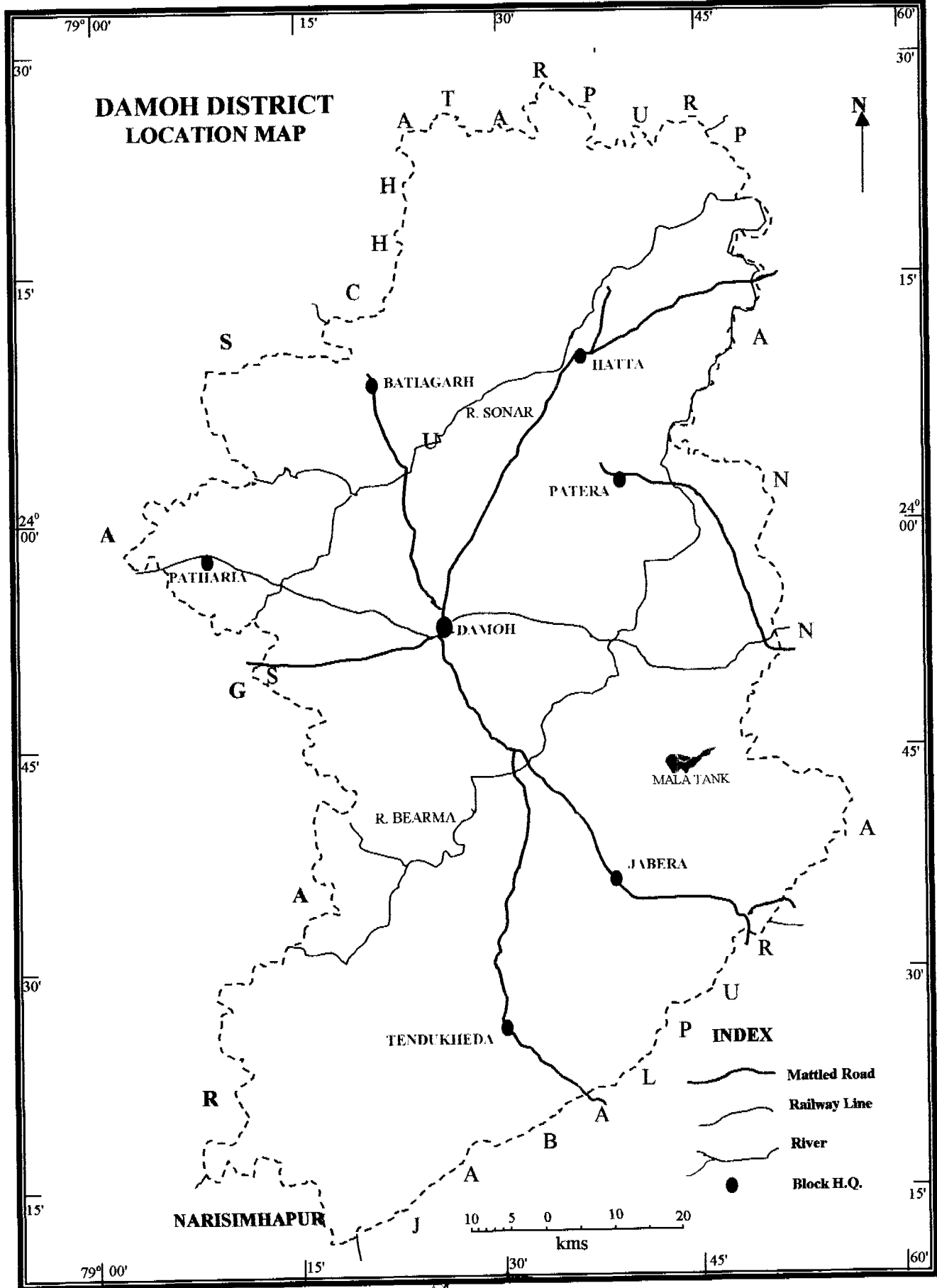
Topography determines the capacity of an area to produce things needed for the survival of all living. In different physiographic characteristics the preferences for particular crops, in turn affect the dietary pattern. A natural focus of disease exists under the combination of specific climate, vegetation, soil and favourable microclimate, in the places where vectors, donors and recipients of infection take shelter. Therefore the analysis of physical environment is very vital in the study of the various health conditions of the people of any region.

The characteristic of the drainage of the region influences the agricultural potential of the region. Climate determines, to a great extent, the amount and nature of food available to people. If the rainfall is good, people have more and better food to eat, if it fails, famines occur and people suffer from both under-nourishment and malnutrition. The major function of soil from the view point of agriculture is to provide mechanical support to plants to store and supply the required nutrients and water for proper growth, and these functions depend on soils, physical, chemical and biological characteristics.

## LOCATION

The study unit lies in the Central part of Madhya Pradesh. The Region, Damoh extends between 23°91' and 24°26' north latitudes and 79°03' and 79°57' east longitudes. It is situated in the eastern part of the Sagar division and lies in the north of the Jabalpur division. Damoh has a central location in the country. The shape of the region is irregular and elongated in the north and south with projections. Damoh region is surrounded by Sagar, Jabalpur, Katni, Narsinghpur, Chhatarpur and Panna districts of Madhya Pradesh.

