Chapter 2

Physical Setting
PHYSICAL SETTING

PHYSIOGRAPHY:

The district of Etah lies in the central portion of the Ganga - Yamuna doab and is bounded on the north by the Ganga which separates it from Budaun district, on the west by the district of Aligarh, Mathura and Agra, on the south by Agra and Mainpuri and on the east by Farukhabad. The district lies between the parallels of 27° 18' and 28° 2' north latitudes and 78° 11' and 79° 17' east longitude and is of very irregular shape (fig.1.1). The Jalesar Tahsil running out in a long promontory between the adjoining district of Aligarh, Mathura and Agra both Etah, Sakeet and Aliganj. Thrusting out large wedges of their territory in to the Mainpuri district. The total area of the district according to the recent survey is 4446 Sq. Km. The greatest length from South West to North East is 62 miles and from North to South a line drawn through the city Etah measures 43 miles.

The district Etah structurally forms part of upper Ganga plain (Ganga - Yamuna doab) which lies between the northern peninsular India and the recently built Himalian chain. The geological evolution of the plain remains a matter of discussion. Eduard Suess the Austrian geologist, suggest that the plain is a “fore deep” formed in front of resistant mass of the peninsula when the Tethyan sediments were thrust southward and compressed against them. According to a second view by Sir Sydney Burrard (Formerly Surveyor – General of India) the plains represent a rift valley bounded by the parallel fault on this region as a sag in the crust formed between the northward drifting
Fig. 2.1

Source: Census of India (1981), Regional Division of India- A Cardiography Analysis-Series-1 Volume-XXII, Uttar Pradesh Map No. 42
India continent and comparatively of sediments accumulated in the Tethyan basin—when the latter were crumpled up and lifted up into a mountain system. The Ganga-Yamuna doab is a geomorphologic entity of the surface alluvium which has a thickness of 1000 to 2000 meters. Generally the flat characteristics of the whole districts is evident from the fact that the relative relief varies from 4 to 6 meters only. On the other hand it varies from 6 to 10 meters on bhangar upland (Fig-1.2). The Kalinadi flowing from North West to south east divides the district into two parts. The area to the south west of the Kalinadi consisting of the Jaleser and Etah Tahsil and comprising less than half of the total area, is a fertile tract of stable cultivation, while the northern portion which include the tahsil of Kasganj, Aliganj and Patiali is the reverse, being subjected to the remarkable vicissitudes of fortune and very sensitively to any abnormal variation of season and rainfall.

Topographically there are four distinct tracts—first the Tarai or low land between the River Ganga and its old high bank, second the central doabs, or the upland between the bank and crest of the Kalinadi bank. Third valley of the Kalinadi and forth in the tract lying on this river.

TARAI:

This tract stretches from the bed of the Ganga to its old high bank and at some places is as much as -15 km. in breadth. It comprises the parganas of Fiazpur Badaria, Ulai and Nidhpur, more than half of the Soron, one third Patiali and a portion of Pachlana, Sahawar and Azamnagarh. The soils throughout are alluvial character with the difference that they have a large admixture of vegetable matter than their counter part in the upland. Even where the portion
of the sand is high, they are soft to touch and resemble rather artificial soils, the composite of gardener, than natural earth. The most valuable of the Tarai soil is the rich soft loam found along the edge of the Ganga; similar but less valuable soil is met along the edge of the Burhganga (old bed of the Ganga). Here the quality of the soil deteriorates from north to south, being a very sandy just above the Burhganga. South of that stream there is always considerable stretch of very poor soil, either wind blown sand or usar (barren land) but towards the high bank there is marked improvement in the soil. The subsoil throughout this tract is sand, the pure white sand of the Ganga bed and the fertility of the given tract depends more upon the depth than quality of the alluvial deposits with which the sand is severed. The surface is everywhere uneven, following through with less marked variation, the contours of the underlying sand, so that the hollows, which were the first to catch alluvial deposits, are richer than the ridges.

