CHAPTER - X

MORPHO - AGRICULTURAL REGIONS

The comprehensive study of the physiography and agricultural development of the foregoing chapters presents a diversified picture of geomorphic features and agricultural pattern within the Lower Chambal Valley. The geomorphological characteristics and hydrological conditions of the various parts of the region have created an agricultural pattern that is very varied. Therefore, the regional analysis of morpho-agricultural features is imperative in order to make the future plan of land resource utilization of the region in a rational way. As a matter of fact in this chapter an attempt is being made to bring out morpho-agricultural regions of the Valley on the territorial differentiation of geomorphic features and crop pattern and evaluate them according to their land capability.

BASIS FOR MORPHO-AGRICULTURAL REGIONS

The morpho-agricultural regions of the world or part of it may be delineated on the basis of climate, geomorphic and hydrological characteristics, land capability and crop pattern. No attempt has yet been made to divide the world or part of it into morpho-agricultural regions by geographers. Although considerable work has already been done on the
geomorphic and agricultural regions separately. Most of the geomorphologists while dividing the region into geomorphic regions have considered climate, structure and lithology of rocks, fluvial features, degree of dissection and morphometric properties. The study of work on geomorphic regions reveals that when the area of a continental size is considered in that case climate becomes a common denominator. In smaller area geological structure of rocks, relief, and erosional peculiarities of the region become more important. While in still smaller area, morphometric properties as slope, form of the ground, quantitative properties of streams and surface morphology are used as an important criteria of geomorphic regions.

Similarly, the agricultural regions of the world or part of it may be delinated on the basis of climate, relief, land capability and crop combination. The first attempt in this direction was made by Jonasson (1925) and Baker (1926). The agricultural regions of Europe and America as recognized by these authors are primarily based on climatic elements. Harstshorne and Dicken (1935) adopted a different line for delimiting North America and Europe into the agricultural regions. These authors, instead of using climate, have used crop isopleths for deleneating agricultural regions.

Owen (1941), Stamp and Weaver (1954), Higbee (1947) and Sirri and Tuncdilek (1952) have demarcated agricultural regions on the basis of relief features Ayyar (1967) has
divided the *Upper Narmada Basin* into the agricultural regions on the basis of topography, soil and crop combination. Recently Kampp (1968) has determined agro-geographical regions of Denmark on the basis of soil capability.

The present scheme of the morpho-agricultural regions is a simple one. In the case of the Lower Chambal Valley, because of uniform sub-humid climate throughout its extent, this factor has not been used as a basis for delimiting the agricultural regions. But the geomorphic contrast between the hilly section of the north west, the plain of south east, the dissected elongated zone and the upland of the south west is so obvious that one can divide the region into four broad geomorphic regions, viz., the hilly section of the north west, the upland sections of the south west and north east, level riverine plain of the Chambal and dissected ravine belt while dividing the Valley into morpho-agricultural regions, these geomorphic boundaries were the main consideration, because agricultural pattern is mainly controlled by geomorphic features of the various regions. Amongst these geomorphic factors which shows marked variation from one region to another has been used for deleneation. For instance, the north western hilly region has been demarcated on the basis of relief using 304 metres contour line as the lower boundary. In contrast to this, the boundaries of the agriculturally stagnant region of north eastern and south western upland sections have
THE LOWER CHAMBAL VALLEY