The area under study has an area of about 7,306 Sq. kms. and with 1.64 per cent of the State's total area and ranks 29<sup>th</sup> among the districts of the state. According to 2001 census Damoh district accommodates 10,81,909 persons out of which 5,68,704 male and 5,13,205 are female. The density of population comes to 148 persons per sq. km. Administratively, the district is divided into seven Tahsils i.e. Damoh, Hatta, Batiagarh, Patera, Patharia, Jabera and Tendukheda. The district is further divided into seven development blocks i.e. Damoh, Hatta, Batiagarh, Patharia, Jabera, Patera and Tehdukheda and into 18 revenue inspections circles having 1205 villages (according to 1991 census). The region is accessible by railways and road network. The district is traversed by the State Highway No.3 that provides direct links with important towns like Jabalpur on the south-east, Jhansi and Gwalior on the north and Bhopal on the southwest. Damoh railway station lies on the Bina-Katni section of the Central Railways and provides direct accessibility to Delhi, Mumbai and Howrah (Map 1. .).



## **TOPOGRAPHY**

Damoh district lies on the south-eastern part of the great Vindhyan plateau, which stretches north of and parallel to the Narmada. The plateau rises abruptly from the Narmada valley in the line of steeply scarped hills. At the summit it reaches its greatest elevation from where there is a gradual slope, generally towards the north-east. The plateau is broken and crossed by the Sonar valley in this district and by a series of valleys between the chains of hills further into the north-east. Thus, the Sonar valley divides the plateau into two parts, a large block in the south and a narrow belt in the north-western part of the district.

## **PHYSIOGRAPHIC DIVISION**

In restricting human access, habitatory and cultivation, the landform plays an important role. The gazetteer of India places the district into three physiographic sub-divisions, namely, Vindhyan range, Vindhyan scarps and Bundelkhand upland. In this classification of physical divisions on an all India basis, the Vindhyan scarp-land covers the entire Sonar valley and the southern plateau, excluding the main chain of hills belonging to the Vindhyan range. Considering the small size of the area like the region under study, the Sonar valley is considered as a separate physiographic unit and the Vindhyan range is grouped with the area covered by the southern hills, classed as Vindhyan scarps. Thus, the area under study is divided into following physiographic divisions:

1. The Southern plateau,
  - (a) The Vindhyan range and the southern precipice,
  - (b) The broad Southern plateau,
2. The Sonar valley,
3. The North-western hill range.

## 1. THE SOUTHERN PLATEAU

The southern plateau lies at a general elevation of about 450 metres, marked with main chain of hills on or along its southern and southeastern margins and more or less a continuous precipice overlooking the valleys of the Narmada and the Hiran. Considering the topographic variations the southern plateau is subdivided into:

**The Vindhyan Range:** The Vindhyan range is the long range of escarped hills, which stretches from the vicinity of Mandvi to the junction of the Hiran and the Narmada. It continues into the Bhandar and Kaimur ranges to the north of the Son valley. In fact the range is the southern edge of the Vindhyan plateau. Generally the escarpment is more prominently marked than the hill range because the range is either mingled with or is less distinct from the offshoot ranges branching off towards the north and the north-east. In the region the southern part of the Vindhyan range up to Katangi is called the Bhandar range. Beyond this point, the escarpment enclosing the landlocked valley of Singrampur, and the hill-range in the continuation, is called the Kaimur range. The southern edge of the plateau and the hills make a steepy scarp in the south facing Narmada and Hiran valley. The escarpment is mostly composed of sandstones with quartz formation at their base and owes its origin either to a fault in the Narmada valley or to the upheaval of the whole strata of the Vindhyan plateau into an almost vertical position.

At places, as in Narsinghpur and Sagar districts, the precipice has been much cut up by agencies of erosion and turned into a belt of various countries. In the region it forms a sharp edge and natural boundary with that of Jabalpur district. Even the long and the

narrow ridges of Vindhyan hills, wherever they lie, are separated from the plateau and have scarping sides facing the valley. Along the lower course of the Hiran one such close and parallel ridge of Bhandar is noted to have south-eastern scarp in the Jabalpur district. These features have been effective barrier in the development of communication, and the only easy pass through Singrampur and Katangi seems to have been a highway of strategic and administrative importance since the long historical past. The greatest height in this range is that of the Kulumar hill, 751 metres above the mean sea level. On the north-east of Singhrampur - gap, Kheri is the highest peak with 586.7 metres elsewhere the height of hill range varies from 550 to 580 metres above the mean sea-level.

**The Broad Southern Plateau:** North and northwest of Bhandar range, northwest of Kaimur range and the great table land has a slope towards the northeast and originally was extended beyond Panna in the north. With the formation and development of drainage lines and the consequent erosion now the valley of the Sonar and the Kopra lies in the broad belt of low alluvial country between the line of dissected hills on the southeast along the scarps of the northwestern plateau. Thus, the plateau region has been separated from the hill range lying in the north-western part of the region.