CENTRAL DOAB:

This tract comprises the major portion of pargana Pachlana, Bilram, Soron, Sahawar, Sirpura, Birna and Azamnagarh. The character of soil in this tract depends largely upon the distance from the Kalinadi and old high bank of the Ganga. At the western boundary of the district the average distance is about 21 km. The Kalinadi is than running eastward, while the trend of the high bank is to the east with the result that when Sahawar is reached the distance is shrinks about 22 km from that point to the commencement of Berna, it varies from 12 to 16 km. The banks of the river in this tract are marked by a belt of sand and it is well marked characteristic that wherever they approach one another, these ridges stretch out as though to join hands forming an almost continuous sea of sand from one river to the other. Where on the contrary, they diverge.
The sand seems to shrink and the center of the tract is occupied by a level plain of loam and usar. Elsewhere the surface is uneven sand being pitted with hollows and depression in which water collects, giving rise to a little former soil. The subsoil in this tract is nearly everywhere sandy. In some places as in the east of Aliganj and near Sahawar, a firm subsoil is met, but such tracts stand out as entirely distinct from the rest of the doab.

**KALI NADI VALLEY:**

The width of the valley varies according as descent to the low land is gradual and abrupt. On the southern bank and the eastern half of the northern bank of this descent is almost everywhere gradual. But in the western half of the northern bank, the descent is in many places sudden, often with a kind a steppe between the crest and valley bottom. The soil of these steppes is tough sandy yet fertile. The lowest portion of the valley is at the foot of the high bank where the soil is always rich, but liable to swamping. This is especially the case where the drainage channels from the upland make their way down. The soil on the immediate margin of the stream is a good loam, well raised and not very steep. Some times soil similar to that on the river bank extents nearly to the upland. This is more often the case in the west than in the east. However the central part is inferior to the rest of the valley, if raised, it is sandy and if low line, it is infected with reh.

**SOUTHERN TRACT:**

The tract south of the Kalinadi comprises Jalesar, particularly the whole Marehra and east Sakeet, Two-third of Pargana Sonhar and a portion of Bilram. The tract is distinguish by the absence sandy soil, and is also the most stable. The prevailing soil is a good loam. As we proceed towards the Isan, which runs through the southern portion of Marehra and Etah Sakeet, the soil becomes stiffer and clay is more
frequent. On the opposite side of the Isan, the rivers are the case. The stiffest soil is in the north, which is followed by good loam and then by lighter loam. The sub soil most part of this tract is firm. In the extreme south-west, however, the level sinks to a marked degree, increasing materially the cost of raising water.

**NATURAL DRAINAGE SYSTEM:**

The water available for agriculture in the form of surface water is one of the essential bases and the foundation of farming. Drainage system of any region works like veins in human body. With a poor water supply the otherwise productive lands tilled by assiduous farmers have only an inferior and subsistence farming and a poor living for the peasantry; with sufficient and assured water supply to the same the farming is superior, stable, diversified and commercially profitable and the living of peasant proprietors' affluent. In the areas having meager, concentrated and highly truant rainfall the establishment of prosperous farming begins with the utilization of the water resources by extending and improving the irrigation facilities. An assured and regulated supply of agricultural water from ground and surface resources is the basic and essential aspect upon which the future planning of irrigation depends. Because of the uncertainty in the flow of surface water it is probable that any attempt to improve agricultural techniques and land use planning without combating the problems associated with shallow and deep water table are bound to be abortive.

The chief rivers of the district are (Fig-1.3) the Ganga, the Burhanga, the Kali nadi, the Isan, The Rind and the Bagarh river. The general flow of these rivers is from North – West to South – East.
GANGA:

The Ganga forms for about 51 Km. northern boundary of the district flowing in south easterly direction. The river flows at a distance varying from 5 Km. from its old high bank.