Morpho-Agricultural Regions

Problem Areas of Agriculture

Explanation:
- A: Agriculturally Negative Hills Region of Northwest
- B: Agriculturally Stagnant Rolling Uplands of Hills
- C: The Lowland, Prosperous Agricultural Region
- D: Wheat–Jowar Sub-Region
- E: Jowar–Wheat Sub-Region
- F: The Ravine Lands, Problem Areas of Agriculture
been marked on the basis of extent of out crops of the Upper Bhandar sandstones. The ravine tract has been distinguished from the lowland section on the basis of degree of dissection and ravine topography. The lowland section - a prosperous agricultural region - is demarcated on the basis of level riverine plain, rolling surface, except on interfluves, adequate rainfall and fertile clayey soils. Further, within the lowland of the Valley, there are important local variations on account of the land capability and the water resources. Therefore, it has again been divided into two micro morpho agricultural regions. The north western part of the lowland is appreciably suitable for wheat as the main crop and jowar as the secondary crop. So the name employed to this micro region is wheat, jowar sub-region. The south eastern part in favourable for jowar as first ranking crop and wheat as second, therefore, the name given to this part is jowar - wheat sub-region.

PROCEDURE ADOPTED IN DEMARCATING BOUNDARIES

For demarcating the boundaries of morpho-agricultural regions, the author first mapped the geomorphic features on the basis of map work and field study. Subsequently, he mapped the distribution of three first ranking crops (wheat, jowar, and gram) using tahsil-wise data. But this rule is not applicable in case of the ravine - infested region of the Valley. The first ranking crops of the ravine
-infested region of the Valley are bajra and barley. Therefore, the bajra crop has also been mapped. Lateron correlation between geomorphic features and crop-pattern has been made. Finally, the boundaries of the major morpho-agricultural regions have been deleneated on the basis of geomorphic characteristics as referred above. While the sub-regions have been determined by three first ranking crops and soil capability. In all, following major and sub-morpho-agricultural regions of the Lower Chambal Valley have been distinguished (Fig. 39):

(A) Agriculturally negative hilly region of north west.

(B) Agriculturally stagnant rolling uplands of north east and south west.

(C) The lowland (Harawati plain) - prosperous agricultural region.
    (C 1) Wheat - jowar sub-region.
    (C 2) Jowar - wheat sub-region.

(D) The ravine lands - problem areas of agriculture.