The southern plateau extends in a broad belt from southwest to northeast. It is centrally drained by the Bearma and is traversed by a number of spurs and ridges, generally accounted in the Vindhyan range. The northwestern limit of the southern plateau is marked by the hills of Fatehpur (450 metres), Satiria (479 metres), Hindoria (above 457 metres) and Jamunia (triangulation point at 447



metres) which are apparently disjointed from a single ridge. The hills of Lodhikheda (463.6 metres), Gubra (417 metres) and Patharia (429.9 metres) are the off-shoots of the Bhandar range in the southern part of the district. They extend from south to north. The western slopes of Salaiya plateau marked along the district boundary and the hills to the north and west of Mala are grouped into the north-eastern hills. Locally, the hills near Hindoria are known as Bhondla range and those running from Mangarh, above the Sone Valley to the Bearma, the Mangarh range.

The Bearma and its tributaries have a zigzag, branching and narrow upland-valley amidst low hills and is covered with dense forest. The soil cover of the valley is comparatively shallow, but there are occasional deeper and broader beds of black soil, which is supposed to be the most fertile soil in the district. The land is commonly embanked to retain water and wheat is grown often after a crop of rice. However, agriculture pays here better than the Haveli area.

Among the more fertile patches in the Bearma valley may be mentioned the Sone valley, where the Chaubisa group of villages is very fertile. Around Abhana and Nohta the valley of the Bearma opens out into a stretch of fertile black soil which is largely double-cropped. The narrow and small valleys on the east and west of Kalumar hill in this region are also fertile patches of land. The Jaber valley drains west into the Bearma and across the line of the Kaimur which is broken up here. It is said to have been a vast lake once. It now consists of several agricultural villages. But this and the Singhpur valley along the Phalku river and Bhaddar stream banks are accounted to be less fertile than the Sone valley. The Bearma valley around Taradehi and below up to Nohta is also of lesser agricultural value.

Except the narrow river valley and a few clearings on the even surfaces, e.g. around Selwara, Behoria and Mohli, nearly the whole area of the southern plateau and the Vindhyan range is covered with the reserved forests.

## 2. THE SONAR VALLEY

The Sonar valley (Haveli) extends in a belt across the north-central part of the district. It is about 80 km. long from south-west to north-east and 32 to 40.3 km. wide between the scarps of the southern and northern plateau of the Vindhyas, which also form the local water-shed between the Sonar and the Bearma to the south and the Sonar and the Barana nalla to the north-west. It lies at an elevation of 335 metres from the mean sea level. The Bewas, the Kopra and the Bearma are the important tributaries of the Sonar joining it at Damoh and flowing through the valley. The valley lying in the south of Sagar and at the centre of Damoh district is composed of fertile black soil formed from the detritus of volcanic rocks which still cap the southwestern hills, and had extended in larger area in the geological past.

The Sonar valley is the principal agricultural region of the district wholly devoid of forests. It is the most populous zone containing a large number of villages and the major commercial, administrative and industrial centres. Damoh town, Hindoria and Patera are located along the south-eastern margin of the valley. Kerbana, Batiagarh, Fatehpur, and Mariado villages are settled along the north-western limits of the valley whereas Hatta, Gaisabad, Reneh, Sitanagar and Bangaon are in the centre. Though it is not adequate, by reason of necessity and because of the even surface of the ground a large percentage of road and railway length of the district has been

constructed in this part. Naturally, they follow the drainage lines and low gaps in the hilly region to the south-east and north-east of Damoh town. In the Sonar valley region the roads track along the higher grounds and prefer to cross the rivers at fords. However, the control of topography is less binding on the human activities in the Sonar valley. The Sonar is the most important river of the district and forms its central drainage. Its valley slopes gradually and gently towards the north-east.

### 3. THE NORTH-WESTERN HILL RANGE

The north-western plateau rises about 120 metres like a wall from the Sonar valley. Its north-western slope in Damoh drains into the Barana nala which joins the Ken river. Locally known as Barana hills, the central ridge (460 to 520 metres) is marked by several flat-topped hills and runs from south-west to north-east. The Phurtal hill (525 metres) is the highest point of this range in the district. There are a few small villages along the flat top of the range and on the banks of the streams, rest of the area is occupied by low forests taken under the Government Reserves. The only metalled road crossing the hill range is Damoh-Hirapur road passing through Batiagarh and Bakswaha.

## **DRAINAGE**

Moreover, the characteristic of the drainage of a region influences the agricultural potential of the study area. The most interesting characteristic of the drainage of the region is that though the Narmada flows along nine kms. of its southern boundary, it forms largely a catchment area of Yamuna. Except a few small streams joining the Hiran, a tributary of the Narmada, the whole district is

drained into the Yamuna through the tributaries and feeders of the Ken. The main local system is of the Sonar and the Bearma which follow the general slope of the country and flow towards the north-east. These rivers are perennial in their later courses but most of the drainage lines are seasonal in their character. While the floods cause great inconvenience and loss to the region, the summer spell scarcity of water for drinking and other purposes.

### **THE SONAR**

The Sonar rises in the low hills in the south-west of Sagar district ( $23^{\circ}22'$ ;  $78^{\circ}37'$ ). It flows in a north-easterly direction in Sagar and Damoh districts, passing through Rehli and Garhakota of Sagar and Sitanagar, Narsinghgarh, Hatta and Aslana. Its valley in Damoh, called the Haveli, is a fertile black soil plain forming the principal wheat-growing tract of the district. It joins the Ken river 12 kms. beyond the northeastern boundary. Of its total length of 186.7 km. it flows for 102.4 km. through the district. The river does not attain any great width and flows into a deep channel, its bed being more or less stony. Its greatest width is under 320 metres, except at the junction of the Bearma, where it extends to a kilometre. The principal effluents of the Sonar are the Kopra and the Bearma on the right bank and the Bewas on the left.