BURHGANGA:

The former bed of the Ganga is marked by the Burhiganga or Burhganga which enters the district from north west corners and flows south eastwards at a considerable distance from the old high bank which is locally known as the pahar and has an average height of about 7Km. above the level plain, rising up to 10 to 15 meter and varying considerably in the appearance at different places. Some times it descends with a gentle slope to the low lands in to which it imperceptibly disappear, at other places it raises abruptly like a wall. The current of the Burhganga is sluggish and its course is tortuous, blocked in many places by sand hills and weeds. It is thus unable to cope with rainfall above the normal and floods are common. While the land in its neighborhood are liable to water logging, its bed has been excavated and straightened and is annually infected to keep it clear of weeds by the irrigation department.

KALI NADI:

The kalinadi or kalindi, as it is often called locally, flows to the south of the Burghanga at a distance of 11 Km. to 27 Km. Entering the Etah district from Aligarh in the North West its general trend is to the south east and finally it forms the southern boundary of Aligarh Tahsil. Its total length in the district is about 104 Km.. The valley through which the river flows is deep and about 5 Km. in width.
ISAN:

The Isan is apparently the outcome of wide shallow depression which is said to be traceable from Sardhana in Meerut down to the border of this district. On the west it is still an ill-defined depression rather a waterway, but it develops a distinct bed about half way across the district. Its level however is never much below that of the surrounding areas. It has not tarai, the approach to it being merely marked by extensive stretches of low-lying clay lands.

RIND:

The Rind, Ratwa or Arind flows through portion of the south of the district beyond the Isan and though a river of considerable size in the rains in the cold and the hot seasons it almost entirely dries up.

BAGARH:

The Bagarh rises in the north-east of Azamanagarh, where it forms a series of a shallow depression depending occasionally into Jhils and ultimately becomes a stream which flows into the Furrukhabad district. It rises up soon after the rains and its bed affords some good tarai cultivation.

There are some also small tributaries of the Kalinadi, such as the Nim, which flows into it at Baswan near Bilra, The KarohNala, which join the Kali nadi near Mandri, the Karno Nala which falls in to the Kalinadi near Dumari and the Bhongaon Nala, which after passing about 7km. from Aliganj join it near Sarai Agnat.

CLIMATE:

The climate of the district is characterized by a cool winter and hot summer. The year may be divided into four seasons, viz the cold season, running from the middle of November to the whole month of February, followed by the season extending from March to the third
weak of June. The period from the third week of June to about the third week of September constitute the south-west monsoon season and the succeeding period lasting till the middle of November is the post monsoon season.

The three most important factors in climate from the stand point of plant response are temperature, water supply and light, which may be treated as the primary determinants of crop growth. Water supply from the rainfall, the most important variable of these climate parameters is aberrant throughout the state on account of the unpredictable, pulsatory and patchy character of the monsoon. Sunlight controls the onset character of certain biological processes, that, pollinations, flowing, ripening etc., but in the Etah, sunlight is not major factor in accounting for the distribution and pattern of agricultural activities because of its sufficiency. There is a bright sunshine for major parts of the agricultural year. Temperature as such is not a limiting factor in crop growth in Etah.

RAIN FALL:

The moisture input in the form of rain is the major ecological influence on possible and actual farming system in Etah. In Etah, rainfall is the main determinant in the choice of crops. A very clear ecological change in types of food grains grown is discernible as the rainfall decreases specially in Kharif season where the rainfall is sufficient, rice, millets and maize are important crops in the Kharif season. In Etah rainfall is the only dominant single weather parameter in farming because of its meagreness, concentration, intensity, variability and unreliability. The ways in which rainfall characteristics affect agriculture need a detailed investigation as it is probable that their operation is more subtle for crops can be affected by moisture conditions at sowing, germination, shooling and stalking and heading
and at maturing, harvesting and threshing. Moisture is an important factor in all crop-producing areas. It is the all-important factor in the minimal regions, where the average normal rainfall is generally necessary for the successful crop production. Thus it may be asserted that rainfall is the most important climatic factor influencing agriculture in the district as it undeniably determines the potential of any area in terms of crops to be raised, farming system to be adopted, the nature and sequence of farming operations to be followed, and accomplishment of production per unit area. Finally in association with evapotranspiration, rainfall characteristics make a case either for the necessity and feasibility of irrigation or in favor of no irrigation.