The main agricultural characteristics of the morpho agricultural regions and their geomorphic features are summarized in the table XXIII.
<table>
<thead>
<tr>
<th>REGIONS</th>
<th>Major structure</th>
<th>Age of rocks</th>
<th>Character of lithology</th>
<th>Topography and elevation</th>
<th>Major geomorphic features</th>
</tr>
</thead>
<tbody>
<tr>
<td>A Agriculturally negative hilly region of north west</td>
<td>Low to steeply dipping rocks, folded and faulted structure</td>
<td>The Gwalior and the Upper Vindhyan, intrusive rocks, sandstones, quartzte, shales, lime stones.</td>
<td>Highly rugged and undulating longitudinal valleys, eroded anticlines, fault line scarp, composite scarp.</td>
<td>Strike ridges, 300-600 metres. valleys, eroded anticlines, fault line scarp, composite scarp.</td>
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<tr>
<td>B Agriculturally stagnant rolling uplands of south west and north east.</td>
<td>Low to gently dipping and horizontal beds.</td>
<td>Upper Bhande Dissected and undulating sandstones and shales. 300-450 metres slope N.E. &amp; S.E.</td>
<td>Rounded mesas, deep cut gorges of streams waterfall and rapids.</td>
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</tr>
<tr>
<td>C 1 Wheat, jowar sub-region.</td>
<td>Unconsolidated alluvial sloping deposits. N.W. to S.E.</td>
<td>Very level</td>
<td>Few ravines and gullies along streams</td>
<td></td>
<td></td>
</tr>
<tr>
<td>C 2 Jowar-wheat sub-region.</td>
<td>Unconsolidated alluvium except for interflues of streams</td>
<td>Flat plain</td>
<td>Ravines and gullies are main features.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>D The ravine lands- Problem areas of agriculture.</td>
<td>Unconsolidated alluvial deposits.</td>
<td>Dissected by ravines and gullies.</td>
<td>Ravines, 40-50 metres deep, ravines are common.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Character of soils</td>
<td>Landuse pattern</td>
<td>Modern methods and techniques of agriculture</td>
<td>Irrigation development of canals</td>
<td>Cropping pattern</td>
<td>Agricultural development</td>
</tr>
<tr>
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</tr>
<tr>
<td>Weathed soils, sandy on sandstones and quartizites, clayey on shales and limestone black on dolerites.</td>
<td>2.5% of the total area is cultivated, most of the area is hilley and wooded.</td>
<td>Old fashioned no irrigation facilities. Holding are small. Backward area of agriculture.</td>
<td>Irrigation is conspicuous by its absence.</td>
<td>Maize-important kharif crop. Wheat-chief rabi crop. Mixed cropping is common.</td>
<td>Very little possibility of agricultural development due to rugged topography.</td>
</tr>
<tr>
<td>Thin layer of weathered soil.</td>
<td>Only 1-2% of total area is cultivated, most of the area is dissected and wooded.</td>
<td>Traditional methods of agriculture. No improved cultural practices.</td>
<td>Only small reservoir have been constructed for irrigation recently.</td>
<td>Wheat and barley in rabi and jowar in kharif.</td>
<td>This agricultural region may be specialized for forests and grasses or for fodder crops.</td>
</tr>
<tr>
<td>Heavy clays to loamy sands.</td>
<td>50-60% of the total area is cultivated, unculturable wastelands are 20%.</td>
<td>New methods and techniques have been started. Agricultural implements are new.</td>
<td>After 1960 rapid expansion of canal irrigation.</td>
<td>Wheat, Jowar and Gram are three major crops. Sugar cane and Paddy have also gained favour.</td>
<td>Agriculturally very advanced region of the Valley.</td>
</tr>
<tr>
<td>Heavy clayey brown along rivers.</td>
<td>30-40% area is net sown area culturable wasteland is also conspicuous.</td>
<td>Modern implements have gained popularity.</td>
<td>Nearly 60% of Net Sown Area by canals after 1960.</td>
<td>Wheat is first ranking crop, jowar is second ranking.</td>
<td>Possibility of agricultural development is immense waste-lands may be brought under plough.</td>
</tr>
<tr>
<td>Deep grey soils, light brown near streams.</td>
<td>60-70% of the area is cultivated culturable wasteis also high.</td>
<td>Advance in the modernization, at places farmers still use old implements.</td>
<td>Development of canal irrigation. Topography is ideal for this.</td>
<td>Jowar is first ranking crop, wheat and gram are second and third ranking crops.</td>
<td>Problem of water-logging retards agricultural development at places. Inspite of this it is developing.</td>
</tr>
<tr>
<td>Yellowish brown soils, at places heavy clay. In rainy season it becomes slippery.</td>
<td>Nearly 90% of the area is wasteland and affected by ravines. Ravine bottoms are cultivated areas.</td>
<td>Old implements are used. Due to dissected nature of the area modernization is not possible without reclamation work.</td>
<td>Hydrological conditions are deteriorating, lack of water supply, water table is low.</td>
<td>Bajra is chief crop. On slip off slopes wheat is grown.</td>
<td>Soil conservation works are highly needed. This region may be put under forests and permanent vegetative cover according to hydrological conditions.</td>
</tr>
</tbody>
</table>
(A) AGRICULTURALLY NEGATIVE HILLY REGION OF NORTH WEST

The north-western border hills form an distinct morpho-agricultural region that is a negative area from the point of view of agriculture. In this region the rugged topography is the formost factor governing agriculture. It is handicapped by the steep slopes and resultant hill wash, and inadequate water for irrigation.

The 300 metre contour line marks the lower boundary of the hilly section right from Khenia in the southwest to the Banas river in the northeast. The maximum elevation is about 546 metres near Satur Hight Station in the Bundi Hills.

