CHAPTER II

REGIONAL SETTINGS
LOCATION:

As Maps 1 (A) and (B) show, Sagar-Damoh plateau, the region under study, belongs to the mid-north segment of Madhya Pradesh. Lying between 23°5' to 24°25' north and 78°15' to 79°35' east, it covers an area of 11,331.84 square kilometres. From the point of view of administration, the entire district of Damoh and three tahsilas of Sagar district—Sagar,Behli and Banda—are included in this region. There are 507 patwari circles in this region which have been treated as the basic unit of study. Seven districts adjoin this region: Lalitpur of Uttar Pradesh and Chattarpur of Madhya Pradesh in the north, Raisen and Narsinghpur in the south, Vidisha in the east and Jabalpur and Panna in the west.

PHYSIOGRAPHY:

Known as the Sagar-Damoh plateau in local parlance, the region under study really includes two clearly discernible landscapes. As Map 2 shows, the 450 m. contour line divides it into Sagar plateau and Damoh plateau. The former touches the north-eastern segment of the Malwa plateau while the latter is an extension of the north-eastern part of the Vindhyan range.

Leaving the geological details for the next section, it may be observed here that to the north of the Vindhyan lies a wide expanse of lava landscape overlying or covering a pre-Cretaceous surface. Its general elevation ranges between
500 m and 600 m above mean sea level. During the Tertiary Period, erosion appears to have succeeded in carving out an extensive surface over a pile of lava.\(^1\) Capped largely by the Deccan-trap lava, in places Vindhyan sandstone also crops out, particularly near and within Sagar town. This variety, noticeable in stone-types, seems to indicate that the trap was poured out on a very uneven surface belonging to the pre-Cretaceous era. The younger trap hills are invariably lower in elevation, probably due to a rapid weathering of basaltic lava. The resurrected sand-stone hills, in contrast, are higher, craggy and steep-sided, though these are often cusps-shaped.\(^2\)

The Damoh plateau, on the other hand, lies in the north-eastern part of the Vindhya-chaol and stretches parallel to the Narmada river. It rises abruptly from the Narmada valley, forming a line of steeply scarped hills. It reaches its highest elevation on the summit of these hills. From there onward, there is a gradual slope, generally towards north-east. The plateau is broken and crossed by the Sonar valley in this region, as also by a series of valleys lying between chains of hills further towards the north-east. In this way, the Sonar valley bifurcates the Damoh plateau into a large block in the south and a narrow belt in the north-west.

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2. Ibid.
The Sagar-Damoh plateau can be divided into these four distinct regions: (Map 3)

1. The Northern highlands;
2. The Western highlands;
3. The Southern highlands;
4. The Uplands;
   (a) The Sonar basin,
   (b) The Bansa basin, and
   (c) The Dhasan basin.

1. The Northern highlands;

The Northern highlands rise almost like a wall from the Sonar valley in the east. Locally known as the Barana hills, the central ridge (460 to 520 m) is marked by several flat-topped hills and runs from south-east to north-east. The Phurtal hill (525 m) is the highest point of this range. 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 covered with low forests designated as government reserves. The western part of the Northern highlands is also largely under government reserve forests. The Bila and the Dhasan rivers cross it from north to south.

2. The Western highlands:

The Western highlands run from west to south-east. The extreme western point of the Bina river valley, a segment of this highland, near Rahatgarh town is formed by a series
steeply rising hills, mostly wooded, from Pithora to Rahatgarh. These hills, all over 1750 ft. (533.40 m) above mean sea level, also serve as the water-shed between the tributary rills of the Nina and the Jhimpa rivers on one hand and the Dhasan on the other. Next come the upper waters of the Dhasan, the Beesa, the Sonar and its tributaries and the Bannar rivers.

3. The Southern highlands:

Lying at a general elevation of about 450 m, the Southern highlands are marked by the main line of hills or along its southern and south-eastern margins and more or less a continuous precipice overlooking the Narmada and the Niran valleys.

The Vindhyachal range rises to the north of the Narmada in the form of an escarpment or ridge, varying in character and height in accordance with the underlying rock structure. Overhanging the Narmada valley, this range runs for about 200 kms. Western half of the range, lying in the Sagar plateau, is composed of soft trap rocks which weather rather easily. This perhaps explains why no bold scarps could form in this section. The segment of the Vindhyan range which lies in the western part of Dammoh plateau is locally known as the Bhanrar range. It comes rather close to the Narmada near Pithora and then it runs almost straight north-eastwards as a bold scarp due to the alternation of hard sandstones and soft shales known for helping in the formation of true escarpments.
Another 16 km long secondary ridge has developed here. At its eastern foot flows the Hiram through a strike valley. A ridge-and-valley type of topography appears to be in formation here. This hill range continuation is called the Kaimur range. It has been described as the most pronounced scarp of India developed on sandstones and limestones\(^1\). It is nowhere breached by any sizable stream and is not even notched by any prominent wind-gap. The terraces below the scarp are carved out of quartzites and glauconites. The escarpment seems to owe its origin to a fault in the Harmada valley or to an upheaval of the whole stratum of the Vindhyan plateau into an almost vertical position. On the north-east of the Singapur gap, Khari (586.7 m) is the highest point of these hills. Elsewhere the elevation varies from 550 to 580 m.

The tableland slopes in a north-easterly direction towards north and north-east of the Bhanwar range and north-west of the Kaimur range. It appears to have originally extended beyond Panna in the north. With the formation of drainage lines and the consequent erosion the situation has changed. Now the Sonar and the Kopra valleys lie in a broad belt of low alluvial country separating the line of dissected hills on the south-east and the scarps of the north-eastern plateau. The plateau region has thus come to be demarcated from the north-eastern hill range.

\(^1\) The Gazetteer of India, pp. 43-4.
The Southern highlands also extend as a broad belt from south-west to north-east. Drained by the Breama, the plateau is interpersed by spurs and ridges, generally accepted as belonging to the Vindhyan range. The north-eastern limit of the southern plateau is marked by the hills of Patahpur (450 m), Safiria (479 m), Hindoria (about 457 m) and Jammia (triangulation point at 447 m) which appear to have been severed from the same ridge. The hills of Lodhiksha (463.6 m), Cubra (417 m) and Pateria (429.9 m) are offshoots of the Shunar range. These extend from south to north. The western slopes of the Salaiya plateau provide the district boundary. The hills to the north and west of Mala tank are grouped into the north-eastern hills. Locally, the hills near Hindoria are called Shondla range while those running from Mangarpur above the Sun valley, the Breama are called the Mangarpur range. In general, the Vindhyar range slopes gently northwards, conforming to the dip of the Vindhyar formations and that of the overlying trap rocks.

4. The Uplands:

The three uplands of the Sonar, the Bream and the Dhasan valleys stretch from south-west to north-east. The Dhasan valley is on the western side, the Bream in the middle and the Sonar on the eastern extremity. These three uplands are separated by narrow belts of highlands protruding from the Western highlands in a north-easterly direction.
To the west of the Dhasan valley lies the Pithora-Rahatgarh range while towards the east lies the Lidhora-Jaisingh Nagar range passing through Banda and Sagar. The Sonar valley forms a belt across the north-central part of the Banda district. Lying between the scarps of the southern and northern segments of the Vindhyas, it is some 80 km long from south-west to north-east and 32 to 40.3 km wide. The elevation of the Sonar upland is 335 m above mean sea level. It has got, relatively, a larger proportion of level agricultural land. The Bawas is really a tributary of the Sonar. The upland formed by it lies across the Western highlands. The river joins the Sonar after making a gorge in the Northern highlands and moving in a southerly direction. The Sonar valley is the broadest of these three valleys and also most fertile. The Dhasan and the Bawas valleys are narrow and the angle of the slope is rather acute. These two valleys are also fertile, covered as these are with black soil.

The water-sheds separating these three valleys are mostly wooded. Naharmau is the highest point in the whole region with an elevation of 3242 ft (983.4 m) while the average elevation happens to be a little over 2000 ft (609.6 m).

The Average Angle of Slopes:

The angle of slope is an important parameter in a hilly region. Various methods have been devised to determine average slope from a map. The one developed by C.K. Wentworth was found most suitable for the purpose in this region.1

Working with its help, it was discovered that the slopes in this region are generally not very steep. As Map 4 shows, the region can be divided into four segments from the point of view of the angle.

1. All the river valleys except those which belong to the Southern highlands—Gurani river and Guraiya nala—have an angle of only 0.5°.

2. The angle of slope is between 1° and 2° in the river valleys of the Southern highlands and in the valleys of Bila river and Barana nala of the Northern highlands.

3. Areas where the angle of slope is between 2° and 4° are found in the Western and Southern highlands.

4. The angle of over 4° is found only in patches in the high wooded hills of the three highlands comprising this region. Phurtal hill in the Northern highlands, Lidhore in the western tip of the Western highlands, the Tendu Dabar range in the southern tip and Sannar range in the south-western part of the same highlands, patches in the Fatehpur-Jamunia range, known also as Bhondila range, in the northern tip, Lodhikhet and Gubra hills in the southern tip and Nangarh range in the Sun valley above the Southern highlands deserve special mention.

**GEOLOGY**

Geology of an area is one of the significant determinants of the nature and character of its physiography, soil, vegetation, drainage and even, to some extent, climate. It is really one of those elements which determine the patterns of cultivability of the terrain.
The region under study comprises rock-types of different geological ages. While most of the Sagar plateau is covered with lava-flows, the Damoh plateau is dominated by pre-cambrian age formations except for a few patches which have rocks of later geological ages. (Map 5 A)

The litho-units represented in this region have the following stratigraphical sequence, according to the Indian geochronology, descending from the youngest towards the oldest.