Water resources are a vital component in practically every aspect of agricultural land use in Etah and being in short they are an inhabiting factor to agricultural development. Variation in rainfall from year to year is considerable, and, because rainfall is frequently marginal in amount for agriculture and restricted in season, this variability is more critical.

Data on rainfall are more meaningful and sound. Since more rain gauge stations record rainfall than record temperature (fig-1.4). Pattern of annual totals of rainfall shows marked differences resulting from the prevalence of easterly-moving monsoon and westerly moving depressions. The rainfall increases from the west towards the east and varies from 60.1 cm at the Jalesar to 77.8 cm at Aliganj (fig-1.5). About 88 percent of the annual rainfall in the district is received during the period from June to September. July and August being the month of heaviest rainfall. Variation in the rainfall is from year to year is large. In the 50 years period 1950 to 2000 the highest annual rainfall in the district amounting to 181 percent of the normal, occurred in 1958.

\[ \text{Effective rainfall} = \text{total rain} - \text{evaporation} - \text{mish} \]
DISTRICT ETAH
RAINGAUGE STATIONS

Source: District Statistical Department

Fig-2.4
The lowest rainfall, which was 50-percent of the normal, occurred in 1999. In the same span of 50 year, the annual rain fall in the district was between 400 and 900mm. in 30 years out of fifty. A statement regarding the frequency of annual rainfall in the district is given below for the period of 1950-1999

Table-2.1

FREQUENCY OF RAIN FALL

1950 - 1999

<table>
<thead>
<tr>
<th>Rain in mm</th>
<th>No. of Year</th>
</tr>
</thead>
<tbody>
<tr>
<td>200 to 300</td>
<td>1</td>
</tr>
<tr>
<td>301 to 400</td>
<td>3</td>
</tr>
<tr>
<td>401 to 500</td>
<td>5</td>
</tr>
<tr>
<td>501 to 600</td>
<td>9</td>
</tr>
<tr>
<td>601 to 700</td>
<td>11</td>
</tr>
<tr>
<td>701 to 800</td>
<td>3</td>
</tr>
<tr>
<td>801 to 900</td>
<td>9</td>
</tr>
<tr>
<td>901 to 1000</td>
<td>4</td>
</tr>
<tr>
<td>101 to 1100</td>
<td>0</td>
</tr>
<tr>
<td>1101 to 1200</td>
<td>1</td>
</tr>
<tr>
<td>&gt;1200</td>
<td>1</td>
</tr>
</tbody>
</table>

Source-District Gazetteer 1980 and District Agriculture department
DISTRICT ETAH
MONTHLY RAINFALL
ON SELECTED STATIONS
IN mm

Source: Meteorological Department New Delhi and District Agriculture department Eta
Fig.-2.5
On an average there are 37 rainy days (i.e. days with rainfall of 2.5 mm or more) in a year in the district. These numbers of rainy days have recorded ranging from 33 at Jalesar to 38 at Aliganj. The heaviest rainfall in 24 hr. recorded at any station in the district was 281.7 in July 1958 at Kasganj.

**TEMPERATURE:**

Temperature is far less inconsistent from year to year than the rainfall, but Etah has a great annual range of temperature is highly significant, giving rise to two cropping-seasons viz. Kharif (summer) and Rabi (winter). Between the major seasons there is a Zaid (additional) cropping as well, which is known rabi-zaid. For that reason a wide range of crops, tropical, sub tropical and temperate are grown.

There is no meteorological observatory in the district. The description, which follows, is based on the records of the neighboring districts where similar climatic conditions prevail. After February there is a continuous increase in the temperature and May is generally the hottest month of the year. The mean daily maximum temperature in May is about 41°C and the mean daily minimum, about 27°C.