The Bewas river rises in the Siarmau hills of Raisen district and flows across Sagar district from southwest to northeast. A little to the north of Banda it turns eastward through a gorge into Damoh. It falls into the Sonar about 5km. above Narsinghgarh. Its length is about 148 km.

The Kopra rises in the centre of Rehli tehsil of Sagar district and flows for about 81 km. parallel to the Sonar. It joins the major river about 1.5 km. below Sitanagar. Of its total length of 97 km. it flows

about 67 km. in Damoh. The Bearma is a tributary of some local importance joining the Sonar on the north-eastern boundary.

### **THE BEARMA**

The river rises in Rehli tahsil of Sagar and flows from south-west to north-east in a tortuous course in Damoh district. During the last part of its length it forms the boundary between Damoh and Panna districts and joins the Sonar on the north-eastern boundary. About 13 km. further on, the united stream falls into the Ken river.

The Bearma traverses the most rugged portion of the district and during the greater part of its course it is confined between rocky cliffs. Its valley is nowhere extensive. It passes Taradehi, Nohta, Jujhar and Gaisabad, and is crossed by a causeway at Nohta and a railway bridge at Ghatara station. Its length is about 193 km. and the fall in its course during this distance is 213 metres or nearly 1.1 metres per kilometre. Its velocity in flood time is, therefore, considerable. Its greatest width is about 320 metres at Mohua village about 3 kilometres from its junction with the Sonar.

The principal tributaries of the Bearma are the Guraiya, the Sone and the Padri on the right bank and the Bamner and the Kathera nala on the left. All of these resemble the main river in their character except in length and size. The Guraiya rises near Tendukheda and joins the Bearma at Nohta. Jabera nala, a tributary, drains the Jabera valley and cuts across the scarps of Mangarh. The Jabera valley is said to have been a great lack in the historical past. The Sone rises from the Bakal plateau of Jabalpur district, north of Mangarh scarp, and joins the Bearma near Ghatara. It has been dammed at Mala and its water is utilised for irrigating the fertile valley.

## **THE SINGRAMPUR VALLEY STREAMS**

The small valley of Singrampur, which is cut off from the open country of Jabalpur by the Kaimur range, possesses a drainage system of its own. The Phalku and the Kair nals which drain it flow in a southerly direction and join the Narmada through the Hiran by forming a way through an extraordinary cleft in the hills known a 'Katas'.

## **GEOLOGY**

Geologically, Damoh region is not a very complex area. It is the eastern most part of the great Vindhyan plateau, consisting of the valley of river Sonar in the centre of the region and is running from southwest to north-east with hilly uplands on the either sides.

The stratigraphy of rock formations found in the district is given below:

Recent	:	Aluminium and Soil
Upper Cretaceous to Eocene	:	Deccan Traps
Upper Cretaceous	:	Lameta beds
Late pre-cambrian	:	Vindhyan System

## **VINDHYAN SYSTEM**

The rocks of the Vindhyan system consist of a succession of sandstones and shales with a horizon of limestones and cover a large part of the district. The system is subdivided into three series as follows:

Bhander Series	:	Upper Bhander Sandstones, Sirby shales, Lower Bhander Sandstones, Bhander limestones, Ganurgarh shales.
Rewa Series	:	Upper Rewah Sandstones, Jhiri Sales
Kaimur Series	:	Lower Kaimur Sandstones

The Kaimur stage consists of well-defined bands of grained, massive, markedly lenticular quartzites with an intervening band of shales. The Jhiri shales are soft, less regularly bedded and mixed with numerous layers of soft, earthy sandstones. Pure white with a tinge of pink or red brown, rough and massive quartzite's form the upper Rewah sandstones. The Ganurgarh shale's are purplish red or brick coloured and are impregnated with stringers of calcite. The Bhandar limestone is generally earthy compact and is grey with yellow or reddish tints. Some of these limestones are found to contain specks of argentiferous galena and fibrous calcite. Khaki coloured and thinly laminated. The upper Bhandar sandstones are composed of flaggy, thin bedded fine grained sandstones which are dirty white, dark red or brownish red and greenish white in colour. The sandstones are at place purplish red with white spots and prominently jointed.

#### LAMETA BEDS

These rocks consist of conglomerates, cherts, sandstones, clays and limestone which often contain bands and nodules of chart.

#### DECCAN TRAPS

A few outcrops of dark grey prophyritic Basalts are met with, which occur in the form of sills and flows in the Vindhyan Sandstones. The Basalts consist of augite, pigeonite and plagioclase feldspars. Magnetite and ilmenite occur as accessories. The Basalt is a fine to coarse grained rock and shows columnar jointing at places. Vesicular, scoriaceous and amygdaloidal varieties are also met with. Inter-trappean beds are found between the flows of Basalt and consist of siliceous limestones, cherts and clays.