<table>
<thead>
<tr>
<th>Age</th>
<th>Formation</th>
<th>Rock-types</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. (4000) Archaean</td>
<td>Bundelkhand Granites</td>
<td>Granitoids and acid igneous rocks with otechian reefs and ultrabasics at places</td>
</tr>
<tr>
<td>2. (1500) Upper Pre-cambrian</td>
<td>Bijawar Series</td>
<td>Metasediments with igneous rocks</td>
</tr>
<tr>
<td>3. (520 to 1500) Upper Pre-cambrian to lower Palaeozoic</td>
<td>Vindhyan System</td>
<td>Sediments and metasediments with igneous intrusions in lower parts</td>
</tr>
<tr>
<td>4. (110) Cretaceous</td>
<td>Lameta System</td>
<td>Calcareous and Argilaceous and rocks</td>
</tr>
<tr>
<td>5. (60,110) Cretaceous Rocence</td>
<td>Deccantrap Lavaflows</td>
<td>Basaltic flow and inter-trap sediments</td>
</tr>
<tr>
<td>6. (01) Recent</td>
<td>Alluvium</td>
<td>Alluvium of soils</td>
</tr>
</tbody>
</table>

(Figures in brackets denote the age of formations in approximate million years.)
SAGAR DAMOH PLATEAU

GEOLOGICAL MAP

ALLUVIUM
DECCAN
TRAP
LAMETA BEDS
UPPER VINDHYAN
HYAN
LOWER VINDHYAN
BIJAWAR SERIES
BUNDELKHAND GRANITE

SOILS

<table>
<thead>
<tr>
<th>MEDIUM BLACK</th>
</tr>
</thead>
<tbody>
<tr>
<td>SHALLOW BLACK</td>
</tr>
<tr>
<td>MIXED RED &amp; BLACK</td>
</tr>
<tr>
<td>DEEP BLACK</td>
</tr>
</tbody>
</table>

SOURCE: GEOLOGICAL MAP OF INDIA
SOURCE: ATLAS OF AGRICULTURAL RESOURCES OF INDIA
A study of this table reveals that rocks from the oldest to the youngest geological age can be found in this region. The distribution of rocks seems to suggest that there has been a chronological descent from north to south. The oldest rocks of Bundelkhand granite are found in the northern part of the region while, as we move southwards, rocks from successively younger geological ages are found. In the following pages a brief description of various geological formations has been given in order of relative antiquity.

Bundelkhand Granites and Gneissae:

Bundelkhand granite is among the oldest rock formations of this country. It outcrops in a small area of the Dhasan upland where it is restricted to the north-eastern segment comprising the Shahgahr area of the region.

Bundelkhand granite and gneissae in this region are represented by granitoid rocks. They are medium to coarse grained, ordinarily massive, non-foliated or weakly-foliated. These are quite resistant to erosion and have consequently managed to form long narrow steep walls producing a peculiar topographic feature. These have dammed the drainage courses at several places to give birth to small lakes.

The southern boundary of Bundelkhand granites is supposed to be among the oldest shorelines in India on the margin of which were laid Bijawara and Barrie (the lower Vindhyans).
Bijawar Formations:

A very small horse-shoe shaped outcrop in the north-eastern part of Sagar district belongs to the Bijawar group. It lies on the eroded surface of the Bundelkhand granites. The total thickness of the formations is approximately 800 ft. The bottom-rock in most cases is quartzite on the eastern side and hornstone breccia on the western side. Quartzite is mixed at places with pebbles of white quartz. The hornstone breccia is compact and is made up of brown or red quartz of angular nature. The quartzite overlies the basic traps in the eastern part and continues westward. Extensive dolomitic limestone is also present and is called Sajna dolomite. This dolomite has got various stromatolitic structures. An iron-rich group of iron-mixed ferruginous shale and conglomerate, chart breccia and sandstone overlies the quartzite in the eastern part while Sajna dolomite does the same in the west. The Bijawar beds show a general east-north-east to west-south-west trend and a southerly dip of 10°–25°. Open broad folds and some minor faults are present.

On their westward extension, the Bijawars abrupt against the lower Vindhyan formations (Semri-series) which rest unconformably on the Bundelkhand granites. On the southern side too they are followed by the beds of the Semri series.

Vindhyan System:

As is evident from the table, the Archaens are the oldest rocks in this region. The Bijawars rest on these
rocks unconformably. The Vindhyan similarly overlie the Bijawars.

The Vindhyan have been divided by the geologists into Lower Vindhyan and Upper Vindhyan. The Senri series form the Lower Vindhyan. Only sandstones and shales make up the Senri series in the region under study. The Upper Vindhyan, comprising the Kaimur series, the Rewah series and the Shander series, consist largely of sandstones forming extensive plateau and scarpes. The total thickness of the Vindhyan sediment is some 4300 metres. On top of the Vindhyan rocks are lameta beds on the Deccan trap or at places the recent alluvial deposits.

Lower Vindhyan:

The Senri series, which represents the Lower Vindhyan in this region, consists of the Dulchopore conglomerate sandstones and porcellanite beds. Composed of fragments of white veinquarts and quartzite embedded in a silicone matrix the Dulchopore conglomerate lies unconformably on top of the Bijawar quartzites. The Senri sandstones are coarse-grained, gritty and thinly laminated. Current bedding shows prominently in them. The Sandstones are white to pinkish in colour and at places contain intercalation of shale. The porcellanite beds consist of silicified shales which are generally black or black-green. The beds are either horizontal or gently dipping.
Upper Vindhyan:

The Kaimur series, the Rewah series and the Bhander series jointly comprise the Upper Vindhyan in this region. The Kaimur conglomerate marks the unconformable junction between the Lower and the Upper Vindhyan. It consists of pebbles of banded jasper, grey and white cherts. The Kaimur sandstone is generally pinkish in colour, fine grained and quartzite. The beds here also are horizontal or gently dipping. The Kaimur series is found in the northern parts of Sagar district and consists of conglomerate at the base and sandstone at the top.

The Rewah series is exposed in the northern and eastern parts of the Sagar district and in the southern broad plateau of the Damoh district. It consists largely of the Upper Rewah sandstone and the Lower Rewah shale. The former is more commonly found. It is a fine-grained, hard, compact, quartzite, vitreous sandstone, reddish brown in colour and at places also white, red, pinkish or grey. Though thinly laminated varieties are not absent, it is largely massive. Coming to the shales, the Jhiri shales are soft, less regularly bedded and mixed with numerous layers of soft, earthy sandstone. The Ganurgarn shales, on the other hand, are impregnated with stringers of calcite and are purplish red or brick coloured. Varieties containing ferruginous (haematitic) nodules are also present here and there. The beds are mostly horizontal or show gentle and rolling dips. Current bedding and ripple marks are often found in these sandstones.
Upper Bhander sandstone and Sirbu shales, lower

Bhander sandstone, Bhander limestone and Ganurgarth shale comprise the Bhander series. It is exposed mainly in the middle of the eastern south of this region, though there are few exposures in the northern and eastern parts of the region also. The Ganurgarth shales are brick-red in colour and are calcareous with stringers of calcite. They are often ferruginous and show gentle dips. The Bhander limestone is hard, massive and bluish grey in colour. Dark grey, pinkish and cream-coloured varieties are also found. The limestone is of variable quality. It is either pure or silicious or magnesium and is intercalated with thin bedded sandstones, shales and quartzites. The beds are horizontal or gently dipping. The lower Bhander sandstone is thin bedded, fine to medium grained, brownish or reddish-brown in colour with whitish or brown spots. At places it is massive.

The Lameta Beds:

These are considerably younger than the Vindhyans and also differ from the latter in regard to the fossil content. They are extensively developed along the eastern fringe of the Deccan Trap flows. They seem to bisect the Sagar-Damoh plateau in the middle and occur as discontinuous outcrops in the Sagar district. They also occur as scattered rare outcrops in the Damoh district. These sedimentary rocks consist of sandstones and clays of fresh water origin and of limestone which often contain bands and nodules of chert.
Daccaan Traps

It consists of ten or more horizontal flows of light grey and dark grey basalt, composed chiefly of augite, intermediate plagioclase felspar, magnetite, ilmenite and glassy material which is partly chlorophyllus. Fresh olivine is rather rare. It is fine to coarse-grained and shows column-jointing at places. The Traps either with spheroidal exfoli-ations which often produce large rounded boulders of the outcrops. Glassy vesicular, scoriaceous and amygdaloidal varieties are also found. The amygdales are filled with agate, chaledony, quartz, calcite and zeolites, the commonest of the latter being stilbite, chabazite, apophyllite and heulandite. There are no dykes in this region. The source of the flows is uncertain though they appear to have come from the south. Some of the flows can be traced for more than 60 miles (96.56 kms) and they show no sign of thinning out.

Daccaan Traps are the basaltic lava flows which cased out of several fissures developed in the central peninsular India during the Cretaceous-Tertiary period. Three-fourths of the Sagar segment of the region under study is overlaid by these Traps. Extensively developed in the eastern parts of the Sagar district, they occur as outliers in the western parts. Daccaan Traps are present in the Daman district also, but these are not extensively developed.

The Traps are composed of sub-horizontal to horizontal basaltic lava flows. Their thickness near Sagar is almost 15 metres on an average. Often there are inter-trappean
horizons of sedimentary rocks between the flows.

Petrologically, the flows are basaltic or doloritic in nature and are medium to fine grained perphyritic or non-perphyritic. The flows are mostly olivine-free tholeiite or plagioclase basalts. Small amount of glass might have been present which is now found in the form of phlogopite and chlorophaseite.

The characteristic Sagar-Damoh landscape — flat-topped plains and conical hills — are really the consequences of the plateau basalt. Formation of conical hills can be explained by the process of lateral erosion. However, after certain changes the flows have given rise to fertile black cotton soil (Jagg) which is responsible for good agricultural development of the eastern part of the Sagar district and the southern-central part of the Damoh district.

Inter-trappean Beds:

These are found mostly near Sagar between the flows. These consist of pure and silicious limestones, clays and clays. At places they contain fossil shells, especially the clams. The most commonly found species are Physa, Paludina, Turbo, and Unio, while fossil wood, mostly palms, is also found.

Several local lakes were formed in the period intervening two flows in which lacustrine and fluviatile sediments came to be deposited. These sediments are known as inter-trappean, between two consecutive flows as these are. They
contain poorly preserved fossils of animals and plants which help in the determination of the age of Deccan Trap. Composed of chert, impure limestone and pyroclastic material, these are common in the trappcan country of the region.

Alluvium and Laterite:

Alluvium is found in the eastern fringes of the Sagar district and in the big river valleys. These conceal various older rocks. In the Ranchi district it is found in the Sonar valley and also the valleys which intersect the Vindhyan hills to the south.