The summer season is intensely hot with the maximum temperature on individual days rising up to 46°C. Hot dry dust laden winds, which blow during the summer, make the weather very uncomfortable. With the onset of monsoon in the district by the third week of a June, there is rapid decrease in the day temperature due to the increased moisture in the atmosphere even in the monsoon season the weather is oppressive in between the rains. After the withdrawal of the monsoon by about third week of September there is a rapid decrease in the night temperature while there is slight increase in the
day temperature. It is only after October that both the day and night temperature decrease rapidly. January is generally the coldest month with the mean daily maximum temperature of about 22°C and the mean daily minimum about 8°C. During the cold season the minimum temperature may go down to about freezing point of water and frost may also occur when the district is also affected by the cold waves in the wake of the western disturbances.

The crucial air temperature is 6°C. The air temperature at which active germination and growth begin to take place in winter is most useful for crops. The universal climatic elements of greatest significance to agriculture are temperature and moisture. Temperature conditions, express the amount of energy in the environment available for the conversion of minerals and moisture into plant tissue. For the agricultural geographer, the best indicators of regional differences in temperature currently available or easily derived are length of growing season and accumulated temperature above the minimum for plant growth. In Etah the length of growing season and temperature, nowhere are the limiting factors to cropping. Throughout the year, it is favorable for crop-husbandry because the temperature is above the conventionally accepted threshold temperature.

CLIMATIC REGION:

The combined effect of the variations in the fundamental elements of weather (temperature, precipitation, atmospheric humidity, pressure and wind velocity) interplay between the various climatic controls many variations in climate exist, even within a small area or given latitude zone. The climatic studies have tended to become statistical analysis of the observations of individual elements. Because of this, climatology has been regarded in some quarterly as nothing more than statistical meteorology. Climatic classification has
a number of advantages both to the geographer as well as to the
scientist actively associated with other aspect of our natural
environment such as soils, plants life, animal life and the
configuration of land surface. By identifying climatic types we are able
to predict various associated visible aspects of the environment. It may
also enable the geographer to predict the climate of a region through
his observation of the vegetation, animal life, soils or land forms.

In order to achieve a rational quantitative classification of
climate of the district under study, definite and distinctive break
points are discovered in the climatic series. No such break points exist
in data either of precipitation or potential evapotranspiration. Both
run in continuous series from very low values to very large ones. But
when they are taken together, there are some distinctive points.

The climatic region of the Etah districts is based on the
relationship between moisture and heat, and tries to know whether a
climatic region is moist or dry and warm or cold and there is seasonal
variation whether the climate is moist in one season and dry in
another.

THE MOISTURE FACTOR:

Since it is not possible to know whether a climate is moist or dry by
knowing the precipitation for this, it has been calculated whether the
precipitation is greater or less than potential evapotranspiration. To
know whether there is surplus or deficit of water in the region
moisture index has been calculated. It is apparent that the actual
evaporation and transpiration from the soil is not what must be
compared with precipitation in order to obtain a moisture index, but,
rather, the potential evapotranspiration. Where the precipitation is
exactly the same as the potential evapotranspiration and water is
available just as needed, there is neither water deficiency nor water
excess, and the climate is neither moist nor dry. Where water deficiency becomes larger with respect to potential evapotranspiration, the climate becomes arid; where the water surplus becomes larger, the climate becomes more humid (fig. 1.7 surplus & deficiency of water).

The moisture index is calculated on the basis of following formula.

**Moisture index (Im)** = \( 100S' - 60Q' / PE' \)

Where \( S' \) is the surplus of water

\( Q' \) is the deficit of water

\( PE' \) is the water need or potential evapotranspiration, which calculated on the basis of following formula. And adjusted through the table and nomogram.\(^{10}\)

\[ e = 1.6 \left( \frac{10t}{I} \right)^a \]

where \( e \) = monthly evapotranspiration.