## SOILS

Soil is one of the natural resources to affect the environmental phenomena. From the point of view of health and nutrition, the main function of the soil is to store and supply the required nutrients and water for the growth of plants. The nutritive value of the grains largely depends upon the soil and human beings are directly influenced by their food. The detritus of the sandstones form the sandy soil known as sihar which is of very poor natural fertility but a greater part of Damoh plateau is covered with medium black soil, a sub-class of black soil and skeletal soil which is found particularly on the uplands of the vindhyan range. The bulk of Damoh plateau is covered with medium black soil. However, the characteristic qualities of the soil vary from place to place in the region and it depends largely on the local topography and the underlying rocks. The soil is dark brown with red and light brown here and there. It is 0.3 to 1.5 m in depth. It has 20 to 60 per cent clay and is good for almost all kinds of crops grown in this region. The evolution of skeletal soils is over millions of years from conglomerate quartzite sandstone and shales. This sort of soil covers the story uplands of the Vindhyan range. Skeletal soil lacks in soil nutrients, and only the crops like millets and oilseeds can flourish on it. In fertility too, these lands are poor though some patches of good black soil, which are suitable for crops, like rice and wheat are also found on them. Amongst such patches, the soil types locally known as Patura and Bhatua, are used for Patura lands on the eastern side of the plateau. The silt soil and patura are in abundance in the hilly tracts.



An integral part of land surface is soil and is of great value for arable farming. Commenting on the significance of soil to man Bannett says that out of the long list of nature's gift to man is perhaps so utterly essential to human life as soil (Bannett, 1939). The major function of soil, from the viewpoint of agriculture, is to provide mechanical support to plants to store and supply the required nutrient and water for plant-growth. And these functions depend on soil's physical, chemical and biological characteristics. The question that what type of plant and crop are suitable to be grown and which kinds of cattle can be reared in a given region depend on the nature of soil. No any systematic study has been carried on this fact so far in Madhya Pradesh. For all these difficulties some responds readily to water and manure. Towards the west of the district, the Deccan trap area and Sonar valley are entirely composed of the black cotton soil. Black soil is also found in the valleys, which intersect the Vidhyan hills to the south.

## **CLIMATE**

Food availability is influenced by climate, and therefore, a particular crop growth under particular climatic condition. The direct effect of climate on the health and disease is very important and obvious. The environment may also affect the nutritive content of the plant. It must be remembered that climate exercises a deep influence on the agriculture of any region. The variations in temperature therefore, greatly influence the crop selection especially during Rabi season. Similarly rainfall is also a dominant factor which determines not only the selection of crops of cultivators but also the pattern and intensity of cultivation. The segments of the regions, which receive

over 100 cm. of rainfall, are not considered suitable for the growing of jowar while those less than 100 cm. of rainfall are relatively good for this purpose. The rains also markedly influence the cropping intensity. The double-cropped sections thrive only during good monsoon. Consequently, in the same holding the farmers grow a single crop where they would have grown two if rains had been kind vagaries of rain goods.

The climate of the district is generally pleasant, the air being mostly dry except in the south-west monsoon season. The year may be divided into four seasons. The cold season from November to February is followed by the summer season from March to about mid June. The south-west monsoon season is from June to the end of September - October is the period of transition from monsoon to winter. The direct effect of climate on the health and disease is very important and obvious.

## **RAINFALL**

Rainfall in this region is mostly due to Arabian sea (Western) monsoon. The pattern of rainfall indicates a declining trends while moving from west to south. The total annual rainfall varies from 80.85 cm to 148.16 cm. In Damoh district, Hatta station situated in the Sonar valley, receives only 92.70 cm rainfall. The Damoh station on the other hand, located south of the Sonar valley, has as much as 148.16 cm of rainfall. The third rain-gauge station, Jabera, located to the north of Kaimur range, gets the lowest average, only 80.85 cm. The annual average rainfall over this entire region comes to 117.23 cm. The south-western boundary receives more rainfall than the north-east and east. Notably, the region experiences three distinct seasons over the year winter (October to February), Summer (May to June), and the rainy season (July to September).