Alluvial deposits, the most recent geological development, provide the top soil in many parts of the region. While the older alluvium found in the northern segment belongs to Ganga alluvium, that found in the southern segment belongs to Narmada alluvium. It appears to contain more than one horizon of gravel sand, sandy clay and clay. The deep soil covering large tracts extending north-east to south-east, from east of Sagar to beyond Panna district, largely represents altered shale and limestone formations of the Shander group.

Laterite is found capping the Deccan Trap and the Vindhyan sandstones and shales which are ferruginous. But it is primarily found within the trappcan terrain, on the summits of hills, about 1900 feet (579.12 metres). The most prominent outcrop forms the summit of Tinsmal, 25 miles (40.23 kms) from Sagar along the Shahyarn road. It shows pisolithic and vermicular
structure. At places it is aluminous (bauxitic) and is light
coloured. Some of the ferruginous laterites were smelted for
iron on a very small scale in bygone days.

Economic Minerals:

The region under study is not particularly rich in
mineral wealth though it is not altogether absent. Thus,
meagre quantity of copper-ore has been reportedly found at
Mirapur in Sagar district. Chances of discovery of diamonds
have not been ruled out though, once again, these are found
in economically feasible quantities only in neighbouring Panna.

Building stones and road metal are, however, found
abundantly in this region. The sandstones and limestones of
the Vaisal, the Rewah and the Shander series furnish excellent
building material. These rocks are found all over the region.
The traps are worked for building stone, road metal and railway
ballast where these are fresh and free from vesicules. Large
deposits of high grade (Shander) limestones occur in an area
24 kms long and 3 to 5 kms wide. The thickness of the individ-
dual beds is 3 to 6 metres and the limestones contain 46 to 55
per cent calcium oxide and are non-magnesian. The occurrence
of thin-bedded Vinghyan limestones has been recorded in the
Sonar valley near Hatta which may turn out to be sufficiently
compact for lithographic purposes.

There are some ferruginous laterite and haematite
bodies, particularly in the Bijawar series. These were smelted
for pig-iron locally for some time now. However, they are
neither rich enough nor are they found in a large enough quantity to support a modern iron industry. Traces of nickel have been reported from the vicinity of Jharsa in Sagar district. Finally, minor occurrence of pyrite has been reported at Bharat Pahar near Jama Shankar in Sagar district.

In conclusion, it may be observed that the edaphic and topographic base of this region mainly stems from the Vindhyan and Deccan Trap rocks which outcrop over a greater part of the region. These have been responsible for the development of a characteristic Vindhyan and Trap landscape which has in its turn influenced many aspects of the agricultural geography of this part of the country.

SOILS:

Like climate, soil also plays a decisive role in determining the living standard in a dominantly agricultural region. The 15 to 20 cm thick top-soil and its physical-chemical-biological character, in the final analysis, make or unmake the economy of a given settlement. What plants and crops can be grown and which cattle can be reared in a given region depends as much on the nature of soil as on any other factor. (Map 5 B)

No systematic study has been made so far to establish different soil-types in Madhya Pradesh. The heterogeneity of the surface rocks and varying degree of slopes covered with a bewildering variety of flora and fauna make it difficult for
anyone to classify soils with any degree of accuracy. Nevertheless, some attempts have been made which deserve attention. Details have been given by Raychaudhuri et al in the 1963 ICAR publication Soils of India, in the concerned District Gazettes and in settlement reports.

Traditional Soil Classification:

Almost the whole of Sagar-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.

Medium Black Soil:

As noted above, this type of soil covers the bulk of Sagar-Damoh plateau. However, the characteristics of the soil differ considerably from one place to another in this region, depending mostly on the local topography and the underlying rocks. It is dark brown in colour with patches of red and light brown here and there. It is 3 to 1.5 metres in depth. It has 20 to 60 per cent clay and is good for almost all kinds of crops grown in this region.

Skeletal Soil:

Evolved over millions of years from conglomerate quartzite sandstone and shales, this type of soil covers the stony uplands of the Vindhyan range. It is generally poor in soil nutrients. Crops like millets and oil-seeds alone can
be grown on it. These uplands are poor in fertility, though some patches of good black soil are also found on them which are good for crops like rice and wheat. Among such patches, soil types locally known as 'nataura-IX' and 'nataura' are chiefly used as pasture lands on the eastern side of the plateau. A silt soil and 'nataura' abound in the hilly tracts.

Table I : 1

Analytical Table of the Soils Found in This Region

<table>
<thead>
<tr>
<th>Soil Type</th>
<th>Parent Material</th>
<th>Colour</th>
<th>Texture Clay</th>
<th>pH</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Medium Black</td>
<td>Plagio-classes olivine and other ferro-magnesian material</td>
<td>Dark brown to dark grey</td>
<td>35% to 55%</td>
<td>6.3-7.3</td>
</tr>
<tr>
<td>2. Skeletal Conglomerate quartzite sandstone and shales</td>
<td></td>
<td>Gravelly shallow</td>
<td></td>
<td>poor</td>
</tr>
</tbody>
</table>

Revenue Classification:

The traditional classification described above is rather generalised and therefore does not go far as a help for correlating soil and agriculture in a given area. The revenue classification of soils gives a better idea of soil fertility although preparing a map on its basis would be difficult.

All the local soil-types have been grouped in three categories:

1. Good medium black soil group,
2. Inferior medium black soil group, and
3. Hilly, stony and sandy soil group.

This classification is based on the one used by
the cultivators.

Good Medium Black Soil Group:

In this group may be included Mar, Habar I and II
and Mund I and II.

Mar:

It is a clayey soil of first-rate fertility found
in level areas. It is grey black in colour and is of great
depth. It retains too much moisture, does not easily crack
and can be ploughed only a long time after the rains. If the
winter rainfall is copious, wheat crop on Mar soil tends to
suffer from rust.

This soil is uncommon in this area. It is found
in the Western highlands, in the Pankhari and Sagar groups
of Sagar tahsil and in the Bansa upland. It is very rarely
met with in the Banda and Rehli tahsils.

Habar:

This is a first-rate black cotton soil. It differs
from Marx and Mund in being composed of smaller particles and
is consequently more sticky when wet and harder when dry.
It is a highly productive soil. It has been further sub-
divided into Habar I and Habar II. It is of very close and
even texture containing no pebbles. The clay percentage in the soil is 50 to 60, which is the highest in the black soil group. Due to this high percentage of clay, kabor is rather plastic and cloddy. The moisture-retaining capacity of this soil is so high that it bears a good crop of wheat or hirra (wheat-gram mixture) even in years of deficient rainfall without irrigation. Due to their sticky nature, the kabor soils tend to get water-logged in year of heavy rainfall. Kabor II is relatively coarser in texture, is less moisture-retaining and is lighter in colour. It also contains black nodules known as kala kankan.

Kabor soils are mostly found in the Western highlands, in the Sonar valley, in the Bahli and Gurjhar group and in the Balesh group in the Kopra valley. It is plentiful in Batiangri in the Sonar upland.

Mundi:

Mundi is the most common soil in the alluvial valleys. It is inferior to both mar and kabor, comparatively lighter in colour and is also less deep. The percentage of clay is 35 to 50. The soil also contains limestone nodules known as safed kankan. Like kabor, mundi is also sub-divided into two classes. Mund I is darker in colour and contains no other type of gravel except safed kankan. Mund contains a larger proportion of sand and gravel. The former is the typical wheat soil. When well cultivated it can grow wheat continuously without manure or resorting to rotation. However, scanty the rainfall, this fine soil seems capable of producing
a fair crop. However, in low-lying areas it tends to promote rust more than the lighter soils.

In the Western highlands, this type of soil is found in the Bina valley, in the Juilla group, in the Dhasan upland (Sihora and Marisoli group) and in the Dhana group of the Barma upland. In the Sonar valley, it is found in the Garhakota group. It grows steadily poorer as the junction of the Sonar and the Barma comes nearer in the Sonar upland.

Inferior Black Soil Group:

Rathia, rayian and nataura soils belong to this group.

**Rathia:**

It is an inferior kind of light coloured *lalbar*. Brown in colour, it contains pebbles and grit and forms into hard clod when dry. On the whole, it is a difficult soil to handle and ploughing becomes very difficult if there is any delay.

Largest concentrations of this soil are found in the Western highlands and on the Dhasan upland near the Sihora and Marisoli group. In the Southern highlands, it abounds in the Barma valley.

**Rayian:**

Rayian is a black soil generally containing a some black stones. It is distinguishable from *mug* lalbar and *mudi* due to its shallowness. It dries up rapidly and requires good
rains at sowing time. On the other hand, it is well drained
and grows kharif even in years of excessive rainfall. It is
found in the vicinity of hills and rock underlies the soil at
a small depth. Wide and deep cracks are formed when it dries.
It carries both autumn and spring crops, but wheat sown on it
requires winter rains.

It is chiefly found in the Western highlands, on
the Beas upland, in the Dhana and Jaisinagar groups and in
the Sonar valley near Mahamau group.

Pataura:

Pataura or thin soil is an inferior type of mud,
the best layers of which have been washed away by drainage.
It is generally found on uneven ground. Pataura too has
been sub-divided into I and II, depending on the extent of
admixture of black soil. It is the most common soil and is
found in the villages of hilly tract. Good pataura can grow
wheat in favourable seasons, but it is mainly devoted to
inferior crops. Another variety of pataura is light-coloured
sandy soil, suitable for rice-cultivation, which is found
near the Vindhyan hills.

In the Northern highlands it is found in the Binaika
and Shahgarh groups and on the Barana Hills. In the Western
highland the largest tracts of this soil are found in the
Rehli group in the Sonar basin and in the Dhana group in the
Beas upland. It is also found on the slopes of Vindhyan range
in the Southern highlands.
Hilly, Stony and Sandy Soil Group:

_Bhutan, Sihar and Jachhar_ are included in this group.

**Bhutan:**

_Bhutan_ is the red, stony soil covered with cobble stones. The soil is rather poor and needs being left fallow for longer periods. It can grow only inferior autumn crops like millets and oilseeds, _jodo-bhatki_ and _til_ in particular.