Geomorphic characteristics

The main geomorphic characteristics of the Bundi - Sawai Madhopur line of hills have already been discussed in chapter III. These hills are composed of the older Gwalior rocks and stratified Vindhyan formations. The Great Boundary Fault which runs along the hills divides the Vindhyan from the Gwalior. The Gwalior quartzites, the Kaimur, Upper Rewa and Lower Bhandar sandstones form ridges while shales form longitudinal and strike valleys.

The drainage of the hilly region is interesting in many respect. The ultimate arrangement of sandstones and shales in the Bundi hills has given rise to anticlinal valleys and synclinal ridges. The resultant pattern of this
part in trallis drainage pattern. The Mej is the major stream of Bundi hills. This river cuts through the strike ridges in a canyon and emerges at Khatkar village. It then merges into the Chambal nearly south east of Lakheri town. The drainage pattern of the Sawai Madhopur hills is some what different than the Bundi hills. The subsequent streams which descend from the south eastern falls of these hills join the Chambal at right angle. On the whole drainage pattern is irregular. Streams in the hilly section are non-perennial.

The soils on the hills is very thin and reddish brown in colour. In the longitudinal valleys, soil profile is somewhat developed. Generally soils are heavy clay and clayey loam on the outcrops of shales. The soil is comparatively more fertile in the Satur Valley of the Bundi hills, because this has been developed on the Bhandar limestones. The soils of the Sawai Madhopur hills are light and sandy because of their development on the sandstones and quartzites. On the slates and shales of the Gwalior system the soils are fine textured but less favourable for the growth of vegetation and crops. The soils on the Gwalior dolerite on the way from Sawai - Madhopur to Ranthambhor fort, are black in colour and closely resemble the black cotton soils of the Malwa plateau.

The hilly section is characterised by dense forests. All hills are invariably wooded. Forests on the slopes
and tops of the hills comprise of following trees:

<table>
<thead>
<tr>
<th></th>
<th>Dholera</th>
<th>Anogeissus pendula</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>Kher</td>
<td>Acacia catechu</td>
</tr>
<tr>
<td>3</td>
<td>Babul</td>
<td>Acacia arabica</td>
</tr>
<tr>
<td>4</td>
<td>Tendu</td>
<td>Deospyros tomentosa</td>
</tr>
<tr>
<td>5</td>
<td>Dhak</td>
<td>Autea frondosa</td>
</tr>
<tr>
<td>6</td>
<td>Adusa</td>
<td>Adothoda vasica</td>
</tr>
<tr>
<td>7</td>
<td>Ber</td>
<td>Zizyphus jujuba</td>
</tr>
</tbody>
</table>

The Sawai Madhopur hills are more wooded than the Bundi hills. The reason is that the metamorphic rocks of the Sawai Madhopur area support luxurient growth of trees.

**Agricultural characteristics**

A considerable part of this agricultural region is rugged and is not fit for cultivation. The longitudinal valleys with good soils and level ground are common sites where cultivation is being practiced.

The study of some hilly villages indicates that only 2 - 5% of the total area is cultivated and in most of the cases the proportion is not higher than 1%. Like lowland (to be described later) the hilly region is also a land of grain production. More than 60% of the arable land is devoted to wheat and maize crops.

Maize is an important kharif crops of the region. Til is grown to a little extent where irrigation is not possible. Cotton, chillies and sugarcane are other kharif
crops.

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Wheat is an important rabi crop. Wheat generally follows maize and in such a case manuring is not done as maize is heavily manured. Barley is another important crop which is sown mixed with wheat.

In the hilly region there are some areas where the agricultural practices are different than described above. Variations in such areas are given below:-
1. The characteristic feature of the Satur anticline Valley, represented by Talaogoan (Dundi tahsil) village is that it is flooded during the rainy season hence only rabi crops is grown. Wheat is the important rabi crop which is grown under 'barani' (unirrigated) condition. Manuring is not commonly practiced.
2. The area in Motipura village (east of the Mez River in the hilly section) has soils of very light nature with poor moisture retentive capacity, so only kharif crops are grown except for gram in rabi in small area. Important kharif crops are jowar and til. Moong is grown as a mixed crop.
3. In some parts of the Sawai Madhopur and Khankar hills the soil is too sticky and plastic to be workable. Therefore,
only rabi crops are grown where the soil is light in texture near nallahs, kharif jowar is also cultivated.