\( t \) = mean monthly temperature in °C

\( I \) = summation of 12 monthly heat index \([t/s]^{1.514}\)

\( a \) = further complex function of I

The whole of the district falls in the category of semi arid (d) type of climate. The precipitation data taken from all the four station (Etah, Kasganj, Aliganj and Jalesar) of the district shows a little variation owing to the plain topography and interior location of the district, consequently moisture index also shows a little variation.
Table-2.2

<table>
<thead>
<tr>
<th>Station</th>
<th>Moisture index</th>
</tr>
</thead>
<tbody>
<tr>
<td>Etah</td>
<td>-31.7</td>
</tr>
<tr>
<td>Kasganj</td>
<td>-30.21</td>
</tr>
<tr>
<td>Jalesar</td>
<td>-35.02</td>
</tr>
<tr>
<td>Aliganj</td>
<td>-27.6</td>
</tr>
</tbody>
</table>

In figure-1.7, representative stations show the whole of the district has a moderate water surplus. There are two months (July and August), which have surplus of water. The summer concentration of the thermal efficiency in the district displays a mega thermal (a) type. We can say that summer concentration is of full mega thermal (a) climate. Table-1.3 shows, the water need, in the first column, is, of course potential evapotranspiration. column gives the percentage that summer potential evapotranspiration is of the annual total. The column labeled “surplus as percentage of need” gives the humidity index and that labeled “deficiency as percentage of need” the index of aridity.

The district have (DA'wa) is semi arid, megathermal with moderate summer water surplus and a temperature efficiency is normal to megathermal (Table 2.3).
DISTRICT ETAH
AVERAGE MOISTURE BALANCE
ON SELECTED STATIONS

INDEX
- SURPLUS OF WATER
- DEFICIT OF WATER
- RAINFALL
- P.E.

Source: Calculated on the basis of Thonthwait's Formula

Fig-2.7


NATURAL VEGETATION:

As the natural vegetation is the representation of the totality of climate of any region, the natural vegetation of the district Etah is dry deciduous type. There are two forest blocks in the district Etah, under the forest department namely senthri (65.5 hectare) and Sheetalpur (89 hectare). Land measuring 1013.96 hectare along the canal banks has been afforested 423 km. of road sides avenues have been planted.

*Dhaka* (*Butea monosperma*) trees are commonly seen in patches especially, in Azmnagarh, Pinjery, Daryaganj, Rampur, Arjunpur, Sidhpur, Utoma, Sikhra, Pachlana and Sirsa. *Babul* (*Acacia arabica*) is found most in *usar* land.

Under the scheme of road side avenues plantation program, *shisham* (*Dalbergia sissoo*), *Jamun* (*Syzygiumcimini*), mango, *Kanjji* (*Pongamia pinnata*) and *Eucalyptus* have been planted in recent years. The other common trees found in the district Etah are *neem*
The long coarse grass called gandar is found along the Ganga and Burhgang river. The longer and stouter reeds, called senta used for making chicks and thatching are also found in the district. The khas (Zizamodes) grass is also found in the swampy ground. The mum (Saccharum munja) is commonly met within low lying areas and patera (Typha elephantina) is found in wet and water logged tracts. The other grasses found in the district are dab (Desmastachya bipinnata) and siru (Imperata cylindrica). The under growth is chiefly composed of arusc (Adhatod vasica), hins (Capparis zelenica), karaunda (Carrissa spinarum) and makoya (Ezyphus ocnalapia).

THE SOIL:

At the beginning of his work on political Geography, Ratzel made a far reaching statement: "Jeder Staat ist ein Stück Menschheit" (every nation is a bit of soil and humanity) (Quoted by Jasbir Singh. 1976). Therefore no student of civilization forgets for an instant the fundamental importance of the soil. It is the source of practically all man's food, clothing and an ever increasing list of other needs. So much so that man gets nearly all of its food from the soil, less than one percent of what he eats being fish (Person and Horpes, 1945). Top soil or the upper layer having an average thickness of about 20 cm. in the principle feeding zone of the crops; provide food for human ingestion or livestock feeds.
Despite all the great advances in manufacturing, agriculture is still the world's most important primary industry - a fact often neglected, through appreciated in all historic, or economic crises. Such considerations apart, even now about 66 percent of the global population comprise farmers, deriving their living directly from the soil. Geographical investigation of soil characteristics in agricultural geography is of great significance as geography is human ecology (Putman, 1967) soil characteristics particularly physical, help to know about the distribution of crops and the section of the soil for specific crops: this may be called the selective rather than 'prohibitive' influence of the soil.