It is found in the Northern highlands and in the southern parts of the Western highlands. In the Southern highlands it is found in the patwari circles of the hilly tract.

**Sihar:**

This is a yellowish sandy soil with a clay percentage of 20 to 30. It is free from stones and is considered to be one of the best soils for rice cultivation. It is really the soft, fine wash off from the Vindhyan sandstone hills.

_Sihar_ is found on the Northern highlands, far from the hill slopes, in the Hatta tahsil. In the Southern highlands it is found on the banks of Barma.

**Jachhar:**

It is the alluvial soil found in narrow strips along the rivers in which Kathis and Dhimars grow vegetables.
Fertility Status of the Soil:

Though there have been state-level surface sample analysis under the fertilizer trial scheme, only a few reports are available for the region under study. The table below, based on data available with the Regional Soil Testing Laboratory, Jabalpur, gives the fertility level of the soil in terms of the three essential plant nutrients, nitrogen, phosphorus and potassium.

Table 1

Initial Soil Fertility Status of Cultivator's Fields in Sagar District

<table>
<thead>
<tr>
<th>Block/Name, Centre</th>
<th>Zone</th>
<th>No. of trials/Depth pH soil samples analysed</th>
<th>E.C. cm</th>
<th>Available Nutrients in kg/ha</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>N</td>
<td>P</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>0.15</td>
<td>7.9</td>
</tr>
<tr>
<td>Type 'A' Trials Kharif 1977-78</td>
<td></td>
<td></td>
<td>0.61</td>
<td>243</td>
</tr>
<tr>
<td>Sagar</td>
<td>1</td>
<td></td>
<td>0.15</td>
<td>7.4-7.9</td>
</tr>
<tr>
<td>Banda</td>
<td>3</td>
<td></td>
<td>1.02</td>
<td>343</td>
</tr>
<tr>
<td>Shahgah</td>
<td>3</td>
<td></td>
<td>1.07</td>
<td>365</td>
</tr>
<tr>
<td>Gahakota</td>
<td>4</td>
<td></td>
<td>0.97</td>
<td>341</td>
</tr>
<tr>
<td></td>
<td>5</td>
<td></td>
<td>0.72</td>
<td>275</td>
</tr>
<tr>
<td></td>
<td>10</td>
<td></td>
<td>0.75</td>
<td>281</td>
</tr>
<tr>
<td>Type 'A' Trials Rabi 1977-78</td>
<td></td>
<td></td>
<td>1.03</td>
<td>345</td>
</tr>
<tr>
<td>Sagar</td>
<td>1</td>
<td></td>
<td>0.15</td>
<td>7.7</td>
</tr>
<tr>
<td>Banda</td>
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<td></td>
<td>1.07</td>
<td>365</td>
</tr>
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<td>Gahakota</td>
<td>4</td>
<td></td>
<td>0.75</td>
<td>281</td>
</tr>
</tbody>
</table>
The analytical data given earlier show that almost all the soil-types in this region are clayey-loamy. Percentages of clay vary from 36.4 to 43.10. Except in one soil-type, locally known as patila, which contains 55.3 per cent silt, other soils contain silt only moderately, from 31.7 per cent to 46 per cent. Loss on ignition is fairly high—between 4.6 and 7.8 per cent—showing roughly the organic matter content. Chemical analysis has been carried out on only one sample of mud soil. It shows that P₄O₅ is only 0.04 per cent, nitrogen 0.04 per cent and potash 6.64 per cent.

Soil fertility level found in the Sagar-Damoh plateau, in brief, is as follows:

Sagar plateau: Medium in nitrogen and potassium and low in available phosphorus.
Damoh plateau: Low in nitrogen and available phosphorus and medium in potassium.

It may be noted that, according to the experts, the soil of this region is likely to respond favourably to the application of nitrogen and phosphorus and an addition of a small dose of potash.

Soils and Crops:

Crop patterns and crop differential are largely dependent on the soil of that area with homogeneous conditions of topography and climate. Relationship between soils and crops are pronounced in this region. There are some specific points which establish this relationship.
1. Khabar soil in Rehli tahsil is equally good for rabi and kharif. After bhirra the fine crop of rice is grown here.

2. Mund is the most commonly found soil in this region. It is on this type of soil that the rabi crops are successfully grown. Examples can be seen in the Dhasan upland, the Bemra upland and the Sonar upland.

3. Ratinia is also found in the Dhasan upland and in the Bemra valley. It is suitable for growing wheat.

4. Ratan is found mostly on the hill slopes. If adequate irrigation could be provided, both rabi and kharif can be grown on it.

5. Sihar is good mainly for rice growing. The Northern and the Southern highlands produce the bulk of rice in this region.

6. The inferior soil, huta, which is good only for autumn millet crops, can be seen on the slopes in the Rehli and Banda tahsils. These areas produce good crops of kodo-little and til.

7. Finally, patauma scarcely produces any wheat or rice. Gram, jowar mixed with pulses or sesame may, however, be grown on it.

These soil-crop linkages are not statistically proved, these being so many exceptions. The general trend of crop pattern and soil description of the area, however, indicates this kind of relationship.
Soil Erosion and Conservation

Soil erosion is widespread throughout this region, as also elsewhere in the state and the country. The problem in this region called for urgent measures as long ago as the 1897 Settlement Report of Sagar district. Areas marked by high relief and steep slopes covered by a thin layer of soil easily fall a prey to erosion. Loss of arable land due to erosion is now causing concern. It is reported that, since only raah crop is grown on black cotton soil, leaving the field fallow during the rainy season, rains erode most of the soil. According to one estimate, as much as 52 tons per acre of top soil is washed away in a single storm of normal intensity. There are several heavy downpours during the monsoons, and one can imagine the loss they cause. On top of it, overpasturing with goats and large-scale deforestation have also hastened the process. Some acceleration of erosion is noticeable wherever cultivation has been extended to hill slopes. Sagar district has a large cattle population. Uncontrolled and excessive grazing — usually confined to easily accessible locations — has also adversely affected the situation. Growth of small trees, naturally grown or planted according to plan, gets stunted wherever goats have a free run of the place.

The following five types of erosion are found in this region:

1. Sheet wash erosion,
2. Ditch or finger erosion.
4. Gully erosion, and
5. Road side erosion.

Sheet erosion has been slight, moderate and severe in different places, depending upon the topography. The first type is noticeable in cultivated areas, the second all over the uncultivated lands and the third on the extreme slopes. Road side erosion can be seen on all the road sides in the region. The prevalent method of digging square pits indiscriminately for obtaining earth for the purpose of filling is decidedly harmful for the terrain.

It is gratifying to note that this region has been affected by erosion in a lesser degree than the state as a whole. Intensity of soil erosion in this region can be divided into high, medium and low. High intensity rate is found in the extreme southern parts of the Rehli tahsil of the Sagar district and the Bhaner range of the Damoh district, amidst the catchment area of the Baima. Medium erosion is noticeable in the vicinities of the river systems of Bhasan, Sonar, Bemas, Baima, Nopra and others. Low intensity of erosion is confined to the north-west parts of Sagar and eastern parts of Damoh district.

CLIMATE:

Climate is among the major factors governing the regional diversification of agriculture on the Sagar-Damoh Plateau. Tropical climate dominates this entire region, lying
just to the north of the Tropic of Cancer as it does. It has fairly hot summers and cold winters while the rainfall follows the monsoon pattern. The year falls in three characteristic seasons: the cold season, lasting from October to February, the hot season lasting from March to June and the rainy season for the remaining period.

Temperature:

The temperature data available from the Sagar-based observatory for Sagar town appear to hold good for the entire region but for some minor local variations due to changes in height above sea level, vegetation, water bodies etc. January is the coldest month of the year with an average monthly temperature of 17.4° C. In May the average monthly temperature rises to 33.29° C which is the maximum for this region. The maximum temperature during January, on the other hand, goes up to 24.3° C during the daytime while the minimum temperature during the nocturnal hours comes down to 10.5° C — a variation of 13.8° C. It would be interesting to note the temperature figures for the adjoining areas. The mean temperature of the coldest month of January in Chhatarpur, to the north of the region under study, is 13.35° C while the corresponding figure for Satna (Dist Panna) in the east is 16.54° C. In the southeast of the Sagar-Damoh Plateau is situated Jabalpur which has a mean monthly temperature of 17.95° C during January while that in Narainshapur, south of this a region, is 16.36° C. These figures show that the January temperature all over this large tract is more or less the same. It starts rising from the
month of February, gradually reaching its peak in the month of May. Maximum mean temperature during May goes up to as much as $40.35^\circ C$ while the minimum recorded is $26.0^\circ C$, thus yielding an average of $33.29^\circ C$. As far as the maximum and minimum temperatures during the winters are concerned, these have been recorded as $26.6^\circ C$ in January and $9.5^\circ C$ in December. The mean daily variation generally correspond to the monthly average. The minimum temperature has been known to fall even further in exceptional circumstances of a cold wave resulting from western disturbances moving northeastward across north India.\(^1\)

Both the day and night temperature rise progressively from January to May. However, the rate of rise of the night-temperature tends to decelerate. The onset of monsoon and accumulation of clouds by the mid-June brings down both day and night temperatures 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 ($14.0^\circ C$) during the month of April owing largely to the low percentage of 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 $6.0^\circ C$.

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1. Based on figures provided by the Land Records Office, Gwalior.
Seasonal Distribution of Rainfall:

The annual and monsoonal rainfall maps of this region appear to coincide ([map 6]). Basing oneself on the figures pertaining to the years 1952-1977, one notices that the monsoonal rainfall contributed as much as 92.23 per cent of the total. Retreating monsoon from October to January hardly contributes anything. However, the depressions responsible for the winter rainfall in Punjab also bring some rain to this region, though it is meagre (only around 5.34 per cent of the total).

Humidity and Cloudiness:

Seasonal variation in humidity and cloudiness are only to be expected when the rainfall is essentially seasonal in nature. Relative humidity is at its maximum during the rainy months of July, August and September. It goes up to 80 to 90 per cent while cloudiness reaches the figure of 7 to 9 tenths of the sky. Clouds begin to accumulate in the sky with the south-westerly and westerly winds in the late summer months. Heavily clouded and/or overcast sky is a regular feature during the monsoon months. For the rest of the year it is either wholly clear or only lightly clouded.