The methods and techniques of agriculture in the hilly section are traditional. The average holding is 1.6 hectares. The small holdings are due to the limited agricultural land that could be brought under cultivation. Mixed cropping is a common practice but double cropping is uncommon. Irrigation is conspicuous by its absence. The implements with which the villagers work are 'hal' (country plough) and 'bakhar'. The complicated nature of hilly topography is the main factor that retards to the introduction of new implements.

(B) AGRICULTURALLY STAGNANT ROLLING UPLANDS OF NORTH EAST AND SOUTH WEST

The upland agricultural region is found in two detached area; one in the north east - called the 'Dangland' and second in the southwest known as the Kota Plateau. The extent of upper shanker sandstone forms the boundary of these sections. The north eastern upland terminates on the south by the Chambal scarp. It slopes from south to north. The south western plateau slopes from southwest to north east. The Kota scarp forms the south western boundary and in the northeast it merges into the lowland section.

Geomorphic characteristics

These two highlands are composed of upper shander
sandstone underlain by shales. The soils are developed on the sandstone due to the long continuous weathering processes. The surface colour of soils is red. Generally soil layer is very thin, therefore, sometimes it is difficult to work with country plough. Due to this nature of soil and the stony character of terrain agriculture is not practiced throughout. Only in those parts where soils are thick and water is available, cultivation is being practiced than otherwise.

The drainage pattern of the highland sections of the Valley is very peculiar and significant as well for the river Valley development projects. The Chambal river after crossing the Malwa plateau breaks the Kota scarp in the direction of dip near about Bhainsrorgarh and forms a conspicuous gorge. Here the course of the Chambal has been superimposed to a depth of nearly 150 metres on the Kota plateau. Due to this gorge (course) the various dams have been constructed on the Chambal. The over all pattern of the drainage is sub-parallel. Except the Chambal and its major tributaries most of the streams are dry during summers. The drainage pattern of the north eastern highland section is consequent type. The streams which descend from the Chambal scarp are of subsequent type.

This agricultural region is appreciably suitable for the growth of grasses and trees and therefore the area is characterized by dense forests. On these uplands for a long distance togather there is no settlement the only
noticeable feature is the dense forest and grasses.

**Agricultural characteristics**

The region is mostly inhabited by Gujars who are poor in cultivation. However, their economy is based on animal husbandry. The natural grasses and vegetation give helping hand to their occupation.

Where water is available and soil is clay and therefore, farmers grow wheat and barley in rabi and jowar in kharif season.

The possibilities of developing this agricultural region are not totally nil. Small reservoirs could be constructed across the many streams for minor irrigation works. But this region will appreciably be suitable for forests therefore plantation should be made on a large scale.

(C) THE LOWLAND (HARAWATI PLAIN) - PROSPEROUS AGRICULTURAL REGION

This is the largest morpho-agricultural region of the Lower Chambal Valley. On the north west it is sharply limited by the Bundi - Sawai Madhopur hills and on the south west the Kota plateau and the Mukandwara hills; to the south east it merges into the Shivpuri plateau.

**Geomorphic characteristics**

This region represents the lowland of the Chambal,
Kali-Sindh and Parbati. Down stream Kota, these three rivers unite to form a triangular alluvial flood plain below 300 metres. The region slopes from south west to north east. It is gently undulating, the interfluves between the rivers being slightly higher.