**TABLE 1.1**  
**AVERAGE RAINFALL (in mm)**  
**Block-Wise**

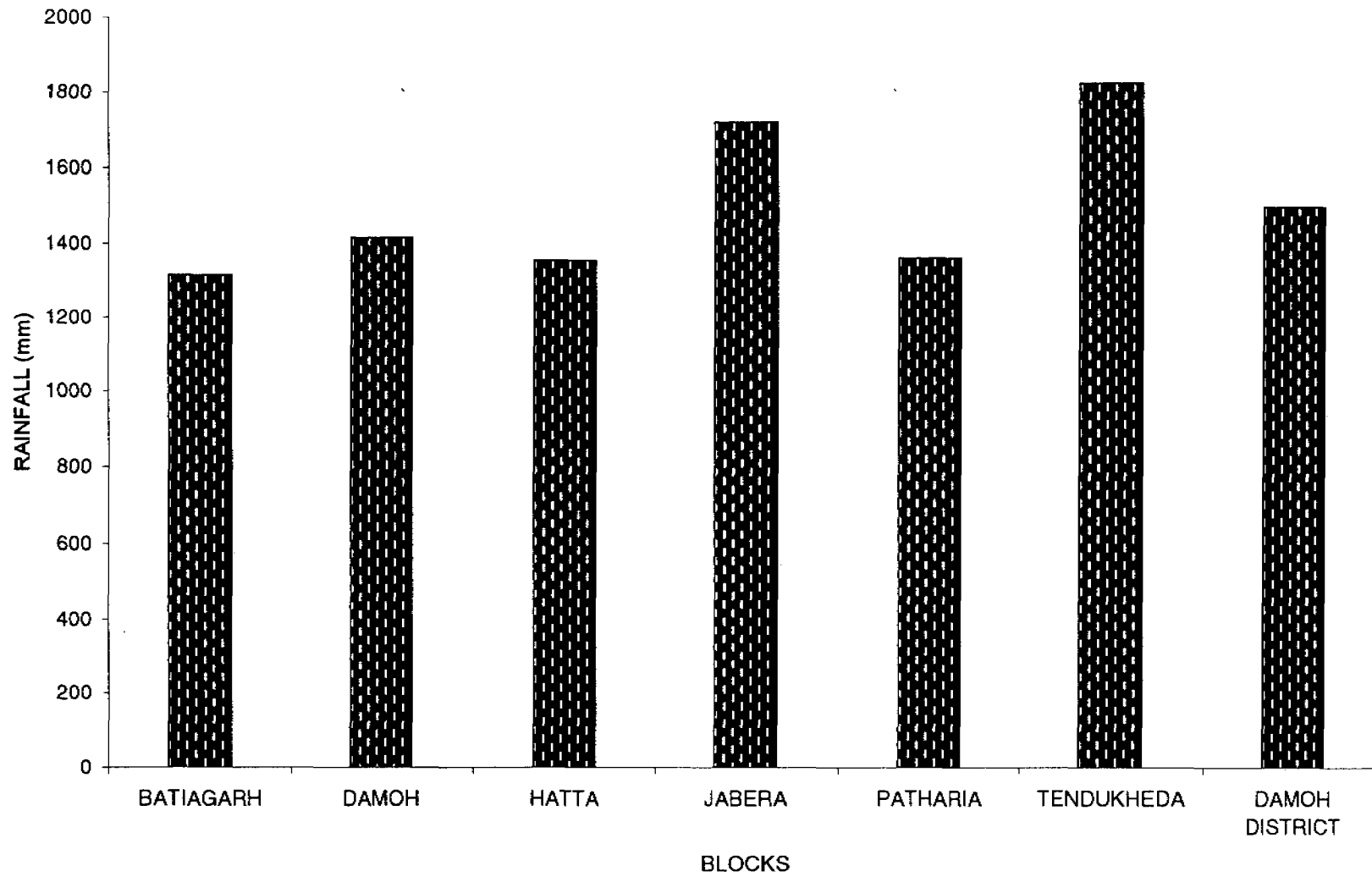
S.NO	BLOCK	1996 - 97	1997 - 98	1998 - 99	1999-2000	AVERAGE
1	Batiagarh	991.80	656.00	674.00	1315.00	909.20
2	Damoh	892.20	901.20	956.60	1416.00	1041.50
3	Hatta	830.20	913.60	950.60	1355.60	1012.50
4	Jabera	978.80	722.20	883.60	1719.80	1076.10
5	Patera	N.A.	N.A.	N.A.	0.00	0.00
6	Patharia	823.00	851.80	923.80	1362.80	990.35
7	Tendukheda	830.00	897.00	930.00	1824.00	1120.25
8	Damoh District	891.00	823.60	886.40	1498.90	1024.98

Source: District Statistical Hand Book Damoh, 2000, P.7

## TEMPERATURE

Temperature is one of the most important variables, which affects human health directly. The coldest month of the year with an average monthly temperature of 17.4°C in January. The average monthly temperature rises to 33.29°C in May which is the maximum temperature in this region. The minimum temperature is known to fall even further in exceptional circumstances of a cold wave resulting from western disturbance moving north-eastward across north India. Both day and night temperature rises progressively from January to May. However, the rate of rise of the night temperature tends to decelerate. The coming of monsoon and assemblage of clouds by the mid June bring both day and night temperatures down considerably, but the day temperature shows a tendency to rise once again after August, and reaches a secondary maximum in October. The daily range of temperature variation reaches its maximum (40°C) in the month of April owing largely to the low percentage of humidity in the atmosphere. This