Depending on the data provided by the Sagar observatory, one could say that the percentage of humidity varies from hour to hour and from month to month. It is noticeably higher in the morning all round the year. The difference between the morning and evening percentages is the lowest in the month of July and highest in December. The summer time
is the driest when relative humidity falls to as low as 10 to 13 percent. It falls below 50 per cent soon after the withdrawal of monsoon by the end of September and the beginning of October and remains in the range of 20 to 40 per cent during the winter months, especially in the afternoons.

Wind:

Movement of winds, as is well-known, is from high atmospheric pressure to low atmospheric pressure. In addition to local and temporary variations, a low pressure belt generally spreads over the entire north Indian plain in the summer months. An even weaker low pressure area forms over the ocean in the South during the winter months.

During the monsoon months, the winds blow mainly from the South-east to North-east. Winds from some other directions also set in during October and during November winds blow from all directions. This happens chiefly because of the shifting of the low and high pressure belts and consequent retreat of westerly monsoon and the advent of the north-easterly trade winds. While the wind-direction during the winters is north to south-east, south-westerlies and westerlies are common during the summer months.

Sagar is probably more windy and even gusty than the adjoining meteorological areas. The number of calm days is small. The wind-speed is high throughout the year. It is somewhat less in the post-monsoon and early winter months than during other months. The lowest mean wind speed is 11.1 km
per hour during November while the highest mean wind speed
gets to 20.8 km per hour in the month of July.

Seasons:

As noted earlier, the region experiences three
distinct seasons over the year. Winter (October to February),
Summers (March to June) and the Rainy Season (July through
September).

Winters: An abrupt drop of temperature from 24.38° C
of early and mid-October to 21.22° C of late October and early
November announces the arrival of winters in this region.
Climate usually remains cold any dry. Morning winds are
light and mainly easterly or northeasterly. Afternoon winds,
in contract, steer between south-east and north-west through
west.

As observed while discussing the temperature-patterns,
January, with a mean temperature of only 17.4° C, is the coldest
month in this area. By February the day temperature rises to
register a maximum mean of 28° C though the minimum daily mean
remains 13.73° C. This range of temperature is explained by
cool nights. Winter rains in this region are far from copious,
leaving it largely dry.

Summers: By March, the first of four summer months, day tempe-
rature records a sharp rise of nearly 5° C over the daily
mean of the preceding month. Nights, however, remain somewhat
cool, making for a marked difference between maximum and minimum
daily temperature. Heating of the air goes on in a gradual
manner till May, in which month the temperature reaches its
annual maximum.

This region experiences local rains only rarely.
Otherwise the weather remains one long dry spell, with very
low humidity. A hail-storm or a convective instability may
occur once or twice in March or April, however. Yet, rainfall
is nearly negligible during these months.

Fall of pressure on the summer-parceled land occasio-
notification causes dust-storms. As a steady monsoon current does
not get set-up before the end of June, wind behaves erratically
during these months.

Rainy Season: The bursting of the monsoons in the end of
June or the beginning of July augurs the arrival of the rainy
season. Months of July and August are the peak monsoon months
in this area. In September the retreat of monsoon begins and
the amount of rainfall sharply declines.

With the onset of rains the temperature registers
a noticeable decline due to the cooling of air-currents. The
general decline of the mean monthly temperature persists up
to late August. In September it again shows an upward trend,
the decrease in cloudiness being the main reason.

During the rainy months the wind blows steadily with
a south-westerly and westerly component, slowly becoming variable
in the month of October which is almost a transitional month.
Rainfall Variability:

The Rainfall conditions appear to determine the agricultural production in most parts of the country. With its meagre irrigation facilities and other impediments to good harvests, the Sagar-Damoh Plateau is among those regions which are even more dependent on Nature's bounty. Study of rainfall variability is a definite help in planning and forecasting of agricultural operations and produce.

Several methods have been suggested, and are in use, for calculating the percent variability of rainfall. Among these, those devised by Williamson and Clark, Bied and Grazzi deserve special mention. The standard deviation method developed by Naqvi and the median method of Crowe and others have also been found useful.

2. Quoted by Williamson and Clark, On Cit.
Rainfall figures for some twenty five years (1952 to 1977) have been used in the present work for the study of rainfall variability of this region. The median method, now in extensive use, has been employed here. For this purpose, all the yearly rainfall figures from a particular rain-gauge station have been arranged in a descending order. The median figure and the upper and lower quartiles have been marked and the percent variability has been expressed as:

\[
\text{Percent Variability} = \frac{(Q_3 - Q_1)^2}{M} \times 100
\]

where \( Q_3 \) : upper quartile; \( Q_1 \) : lower quartile;
\((Q_3 - Q_1)/2 \) : quartile deviation and
\( M \) : median.

On the basis of this method, the following points emerge regarding the rainfall variability in this region. Of the five tahsils covered by this survey, only the Damoh tahsil of Damoh district has less than 20% variability, taking tahsil as one unit. Sagar tahsil has 23.13%, Banda has 21.39%, Rehli has 20.13% and Hatta tahsil of Damoh district has 21.59%. The southern and south-eastern part of the Sagar-Damoh Plateau has generally low variability quotient, the lowest being at Deori, (only 13.49%). No wonder the agricultural forecasting is so difficult in this region.

Another peculiar feature is the unevenness of the general pattern of rainfall variability. Thus, there are places like Sagar and Banda where rainfall is normally heavy and yet the variability is also high. Sagar with an average annual
rainfall of 139.60 cms has a variability of 23.12% while Banda with an average of 119.21 cms has a variability of 21.39%. In sharp contrast, Damoh and Deori rain-gauge stations report a heavy rainfall with low variability rate. Damoh's annual average totals up to 148 cms yet variability is only 15.16% while Deori receives 105.64 cms annually on an average and has the lowest variability quotient of the region. This is not all. Garhakota and Jabara record less rain as compared to other parts of this area and yet have a low variability. Natta alone has low rainfall (92.70 cms) with high variability (21.59%).

Seasonwise, the lowest variability is during the monsoon months (1.18%). During the winters it goes up to 23.10% while in summers it again comes down to 9.78%.

In sum, rainfall variability is of four distinct kinds in this region. Heavy rainfall with high variability, heavy rainfall with low variability, not-so-heavy rainfall with high variability and not-so-heavy rainfall with low variability. It is indeed surprising that these four categories are found in a relatively small area of 11,331.84 square kilometres.

Special Weather Phenomena:

Heavy rains and strong winds are brought about in this region by depressions forming over the Bay of Bengal, particularly during the monsoon months. Post-monsoon storms and depressions during October are also not uncommon. In fact, thunderstorms occur more or less throughout the year, though these are more frequent during the summers and the rainy season. Thunderstorms of the winter and also some of those of pre-monsoon months are accompanied by hail. Fog too is not infrequent during winter months.
Climate and Agriculture:

As observed earlier, climate has a decisive influence on the agriculture of any region. Temperature differences greatly influence the crop selection, especially during the Rabi season. Rainfall is even more of a pre-determining factor. It decides not only the fate of the cultivator but also the pattern and intensity of cultivation.

In this region, segments receiving over 100 cms of rainfall are not considered suitable for growing Jowar while those with less than 100 cms of rainfall are particularly good for this purpose. Cropping intensity too has been markedly influenced by the rains. The double-cropped sections thrive only during good monsoons. Consequently, in the same holding the farmers grow a single crop where they would have grown two if rains were kind. Vagaries of rain-gods have certainly made and unmade the local farmers. The memories of two consecutive monsoon-failures in 1966 and 1967 are still fresh. The poorer were of course the worst affected but even well-to-do farmers felt the severe pinch. Relief operations had to be organised on a large scale, and malpractices during these operations later became subject of much inquiry.

Distribution of Rainfall:

Rainfall in this area is mostly due to the Arabian sea (Western) monsoons. The pattern of rainfall shows a declining trend while moving from west to south. The total annual rainfall varies from 10.35 cms to 143.16 cms. The western part of this plateau, which is really the eastern extremity of the
Himal Plateau, shows a fairly even distribution of rainfall. Banda, the northern tip of this region, receives 119.21 cms annually. Sagar, Rewa and Deori rain-gauge stations report on an average 139.80 cms, 143.80 cms and 105.64 cms respectively. Only the Garhakota station, located in the eastern parts, reports less than 100 cms. Its annual average is 92.46 cms. Coming to the Damoh district, Natta station, situated in the Sonar valley, receives only 92.70 cms. The Damoh station, on the other hand, located south of the Sonar valley, records as much as 148.16 cms of rainfall. The third rain-gauge station, Jabera, located to the north of Kaimur range, gets the lowest average, only 80.85 cms. This is partly explained by the near abrupt elevation of Bhanwar and Kaimur ranges which hinder the southern monsoonal current which is otherwise active in the Narmada valley. The annual average rainfall over this entire region comes to 117.226 cms. The south-eastern boundary receives more rain than the north-east and east.

DRAINAGE:

The agricultural potential of a region is determined also by the characteristics of the drainage of a region. The natures of drainage may affect their utility as sources of useful irrigation and they may be useful as lines of water transport and enhance the external relations of the people of a region. The density of drainage affords an expression of the geomorphic character of land and that of tree availability of land for cultivation. It may, therefore, seem desirable to mention the salient features of the drainage of the region.
The most interesting feature of the drainage of this region relates to the fact that, though the Narmada flows within six miles of its southern boundary, it forms largely a catchment area of the Yamuna. As many as six major rivers flowing through the Sagar-Damoh Plateau — Bina, Dhasan, Buvas, Sonar, Banhor and Barmu — are headed northward or north-eastward and eventually drain their water into either the Betwa in the north or the Ken in east. Only the Hiran, which again has some small tributaries of its own, drains into the Narmada. The reason for this peculiar feature lies in the fact that the slopes are mostly towards the north and the north-east.

Origin of the Drainage Pattern:

Professor W.D. West, whose study of the geo-morphology of this region is considered to be authoritative, believes that the following three phases are noticeable in the evolution of the drainage system of the Sagar-Damoh Plateau.