The whole of the area is composed of the alluvial soils. Around Kota, Bundi and Sangod, the soils are clayey loams to clay getting heavier with depth. The soils along the banks of the rivers are sandy loams to loam and are lighter in texture. Kanker layer is found below 0.92 to 1.22 metres. All over the plain surface soils are crumb in structure and mostly friable while the soils at lower depth tend to have a composed (blocky) structure and are firm and sticky. The permeability of surface soils is moderate and low at lower depth.

The major physiographic characteristic of this section is this that it is known for the ravines. The bank of the Chambal is greatly dissected due to the ravine formation. Similarly all other tributaries of the Chambal are also attended by strips and long belts of ravines, but the only comparable to that one the Chambal is found along the Kali-Sindh and Parbati. The width of the ravine belt here varies from 1 kilometre to 2 kilometres. The depth ranges from 20 metres to 30 metres. It increases towards lower reaches of the Chambal and near the confluence of the Banas the depth is about 30 metres.
Agricultural characteristics

More than 50% of the total area is cultivated. In some tahsil as Digod, Pipalda, Baran, Mangrol and Antah, the percentage of net sown area is more than 60. In Baran tahsil it is exceptionally high and is about 70%. The distribution of net sown area is largely determined by the availability of moisture. The north western part comprising of Bundi and Ladpura tahsils is above all an area of wheat production. While the south eastern part comprising of Digod, Baran, Pipalda, Mangrol, Kishanganj, Antah, Sangod, and Sheopur tahsils is main jowar producing area. Gram occupies third place after wheat and jowar in the plain area. On the whole it may be said that agriculture in this section varies with the changing physical conditions, from the predominating wheat area of the north west to the more favourable jowar producing south eastern region. Differences in the agricultural character are chiefly the result of variation in soil capability, hydrological condition and technological development, and on these basis es two micro agricultural regions within the lowland section may be distinguished.

(C 1) WHEAT-JOWAR SUB-REGION

The wheat jowar sub-region is the north western part of the lowland. This sub-region comprises of Bundi and Ladpura tahsils. This agricultural sub-region has been demarcated on the basis of soils and crop combination.
The soils of this sub-region have calcareous variants at places. These soils are moderately heavy in texture. Near streams soils are sandy loams and loamy sands. The surface soils are crumb in structure. The clay content in the surface layer is higher than the subsequent layers.

**Agricultural characteristics**

The most important characteristics of this sub-region from the point of agriculture are as follows:

1. In spite of the development work, the net sown area is only a little above 30% of the total area. A slight increase in the net sown area has been noticed in 1966-67 over 1956-57. This expansion in the net sown area may be attributed to the provision of soil conservation work.

2. This sub-region is essentially a double-cropped area. The area under double cropping has increased from 6% of the net sown area in 1956-57 to 12% in 1966-67. Obviously it is because of the expansion of the canal irrigation.

3. The agricultural pattern is uniform: grain occupies 80% of the net sown area, with wheat dominating (30% of net sown area) followed by jowar (25%) and gram (17%). Til, maize, barley, rice and sugarcane are the other less important crops. Under these crops only less than 10% of the net sown area is devoted.

4. Irrigation facilities are increasing. Amongst the various sources of irrigation, canals account for 75% of the total irrigated area. Remaining 25% of the area is
irrigated by wells and tanks. Nearly 32% of the total cropped area is irrigated.

5. The techniques and implements of agriculture are in fact still old fashioned. But with the advent of irrigation work and the development blocks, new implements as tractor, halhos and leveller have been introduced. The Japanese method of paddy cultivation has also gained some favour.

6. In recent years due to the efforts of the Agriculture Department at Bundi and Kota, new varieties of wheat, hybridge maize and jowar have been introduced. Common varieties of wheat in this region are C 581, NF 718, Malvi & C 236. 'Sanker' jowar and maize are also giving good results.

7. Under the irrigation manuring is a common practice. Farm manure is applied at the rate of 15 to 20 cart loads per acre. Sugarcane and wheat get maximum application of 20 to 30 cart load per acre. Due to the efforts of block development officers, chemical fertilizers have gained wide publicity. Consumption of chemical fertilizers has doubled during the last decades.