Fig. 1.1  
DAMOH : AVERAGE RAINFALL  
(Block wise)  
2001

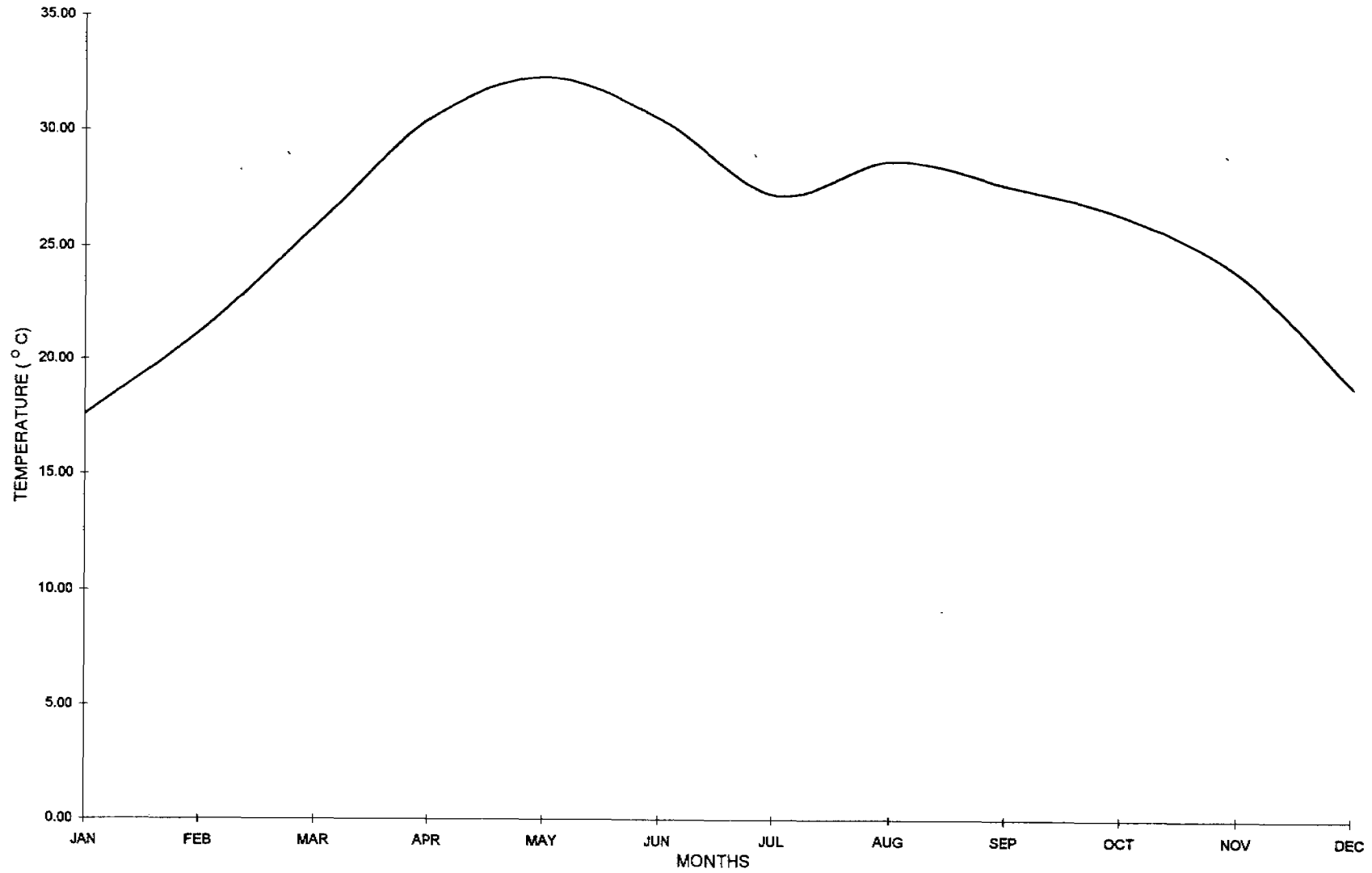


**Table 1.2**  
**AVERAGE TEMPERATURE**

<b>Month</b>	<b>Average ( ° C)</b>
January	17.60
February	21.20
March	25.90
April	30.50
May	32.30
June	30.50
July	27.30
August	28.75
September	27.70
October	26.45
November	23.90
December	18.90

Source: District Handbook, 2001, Damoh

Fig. 1.2  
DAMOH: AVERAGE TEMPERATURE  
2001



range shows a downward trend in July when the humidity in the atmosphere. This range shows a downward trend in July when the humidity goes up and in August, when the humidity is at its maximum, the range is reduced to as low as 6.0 ° C.

## **HUMIDITY**

The summer is extremely dry, the relative humidity in the afternoons very often being less than 15.0 per cent. In the south-west monsoon season the moisture in the air is high, the relative humidity being over 70.0 per cent. With the withdrawal of the monsoon after September the relative humidity fall well below 50.0 per cent.

## **VEGETATION**

Vegetation plays an important role in maintaining the balance of the environment and whenever it is disturbed, it creates various health hazards and nutritional problems. Vegetation is the combined result of climatic factors, biotic factors and soil are the most important among the climatic factor, which comprises temperature and moisture and their combination and seasonal variation. The forests of the district are classed as Tropical Dry Deciduous forests. However, variations in the predominating species at different localities, their quality and density are marked. A good number of deciduous, a few ever green or semi-evergreen and a few xerophytic to semi-xerophytic types of species are met with, mostly mixed up in various proportions. In certain localities one or the other also seems to have monopolised the area. The overwood and underwood are at most places indistinguishable and only single tree canopy is met with.

## MIXED FOREST

The forest in the district is of a general type. Mixed forest is quite extensive in Fatehpur range and occupies the whole of its length excluding the northern slopes along the northern boundary and the Hathidol area. Other large areas are around the cultivated tract of Taradehi and to the south and east of Tendukheda apart from areas with favourable conditions in Damoh, Singrampur and Sagoni ranges. The soil is not well drained and the proportion of clay is higher than required for favourable growth of teak. This leads to the growth of more miscellaneous species. A marked fact about the distribution of mixed forests is that it occupies the high proportion of the north-western plateau in Fatehpur (Hatta) range.