1. Formation of the original pre-Deccan Trap drainage, developed on the Vindhyan. This largely got blotted out during the Deccan Trap volcanic eruptions.

2. Development of a new drainage system topping the Trap at the close of the eruptions.

3. A tendency observable in this new drainage system to revert to the earlier pattern as the old Vindhyan topography became exposed due to the denudation of the overlying trap.¹

¹ Cf. Gazetteer of Sagar.
Drainage Pattern:

Many wet-weather rills coming down the intervening ridges and joining the main streams at an acute angle appears to be the notable feature of the landscape of this region. This invests the drainage system with a typical dendritic character. Instances of a radial type of drainage, however, are not wholly missing. Wherever there are points of relatively high elevation, there are slopes in all directions. Good examples of this are available in the vicinity of the Sagar town as well as in the large village of Jisingh Nagar.

The Bina:

Flowing out of its source located several miles to the south, the Bina river enters Sagar district near the village Mhura. After flowing to Rehatgarh, the river takes a north-eastern turn and forms the boundary between Sagar and Vidisha districts. The river tumbles down a fall of some 50 feet (15.24 m) near the northern periphery of Rehatgarh town. The undercutting of softer sand-stone beds lying beneath the harder ones has been given as the reason for this waterfall. Some 10 miles to the west of the Sawai town (known as Bina for railway purposes) the river joins the Betwa which demarcates Sagar from Guna district.

The Dhasan:

This river also originates just south of the Sagar district. It flows first towards south and then towards north-east, through Mariaoli, a large village situated on the Sagar-Bina section of the railway. It forms the boundary between Sagar and U.P.'s Lalitpur district for a considerable distance.
The Sonar:

The Sonar rises in the low hills in the south-east of Sagar district (23°22′;76°37′). Flowing in a north-easterly direction traversing Sagar and Damoh districts, it touches Rohli and Garhakota in Sagar and Sitanagar, Narsinghgarh, Hatta and Astana in Damoh. Havelli, the valley formed by this river in Damoh district, is a fertile black soil plain forming the principal wheat-growing tract of the district. It merges with the Ken eight miles beyond the north-eastern boundary of the district, its total length being 186.7 kilometres. The river does not attain any great width and rather flows in a deep channel, on a more or less stony bed. However, where the Beemas joins it, it does become somewhat wide. The principal affluents are the Kopro and the Beemas on the right bank and the Beemas on the left.

The Beemas:

Rising in the Siwanu hills of Baisen district, south-west of Sagar, this river flows across Sagar district from south-west to north-east. It turns eastward through a gorge into Damoh district a little to the north of Banda town of Sagar district. It falls into the Sonar about 5 kilometres above Narsinghgarh. Its length is 143 kilometres.

The Kopro:

This river rises in the low hills located in the centre of the Rohli tahsil of Sagar district and flows for about 81 kilometres parallel to the Sonar, which it eventually joins some 1.5 kilometre below Sitanagar. Out of a total length of 97 kilometres the river flows about 67 kilometres in Damoh district.
The Bearma:

It rises in the extreme south of the region, near the boundary separating Rohli tehsil of Sagar from Damoh. Its course is more or less tortuous, running through the most rugged portion of the region. It flows mostly between rocky cliffs, and its valley is not extensive at any point. Its total length is about 193 kilometres. The fall in its course over this distance is 213 metres or nearly six feet in a mile (1.1 metre per km). Its flow during the rainy season, therefore, becomes rather swift. It is widest near the Mahua village, 320 metres, only three kilometres from its junction with the Sonar. During the last part of its course it forms the boundary between Damoh and Panna districts and it joins the Sonar on the north-easterly boundary. About 13 kilometres further on, the united stream falls into the Narm.

Among the principal tributaries of the Bearma can be counted the nalas Guraiya, Sun and Padri on the right bank and the Sannar and Kathera nala on the left. Jabera nala, another tributary, drains the Jabera valley and runs across the Mangarh scarps. The Jabera valley is said to have been a great lake in the historical past. The Sun nala rises from the Bakal Plateau of Jabalpur district, north of Mangarh scarp, and joins the Bearma near Chatera. A dam has been built on this tributary at Mala and its water is utilised for irrigation the fertile valley.

The Singrampur Valley Streams:

The small valley of Singrampur has got a drainage system of its own. The Phalku and Kair nalas which drain it
flow in a southerly direction. These eventually join the Narmada through the Niran by forming a passage through an extraordinary cleft in the hills locally known as Kalas.

Lakes and Tanks:

Sagar lake is the only natural lake in the entire region. Sagar town is situated on the western, northern and eastern sides of this lake. W.H. West believes that this natural lake came into being when the Vindhyan outcrops, which partly surround it even today, became exposed with the gradual removal of the overlying Trap. The more resistant Vindhyan quartzites dammed up the south-to-north drainage, and the lake was formed. The drainage towards the west has been controlled through a bund.

The main source of water supply in the Trap region of the western part of the Sagar-Damoh Plateau are wells. The compact Vindhyan formations and trap-rocks have very limited water-bearing capacity. The area, consequently, experiences acute water scarcity during the summer months. Wells vary in depth between 8 to 20 feet (2.43 to 6.09 metres). Only two wells are reported to be exceptions, being 56 and 83 feet (15.29 and 27.37 metres) deep. The daily yield from these wells can go up to 30,000 gallons (1,36,305 litres) if mechanical bailing methods are employed. Tube-well sinking has not been found feasible.

Availability of ground-water in the western and southern parts of the Sagar district is limited, since Deccan Traps of the Upper Cretaceous Age overlie the Vindhyan in this part. In the alluvial country east of the Patharia-Garhakota
Road, however, the situation is different. Here wells yield large quantities of water. Occasionally, fissured limestones serve as good aquifers.

In the eastern segment of this region most villages depend on the rivers, streams and wells for their water-supply. Several reservoirs have been built on the feeder streams of the Barma between Nohta and Ranch and lie in the foothills of the eastern Damoh. Mala reservoir is the largest among these, built on the Sun. Beharia and Bechhai are two of the small ones on the feeder streams of the Sun. There is another Beharia, to the south-west of Taradehi. Majhawan, Dhangawan and Patna are on the up-streams of the Padri nala. Other reservoirs and tanks are Ghangri, Chiraipani, Jannora, Deori, Phutera, Bandar-Kola, Barpati and Purana. All these feed irrigation channels.

The Forest Department also manages certain tanks for the use of forest villages and for those who work in the forests. Among these, Kishantalaia and Chiraibund in the Damoh Range, Sahapur Tank in the Tendulkhara Range, Dhakerwah tank in the Taradehi Range and Singrampur tank and Danital in the Singrampur Range are notable.

Springs:

Only a few springs are found in the forest area. These are the Bagdari spring and Thapan spring in Tendulkhara range, Rampura spring in Taradehi range and Deotara, Dayaont, Jamunia and Bhamarpani springs of Singrampur range.
DISTRIBUTION OF WATER RESOURCES

(DENSITY OF WATER)

Water resources appear to exert a decisive influence on the agriculture of all the developing countries. In the region under study, this is accentuated by the fact that it falls within the monsoon zone and as such gets ample water supply only during the rainy season lasting three to four months. Winter rains are scanty and unreliable. In these conditions, a cultivator has to depend on the various types of water resources like rivers, streams, rills, lakes and ponds. We shall notice in the sequel that agriculture does well only in those segments which have such resources in good measure. These are the tracts which go in for double-cropping.

The region can be divided into three zones, those of high frequency, medium frequency and low frequency. High frequency zone comprises the upper waters of the Hiran river in the Singnapur valley, the upper waters of Guraiya nala in the Jabera plain; and, most widely, several patches of the Beasna river. Patches of Eppra river also come under this category. However, the proportion of this degree of water-availability is rather small in the region, and is confined only to the south-eastern parts. Perhaps high frequency also indicates the high-rate of dissection. Average number of water courses in one square kilometre in above 16 (Map 8.)

Almost two-thirds of the entire region is covered under the medium frequency zone. In the north, the hilly tracts
of the lower Vindhyan are included in this category along with Bila river, Barana nala and tributaries of Sonar on the left bank. In the north-eastern segment of the Sagar plateau, Bevas and Dhasan have medium frequency. The southern highland of the Sagar plateau and south-eastern part of the Vindhyan range, including the upper Sonar valley, Baner valley, the remaining parts of Koppa, long stretches of Beamsa, remaining parts of Guraiya nala, upper waters of Padri nala and the rest of Singrampur valley are also of this type. There are between 11 to 15 rivulets and rills in one square kilometre.

Coming to the low frequency zone, we notice that the entire north-eastern part of the Sagar plateau falls in this category except for some patches of medium frequency zone in the river valleys. The northern fringe of the southern upland of Sagar plateau, north-eastern part of Damoh plateau and highland between Guraiya nala and Beamsa river also belong to this type. In the north, lower Sonar valley and in the mid-east the Mangarh range are low frequency. These are mostly table-lands with low dissection rate. This partly accounts for the low degree of water-availability in these areas. There are not more than six to ten water courses in a single square kilometre.

FORESTS:

The Sagar-Damoh Plateau is rich in forests and forest-resources. The proportion of forests to the total area is 40.69%.

Forests have been classified under three heads, reserved, protected and unclassed. Certain forests were demarcated in 1979
and declared Reserved by the government of the day. The
Protected forests really formed part of the estates of big
landlords (malgumars) and were handed over for maintenance to
the Forest Department on the abolition of zamindari in 1951,
though these came to be protected in 1958. The unclassed forests,
known also as Chhora Chas areas, still come under the jurisdic-
tion of the Revenue Department.

In the Sagar segment of the area under study, reserved
forests cover as many as 131 blocks of varying shapes and sizes.
In the Damoh segment, reserve forests covered some 2060 square
kilometres and protected (malgumari) forests another 1500 square
kilometres, of which 250 square kilometres were scrub jungles
and grassland. In the year 1906-6, about half the area of the
district was covered by high forests, scrubs and grasslands.
A sizable proportion of these, belonging to malgumars and tenants,
has been denuded of its flora wealth or has been diverted to
other uses like agriculture and home-steads in the intervening
years and now the forests cover about 13.56 per cent of the total
area of the region.