8. The study reveals that with the introduction of the canals and rapid industrialization in Kota and Bundi (Two important urban centres of this sub-region) the value of land is increasing fast. The farmers of the area are awakening to a new consciousness. Their tie with land is becoming stronger with the increase in the yield per acre. Moreover, due to industrialization in the nearby Kota town the prices of vegetables and other cash crops
has increased. Therefore, the cultivation of cash crops has gained some favour in this sub-region.

The possibilities of developing this part are immense. It is expected that as a result of extensive efforts of the Agriculture Department, the new varieties will naturally replace the old ones as of jowar and wheat and it is also hoped that this change will be quite fast after a year or two when the farmers will be accustomed to use water properly. Moreover, the waste lands may also be brought under cultivation with the help of soil conservation measures.

(C 2) JOWAR-WHEAT SUB-REGION

Jowar-wheat sub-region is the south eastern part of the Lowland section. It includes Patan, Sangod, Antah, Digod, Mangrol, Baran, Atru, Kishanganj, Pipalda and Sheopur tahsils. The region also embraces the lowland of Indargarh and Sawai Madhopur tahsils. Approximately 3/4 of the lowland section comes under this sub-region.

Geomorphic characteristics

The soils of the sub-region are heavy clayey in texture. These are deep black in colour. Surface soils are blocky in structure. Moisture holding capacity value ranges between 25.40 - 54.03%. The clay content of the surface layer is comparatively lower than the subsequent layers but the moisture holding capacity is invariably
higher; ranging between 36.79 - 52.31% possibly because of the organic matter. The soils near rivers are lighter in texture.

**Agricultural characteristics**

1. In most of the tahsils which constitute this sub-region the net sown area is above 60% except in Indargarh and Sawai Madhopur. The low percentage of the net sown area in these tahsils is due to the hilly topography. Conspicuously high percentage of (70%) the net sown area is recorded in the centre of this sub-region.

2. Double cropping is a common practice. Inspite of the provision of canal irrigation, the percentage of double cropped area is very little and is between 1.05% to 8%. But the double-cropped area has increased within the last decade (1956-57 - 1966-67).

3. More than 20% of the total area is wasteland and area not available for cultivation. This proportion is very low in comparison to the wheat-jowar sub-region. But the percentage of the other uncultivated land excluding fallow land is somewhat higher in this sub-region than in the wheat jowar sub-region.

4. Jowar is the first ranking crop of this sub-region. More than 30% of the net sown area is devoted to this crop. In Sawai Madhopur and Indargarh tahsils percentage of jowar to the net sown area is more than 40%. The soil of this stretch is very favourable for this crop. Moreover, the
efforts have also been under taken by the State Agriculture Department to specialize this area for jowar. Infact, due to the efforts of the government the percentage of jowar growing area has shown some increase no doubt, but the yield per acre has gone down because of water-logging in the heavy clayey tracts. Wheat and gram are the second and third ranking crops respectively. The soil and climate are suitable for these crops. Wheat and gram both are grown as a mixed crop. Other crops of this sub-region include til, barley, maize, groundnut, rice, linseed and bajra. These crops occupy a small percentage of the net sown area.

5 Irrigation facilities are increasing. More than 80% of the total irrigated area is irrigated by canals. Wells are secondary source of irrigation. But in Baran, Sawai-Madhopur and Indargarh tahsils more than 60% of irrigated area is irrigated by wells. In these tahsils hilly topography is unsuitable for the development of canals.

6 Manuring is also done mostly in irrigated tracts. Due to the propaganda of the Block Development and Panchayat Samities the consumption of chemical fertilizers has increased considerably after the advent of the canal irrigation in 1960.