The good quality mixed forests are usually in the depressing valleys with deep and moist soils. Frosts are common in such localities in winter. The stocking is from 0.1 to 0.8 except in blanks. The most common species are saja, bija, dhaora, tendu, tinsa, jamun, bahera, mahua, teak, rohan, palas, khair and lendia. The undergrowth consists chiefly of ainthini, kodar, ail, and flemingia species.

The medium quality mixed forests is more common on soils of medium depth and on very gradual slopes, away from the nallah's. The stocking is from 0.6 to 0.8. An increase in the drier species is marked in the tree stock but the undergrowth also consists of ail, bharrati, jhilbili, karonda, and gangerua in addition to usual species.

The poor quality mixed forests with an average density from 0.4 to 0.6 are also common in the district on upper gentler slopes on shallow sandy soils. Teak is very poor in this type and xerophytic species increase in number. Salai, gunja, dudhi, papra, kari, lendia, bhirra, ghont, tendu, aonla and achar form the main



stock. Khair and kully are worth exploitation. Undergrowth and grasses are scanty. In certain localities one or more species predominate and based on this fact, several sub-types, except teak, may be recognised in this (poor) quality of forests.

## **TEAK FOREST**

Teak forests are recognised in areas with 20.0 per cent or more of teak in the tree crop. Teak grows well on the well-drained loam to sandy loam soil. Pure crops are restricted only to small areas. The forests are of varied quality. Other physical and natural environments and density of good, medium and poor quality grades, respectively. Forest in winter is quite common in low-lying localities.

The major teak forest belts are along the western and eastern boundaries and on the hills south of Tejgarh and south-west of Tendukheda upto the southern boundary. A fourth belt of teak forests lies along the northern boundary. Small patches of teak forests also lies on the hills of the southern plateau near Damoh, Hindoria and Gahera and near Hathidol on the north-western plateau. Of these the quality teak forests are near Panchamnagar and Mariadoh in Hatta range, near Ghatpiparia and Magra in Damoh range, near Gopalpur, Taradehi, Dudhia, Tindin, Pullar and some isolated patches of Tichai tract of Taradehi range and Bineri, Bansipura and Singorgarh in Singrampur range.

The most common species associated with teak in good quality forests are tinsa, rohan, seja, koha, dhaura, lendia, dhaman, harra, gular, mahua and tendu. Bamboos are mostly absent and lantana is found occasionally in south-western tracts. In the medium and poor quality forests the drier species like salai, gunja, achar, dhobin, semal,

kari, kullu, bhirra, etc. increase in proportion. The undergrowth and climbers are the same as in the corresponding quality types of mixed forest. Teak is predominant in favourable localities because it has greater power of resistance against fires and maltreatment.

### **GRASSY BLANKS**

Where the proportion of clay is high, soil stiff black and water-logged, the conditions are not very favourable for the development of tree species. The commonest species met with are occasional bushy saja, ber, palash and ficus species. The grasses in this type are very heavy and tall, and mostly barru and gunher are found. Frost occurs frequently on such blanks and destroys any tree species that try to struggle against the adverse ecological conditions. Examples of this sub-type are met with along the Lamti nala in the Fatehpur range, near Nagra in the Damoh range, along the Gaurajya river in the Tendukheda range, near Kharideori and Kaliakuhi in the Taradehi range and near Bhineniand Singorgarh Fort in the Singrampur range.

### **SALAI FORESTS**

Salai forests are found on dry shallow and stony soils. The density is fair occasionally reaching 0.7. Salai is often mixed with Gunia, aonla, dhobin and others. The height at times reaches 18 metres. This type is common near Brijpari and Salapari in the Fatehpur (Hatta) range, Piparia in the Damoh range and near Unjorikhera in the Taradehi range.

### **GHONT FORESTS**

Ghont usually occurs as an understorey in all medium and poor quality forests but at places tends to form pure crop throughout the district. The maximum height attained is about 6.1 to 7.6 metres.

## **KHAIR FORESTS**

On the drier fringes of all forest belts Khair is found in patches, at places forming pure crop. Soil in such places is very shallow and the ground undulating and rugged, being cut up by numerous nalas. The maximum height attained is nowhere more than 9 metres. Typical examples are met with near Dudhia in the Taradehi range and near Manakpura in the Fatehpur (Hatta) range.

## **BHIRRA FORESTS**

On dry and sandy soils Bhirra tends to grow pure and forms better stocking. Quality is never better than M.P. IV b and the fifth seldom exceeds 2½ typical examples of this type are met in the Tendukheda range.

## **VERY POOR QUALITY FORESTS AND BLANKS**

The density of very poor quality forests and blanks are always below 0.4 and at places absolute blanks are met with. Such forests are found on rocky out-crops precipitous slopes and uppermost flat plateau locally known as Bhatories where soil is very shallow or the underlying rock is exposed. A sizable area comes under this class. Species met with have a greater frequency of the xerophytic type. Ghont, ber, salai, lendia, kardhai, chichwa, bilsena, astoo, bhirra and kari are the main species. Undergrowth is mostly absent except for scanty ail and ainthni. Makore climbers are numerous. Thuar (Euphorbia) is found locally in thick patches. Grasses are very sparse and even rare; mostly bhusbhusi is met with. Sheet erosion is the commonest feature in this type of forest. Some good lac areas, however, come under this class. Very striking examples of this type are met with near Damoh and Tendukheda range.