Distribution:

In the Sagar segment of this region most of the forest
areas are situated on hills lying between the three rivers, Bhasan
Bouna and Sonar, all flowing almost parallel to each other in a
north-easterly direction. In the eastern parts of the Sagar-
Damoh plateau forest zones are separated by the cultivated valleys
of the Sonar. The forests of Fatehpur range (Hatta tahsil) on
the north-western plateau are generally poorer than those situated
on the southern plateau on which the bulk of forests stand. These
latter are grouped under five ranges for the purpose of management. Damoh range occupies the belt running along the Sonar valley. Other ranges are Sagoni in the east, Singrampur in the south-east, Taradahi in the extreme south-west and Tendukhera in the inner south-west. Except for the narrow river valleys and a few clearings on the even surfaces, e.g., around Solanara, Seharia and Mohli, nearly the entire southern plateau and the Vindhyian range are under reserved forests.

A survey of the area reveals that nearly all protected forests are contiguous or are adjoining cultivated tracts and that the reserve blocks lie mostly in the less easily accessible interior areas and on grounds higher than the valleys.

Forest Types:

The forests of the Sagar-Damoh Plateau belong to a the Northern Tropical Dry Deciduous type according to Champion's classification\(^1\) since the average annual rainfall in this area is between 40 to 50 inches. Within this broad-based main type, variation occurs due to geographical, geological, and other factors.

There are two main types of forests in the western segment of the region, i.e., the Sagar plateau.\(^2\)

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1. H.G. Champion, *Forest Types of India* quoted by the District 
   Gazetteer of Sagar.
2. District Gazetteer of Sagar
A. Teak Forests

i. On the trap-covered hills,

ii. On alluvium along water courses.

B. Mixed Forests

i. On sandstones,

ii. In moist valleys,

iii. On heavy soils.

On the Damoh plateau are found many more types of forests, including (A) Mixed, (B) Teak, (C) Grassly Blanks, (D) Salai, (E) Kardhai, (F) Ghont, (G) Khair, (H) Bhirra, (I) Very poor quality forests. 3

Teak Forests:

The Sagar-Damoh Plateau has abundant teak resources. In the Damoh segment, forest belts lie along the western and eastern boundaries and on the hills south of Tejgarh and south-west of Tandukhara village up to the southern boundary. A fourth belt of teak forests lies along the northern boundary. Small patches of teak forest are found on the hills of the southern plateau also, near Damoh town, Hindoria and Sahara as well as near Hathidol on the north-western plateau.

Good quality teak forests out of these areas are found near Banchanagar and Maridoh in Hatta range, Ghatpiparia and Magra in Damoh range, Copalpur, Taradehi, Dudhia, Tindin and pullar and some isolated patches of Tichai tract of Taradehi range and Bini, Bansipura and Singorgarh in Singrampur range.

In Sagar and Rehli tahsils the teak forests are commonly found on the flat tops and tablelands rather than on slopes. Where denudation of the trap on the tops is noticeable, teak is seen descending all the way down the hill and establishing itself on the alluvium along large water courses in the plains. The descent can be ascertained by observing that the teak trees on the tops are older and in larger proportion than on the lower slopes. On the hill tops teak trees are mostly of coppice origin. At some places, specially near Jaisinagar and Jalampur, the coppice is in the second or third rotation with the stumps of the parent trees still visible.

The teak forests on the alluvium along the more important local rivers — Dhasan, Bevas, Bearma and Sonar — and large nalsas constitute some of the best forests in this entire region. The Sonar-bank forests extend to a width of three miles on either side. The trees near the river reach up to a height of 90 feet and a girth of 7 feet. The forest is dense and often it appears as if it has two storeys or canopies one over the other, the lower formed by the smaller trees and the upper by the taller ones.

The most common species of trees found along with teak in good quality forests are Fina, Roha Sais, Dhunga, Lenia, Dhanu Harra, Sular, Mahua and Tendu. Bamboo plants are by and large absent in the Beach region and in the Sagar segment too these are found only in moist valleys. In the medium and poor quality forests the proportion of drier species like Salai, Sunia, Achar, Dhobi, Senal, Fari, Kallu and Bhiga
increases. The undergrowth and the climbers are not very different from what obtains in the same type of forests elsewhere. Teak is predominant in terrains favourable to it because its power of resistance against fire and maltreatment is greater.

Mixed Forests

Mixed forests can be seen on the Vindhyan sandstones in Banda tahsil and over a large part of the Mohri Block in the eastern parts of Rehli tahsil. The quality and density of forest vary according to the depth of soil and the degree of slope which pre-determine retention of moisture. On deeper soils in the larger forest blocks of the Rehli and Deori ranges, where the amount of rainfall is also satisfactory, the trees grow up to a height of some 60 feet. In the Damoh segment of the region under study, mixed forests are found in the Fatehpur range (excluding the slopes along the northern boundary) and the Nathidol area. Large forest tracts are found around the cultivated areas in Taradehi, towards south-east of Tendi-khara and in areas with hospitable conditions in Damoh, Singrampur and Sagoni ranges also. Since the soil is generally not well drained and the proportion of clay is more than is good for teak, only miscellaneous species grow here. Good quality mixed forests are found usually in the depressions and valleys with deep and moist soil. Among the species found in these forests, the chief are Saj, Tendu, Seja, Dshura, Amla, Acher, Bal, Karai, Kasai, Mokha, Dhoob, Bila, Seen, Salen Saleh, Kan, Barga, Bhire, Khaig, Bhilma, Papra, Anitas, Arjun, Kumbhi, Tina, Mahua and Jannu.
Medium quality mixed forests are more commonly found on soils of medium depth and on very gradual slopes, away from watercourses. An increase in the drier species is marked in the tree stock but the under-growth consists also of *Ail*, *Bharrati*, *Jhilili*, *Karonda* and *Gangeru* besides the usual species. *Chont* in the main forms the understorey of these forests.

The poor quality mixed forests with an average density from 0.4 to 0.6 are also fairly common on the upper gentler slopes on shallow sandy soil. The teak found in these forests is of very poor quality. There is a marked increase in the xerophytic species. *Salai*, *Sania*, *Dushi*, *Panpa*, *Kari*, *Lanai*, *Shitta*, *Chant*, *Tandu*, *Ania* and *Anhar* form the main stock. Undergrowth and grasses are scanty. Bamboos are absent. One or more species predominate in certain tracts which helps in identifying certain sub-types. Some xerophytic species are somehow found in the moist valleys of Banda also.

*Chandan* or *Sandal-wood* trees are found near Jallandhar, Jarnaula, *Amat*, *Rehli* and *Ranana* but the trees are invariably small with little heart-wood in them.

Grassy Blanks:

Largely clayey, stiff, black and water-logged soil is not good for the growth of tree-species. An occasional bushy *Sala*, *Bar* or *Balas* is all that can be seen amidst these conditions. Grasses on such blanks are heavy and tall. Mostly *Barru* and *Gunar* are found, particularly along the Laimit-mala in the Fatahpur range, near Nagra in the Danoh range, along
the Guraiya nala in the Turushada range, near Marideori and Kalialahi in the Taradahi range and near Bhinani and Singorgarh Fort in the Singrampur range.

Salai Forests:

Salai forests are found on dry, shallow and gravelly soils. These forests are of third quality, and are commonly found near Brijpani and Salapurri in the Fatehpur range, Piparia in the Damoh range and near Unjarikhera in the Taradahi range.

Kardhai Forests:

This is not an extensive type and is found only in poor, eroded and over-grazed areas. Almost exclusively Kardhai tracts can be seen at some places in the Sagar region such as in the Rama and Dulchipur reserves. In the Damoh segment such tracts are found in the Fatehpur range.

Ghaut:

Ghaut usually forms the understorey in all medium and poor quality forests. At places it tends to dominate certain tracts. The maximum height attained by this species is between 6.1 to 7.6 feet.

Khair Forests:

This species is found in patches on the drier fringes of almost all the forest belts. At places it also predominates. Soil of such places is invariably shallow and the ground is undulating and rugged, being eroded by several nala. The tree does not grow more than 9 metres in height. Typical examples
of this kind of forests can be found in Banda, near the northern part of the Rehli range, near Budhia in Taradahi range and near Manalpura in the Fatehpur range.

Shirra Forests:

Shirra tends to do better on dry and sandy soils.

Shirra forests usually dominate rocky out-cropping precipitous slopes and uppermost flat plateaux locally called Bhataries. Here soil is very shallow or the underlying rock is exposed. This type of forest appears to occupy a sizable proportion of the total area. Species found in these forests are mostly xerophytic. Sheet erosion is rather common in them. Some good leg areas, however, also come under this class. Striking instances of this type are found in Batiagah in the Fatehpur range, near Damos in Damos range, Tendukheda range, Taradahi range and Singraspur range.

Forest and Economy:

Forests exert considerable influence on the economy of this region. Several small and medium scale industries are based on the forest produce. Timber, of course, forms the bed-rock of the forest-economy. It is even sent to other parts of the state from here. Minor consumer-items like log Kattha (derived from Acacia catechu Willd.), Harra (derived from Terminalia chebula Retz.), used in tanning industry and Tendu (Diospyros melanoxylon Roxb) whose leaves are used for making bidi, are local forest produces. Sarna wood is useful for making match-sticks.
Forest affects the cultivators' life and economy also inasmuch as forests provide additional income by way of fuel wood and building material for humans. Grazing facilities are also provided by them.

FAUNA:

There is no game sanctuary or national park in this region, nor is any part of it suitable for setting-up these. The total area of the forest-ranges is divided into 'shooting blocks' with well-defined boundaries.

Birds and fishes have been the subject of some good studies. King¹ has provided us with interesting accounts of resident birds of Sagar and Damoh districts, based on his personal observation. Records of the Nagpur museum also furnish valuable information regarding the local fauna². More recently, Swarup³ has written on the fish-fauna of the Sagar lake (1952-53). The University of Sagar's Department of Zoology has made a detailed survey of the entire Sagar area under a scheme sponsored by the Indian Council of Agricultural Research.