(D) THE RAVINE LANDS - PROBLEM AREAS OF AGRICULTURE

The narrow and elongated belt from the Banas water gap to the Yamuna is known as the badland region or the ravine belt. The degree of dissection along the Chambal
increases downstream from the confluence of the Parbati river. On the basis of this factor the badland region has been demarcated. This agricultural region in the north is bounded by the Sawai-Madhopur hills and the Chambal scarp up to Dhopolpur and thereafter by the watershed of the Chambal. On the south it is limited by the ravines of the Kunwari river which flows parallel to the Chambal throughout.

**Geomorphic characteristics**

The development of the ravines is a conspicuous topographic feature of this tract. The depth varies from 40 to 60 metres. It depends on the soil characteristics, nature of slope and intensity of vertical corrosion by the ephemeral streams. Most of the ravines downstream from Dhopolpur are U-shaped. The side and head scarp are devoid of vegetation. In the midst of the ravines alluvial knolls are common. From a distance these give an appearance of mesa-like topography.

**Agricultural characteristics**

The main characteristics of this region, from the point of view of the agriculture may be summarized as follows:

1. The whole ravine belt is an area of very poor soil. The soil is sandy loam to loamy sand in texture. In the lower reaches, at places, soils are sticky and plastic.
Kanker layer is found 1 to 2 metres below the surface. Permeability throughout is moderate.

2 The land is a part of land capability class VI which is not suitable for agriculture. Because of the long and continuous fluvial erosion most of the fertile land has gone out of plough. Moreover, due to this menace the water table also gone down, which further retards the development of irrigation facilities.

3 It should, however, be mentioned that within the ravine belt there are some patches of land capability class I, where the accumulation of good soils has enabled the peasants of this part to grow wheat and gram under 'barani' condition (unirrigated condition). Slip-off slopes, ravine bottoms and the marginal sloping areas are the main cultivable areas where agriculture is being practiced. But such lands are few and far between. The study of few selected villages of the ravine-infested part shows that less than 50% of the total area of a village is net sown area. On a very little area double-cropping is practiced. In most of the villages single crop is harvested. The fields which are in the bottoms of the ravine produce rabi crops while in the fields of marginal areas only kharif crops are grown.

4 The first two crops are bajra and barley. Both are staple food of the inhabitants. The light soils with gravels and less moisture retentive, support nothing but bajra as a kharif crop and barley in the rabi season.
Irrigation is conspicuous by its absence. Recently due to the efforts of Soil Conservation and Irrigation Department small works of soil and water conservation have now been undertaken. In some villages as Sagar Pada, Barhi, Jalalpur, Jaikpura, Pali, and Buhata farmers are so backward that they do not readily cooperate with the officers either in the soil conservation or in the other development programmes. Moreover, the economic status of these farmers is alarmingly very low, therefore, they are unable to purchase new and modern implements, although there is limited possibility of mechanization by virtue of the nature of topography. However, it is a primary task to give economic impetus and incentive to the cultivators and in order to get rid of ravine problem and to raise the standard of living.

Apart from the two crops mentioned above, there are four other common crops grown by the cultivators in the ravine lands. These are pulses including moong and arhar, jowar and gram.

In the ravine lands too, there are some local variations in the cropping pattern because of the variation of soils and availability of moisture. Although this agricultural region is predominantly a bajra producing area, the cultivation of secondar, crops as of wheat and gram depends upon the availability of moisture and clayey soils. In the ravine lands of Bari, Baseri, Sapotra, Sabalgarh, and Vijaipur tahsils wheat is the second ranking crop while gram is the
third ranking crop. In the ravine infested parts of Dholpur, Joura, Morena, Ambah, Rajakhera, Bah and Shind tahsils gram occupies the second position next to bajra. Wheat is the third ranking crop.

On the whole, it may however, be concluded the agricultural pattern in the Lower Chambal Valley is very diversified. This differentiation in the agricultural pattern may safely be correlated with the variation in geomorphical characteristics of various part of the Valley.

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