¹ Quoted by the District Gazetteers of Sagar and Damoh
² Ibid.
³ Ibid.
The region has a fair stock of big game. Among the carnivores, the tiger and panther are most common. Tigers inhabit the hilly tracts and come down to the rocky ravines during the rainy season. They do not form as great a menace to the local cattle as do the leopards or panthers. The chief haunts of this magnificent beast are the Abhand ravines near Sagar (otherwise known for rock-shelter paintings), Hanamtapadadi, Patrilota, Chogra, Khanpur, Madaiya, etc. Hyenas, civet-cats and jackals are common but wolves are rarely seen in this region. Wild dogs are considered particularly a danger to other game. The Indian sloth-bear is usually confined to the rocky country and dense forests and does not come near human settlements. Wild buffaloes and bison are not found in these forests though they are a star attraction of the Kanha-Nagzali National Park, not very far from this region. Indian lynx is very rare. The small Indian civet and the Indian palm civet are found in several parts of this area.

Most varieties of deer and antelopes found in Madhya Pradesh are also found in this region except the swamp deer, a rarity now. Sambhar, Chausaingha and guse deer are found all over the region. Chaetal is not common, and is found only on the river banks. Harde black buck are a common sight in the open country, and so is Indian gazelle. The rib-faceted or harking deer is again rare. Only two beasts have so far been sighted in the north-western range of the Hatta tahsil. Wild boars are found all over the forests and are considered responsible for destroying young samplings of trees and bamboo by digging their roots and rhizomes. They harm field crops also if these happen to be near forests.
Rhesus monkeys and langurs are found on the banks of the rivers and streams and also in the dense forests. The mongoose is also common. It is easily tamed though it is an enemy of poultry and snakes while in wild state. The ruddy mongoose is rare.

King has described 153 species of birds as permanent residents of Sagar and Damoh districts. Among land game birds, painted sand-grouse is rare though rock sand-grouse is commonly seen during the winters. The common pea-fowl is found in all the parts. In spite of being a protected bird, it is killed for its flesh and plumage. Spur-fowl is shy but not uncommon. The spotted partridge, though not common, is found all over the region. Grey or spurred partridge is the common variety. Jungle quail and button quail are common but large grey quail and rain quail are rare birds in these areas. Other bird species identified in Sagar and probably found in Damoh also include the stone plover, the spur-winged plover, the eastern golden plover, the little ringed plover, the Kittiwake, the Indian courser, the red shank, the red and blue rock pigeons, the rufous, spotted little brown Indian ring and red turtle doves. The saurus cranes are always found in pairs though the common crane is also rarely found.

The amphibian fauna is restricted to frogs and toads. An interesting tree-frog is also found in this region which glides from branch to branch.

As regards the reptiles, this region is a little
too full of snakes right from king cobras to harmless non-
poisonous ones. Among lizards, several species of Varanus
and Scincus are commonly found in the jungles while the common
wall lizards are abundantly found in residential quarters.

Fresh water crabs, small fresh prawns of Palaemon
and Metapeneaeus species as well as crustacean and molluscs
are reportedly found in the Demch district.

Fiftythree species of fresh water fish, all belon-
ging to the order Teleostei, are found in the rivers and lakes
of this region. Indigenous species are Labeo fimbriatus,
Labeo calbasu, Mystus ernestti, Mystus nor, Mystus cavalius,
Mystus vittatus, Vallago attu, many Ophacocephalus varieties,
Gasterosteus pumilus, Macropodus acutus, Xenantodon
caucilla and some others.

The Department of Fishery also runs some fish farms
and produces catla, Rohu, Mrigal and common carp which are
sold in the local market.

ACCESSIBILITY

Good or at least adequate transport facilities are
a pre-condition for an all-round development of any region.
Agriculture cannot do well without means of bringing in-putes
like fertilisers and high-yielding seeds to the farm and taking
the produce to the mandis. Regrettably, the region under study
has far from satisfactory means of transport. Plateau-type
terrain is a positive hindrance to the building of highways
and railway track. The general backwardness and poverty of the region and a dearth of exportable items too has dampened the spirits of the planners.

Bina-Sagar extension of the then Indian Midland Railway was constructed in 1888, with Sagar town as the terminus. This line was further extended up to Damoh in 1905. This region now comes under the Central Railway's Jabalpur Division and Bina-Katni Branch Line runs through it. This is the only railway tract which crosses the region from west to east.

Only one National Highway — Number 36 — runs through this region. Both Sagar and Damoh are district headquarters and Sagar is also the divisional headquarter. Metalled roads run from both these towns to all the important towns and cities in the vicinity. Banda tahsil has recently benefitted in this regard owing to antidacoity operations.

Among the important roads connecting Sagar with other towns are those going to Chhatarpur (via Banda and Shahgarh), Lalitpur in U.P. (via Mahthon in the north), Damoh (in the east), Nahli (and further on to Patan), Narsinhapur (via Deori in the south), Vidisha (via Rahatgarh in the west), Bhopal (via Rahatgarh in the south west).

Damoh plateau is comparatively less developed in this regard. There are only three main roads going to Panna in Panna district (via Hatta), Jabalpur (via Katangi) and Sagar.
How woefully inadequate is the transport system becomes clear only when we pay attention to the roads serving the villages. Number of villages connected by punca roads, tahsilwise and with the total number of villages and percentage covered is as follows:

<table>
<thead>
<tr>
<th>Tahsil</th>
<th>Total Number of Villages</th>
<th>Number of Villages covered</th>
<th>Percentage covered</th>
</tr>
</thead>
<tbody>
<tr>
<td>Banda</td>
<td>306</td>
<td>24</td>
<td>7.84</td>
</tr>
<tr>
<td>Sagar</td>
<td>531</td>
<td>121</td>
<td>22.70</td>
</tr>
<tr>
<td>Rehli</td>
<td>694</td>
<td>122</td>
<td>17.57</td>
</tr>
<tr>
<td>Natta</td>
<td>535</td>
<td>137</td>
<td>24.68</td>
</tr>
<tr>
<td>Damoh</td>
<td>843</td>
<td>186</td>
<td>22.06</td>
</tr>
</tbody>
</table>

In short, even one fourth villages in any single tahsil are not connected by metalled or punca roads.

Map 9 shows the accessibility by roads and railway. There are many places in the Western and Southern highlands which are even more than fifteen kilometres away from the punca roads and railway tract. The difficult terrain of the hilly tracts has hindered the development of road transport in the Western and Southern highlands. In this region the average angle of slope has also been in some places found above 40. Finally there are large stretches of land covered by reserved and protected forests.

SOCIO-CULTURAL FEATURES:

From the social and cultural point of view, this
region is part of a bigger and well-defined cultural entity, Bundelkhand. It has had a record of valour and patriotism. Bundelas have been known for their bravery. However, these qualities of character are no longer very conspicuous, backwardness and poverty having taken a toll of the people's morale.

Several communities live in this region. Hindus form the bulk, followed by Muslims, Jains, Christians and Sikhs. Hindus constitute over 80 percent of the urban and over 90 percent of the regional population. Muslims and Jains are significant urban minorities. While the latter have some role in the agricultural life, being mostly traders and money-lenders, the role of the former is marginal.

The Hindu community is divided into several castes and sub-castes, as everywhere else in the country. The Scheduled Castes constitute a significant proportion of the population, in the vicinity of 20 per cent. While there is no recognised Scheduled Tribe living in this region, the District Gazetteers report that Gonds, Savars and Bhanias are really tribals. However, all the Scheduled Castes and these tribals profess Hindu faith.

By and large, the rural Hindus are socially backward. Rigid caste barriers, child-marriages, rule of customs and conventions, superstitions and such other social evils appear to characterise the society in general. This has had some impact on the agriculture inasmuch as modernisation becomes difficult in such conditions. Lack of education has
worsened the situation. In a terrain which is generally not helpful for intensive farming, these cultural constraints can play havoc.

On the positive side, one may note that though dowry-seeking is by no means absent in the region, dowry-deaths are still an unheard-of thing. Widow-remarriage is fairly common among lower castes, though not yet among upper caste people. Position of women is somewhat better than what one finds in some other Hindi-speaking regions. They are a recognised asset for agriculture and are not treated as mere appendages in the villages. The joint family structure is gradually crumbling, resulting in fragmentation of agricultural holdings. However, according to the knowledgeable, the family discipline and respect for elders is quite high still.

It is gratifying to note that social evils like large-scale drunkenness and gambling do not plague the rural life. Some people do drink and also gamble, particularly to pass the time where there is lull in agricultural activities. But the percentage of those who do so is still within tolerable limits. Consequently, one does not hear about too many drunken brawls or other rowdy activities, at least in the villages. Prostitution and trafficking in women also do not pose a threat to the social fabric.

According to the sample survey conducted along with the 1961 Census, nearly 93 per cent people lived in dwelling owned by them in the villages. On an average, 4.4 members constitute a household who live in 1.4 rooms. Since the rooms
are small in size, this does present a picture of congestion. Dwellings are usually close to each other, localities broadly divided on caste lines, with the lower castes living on the outskirts. Stone and mud is used for constructing walls on a large-scale in this region.

It is reported that, except for the Brahmans and Jains, most of the male population is non-vegetarian in this region. However, meat or fish do not form the main part of the diet and only a few can afford it often. Lower sections usually eat breads made of Runga, a mixture of wheat and gram, or coarse grains. The standard of nutrition is really rather low. These days, wheat (pisi) and rice also figure among the staple food, and the vegetable-cultivation is on increase. Milk and milk-products are used on a scale which is much lower than what obtains in well-to-do areas. For cooking medium, similarly, ghee is a scarcely-used item while various kinds of oils — til, alsi, gali and mustard — are used in most cases. On festive occasions, of course, people partake of some good things.

The dialect spoken in this region is known as Bundeli which is really a sub-dialect of Braja-bhasha. Khari-boli, however, is easily understood by all and spoken by the educated. This region has produced some very well-learned poets in the past and still has a strong cultural tradition. Singing of alha and Ramayana is very common in the villages. So are other folk-songs and dances. People on the whole are simple,
away from the intrigues, faction-fights, violence and lawlessness which regrettably now characterises rather large areas in the country. The strong bond of cultural heritage and linguistic isolation has kept the folk life intact and has prevented importation of external influences leading to changes in demographic profile and better use of agricultural resources.