There is no resource more important to the district Etah than soil. Whatever are its production capabilities, and however quite unjustly and grossly mined, the soil as a medium of crop growth has furnished directly and indirectly a significant share of the income of the state. Therefore the soil resources must be used in such a way that they are conserved and not exploited; exploitation can mean soil destruction and depletion through erosion and over-use. Soil exhaustion and depletion may increase rapidly in the near feature because of undemographic exploitation. The expansion of cultivation can be achieved by the agricultural colonization of the cultivable wasteland, which is limited. Hence, the available soil resources need to be conserved and carefully used.

Differences in soil fertility, of course have the greatest impact on agricultural land use but after elements such as limited use of modern technical inputs, traditional settlement patterns and marked competition from the adjacent areas may also be relevant. The distribution of soils strongly affects the pattern of distinct land use intensity and agricultural land use occupancies owing to limited progress made in biological and mechanical form production.
techniques, specially the restricted use of chemical fertilizers and hybridized seeds. However, where higher level of agricultural techniques has been achieved with intensification and mechanization, the modification of inherent soil characteristics have been accompanied by a diminution of soil fertility (Jasbirsingh, 1976).

SOIL CLASSIFICATION:

For the purpose of assessing and settling land revenue, the soils of the district were classified in the beginning of the present century. This classification has generally closely adhered to the traditional, local distinction of the soils and the same hold true even today. The most highly rated soil is the rich and well-manured belt immediately surrounding the village site, known as gauhan. In the western Parganas and second zone outside this called the mangha, is recognized. Elsewhere the gauhan was subdivided into two grades. For the outlying tracts the natural division into matyar or clay, domat or loam and bhur or sand, is adopted. There is a variety of rich loam found in the Ganga Khadi, the low lands of the Kalinadi and the Burhganga, generally known as Terai. The most valuable of the Terai soil is the rich, soft loam called by the name of the Katra. Being situated in the Gangetic doab the predominant soil in the district alluvium deposited by the Ganga and its tributaries. The parent material is, in general, calcareous and the native vegetation consists of the shrubs and low grasses. The soils are natural to moderately alkaline and calcareous, and have, sometimes, well developed by accumulation horizon in the subsoil.

In the usar and tracts affected by reh the characteristics feature of the soils in the presence of high content of soluble salts and or high percentage of exchangeable sodium. The calcium carbonate cemented pans are also a common feature of these soils.
Soil survey organization of the state agriculture department conducted a soil survey of the district in 1951-53, according to which the district is broadly divided into five physiographic soil regions, the Gana Khadir, the Ganga Terai the eastern upland, the southern low land and the western upland. Resulting from the influence of water sheds of the Kalnadi. The Ganga and its bed, the Burhganga and the topographical position of the above five regions, five soil association types have been identified which are given in the following table.

### Table-1.4

#### TYPE OF THE SOIL IN THE DISTRICT ETAH

<table>
<thead>
<tr>
<th>Soil Regions</th>
<th>soil association types</th>
<th>Texture Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>(1). Ganga Khadir,Gana Terai</td>
<td>Etah type.1</td>
<td>Ganga loamy soil</td>
</tr>
<tr>
<td>(2). Eastern uplands</td>
<td>” ” 2</td>
<td>Etah loam</td>
</tr>
<tr>
<td>(3). Southern low lands</td>
<td>” ” 3</td>
<td>Uayey loam</td>
</tr>
<tr>
<td>(4). Western low land</td>
<td>” ” 4</td>
<td>Sandy loam</td>
</tr>
<tr>
<td>(5). a. Ganga Allinium</td>
<td>” ” 5</td>
<td>Yamuna sandy loam</td>
</tr>
<tr>
<td>b. Yamuna Allinium</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Source- District Gazetteer 1990

The five soil associations (types) are described as below:

**ETAH TYPE 1 (GANGA LOAMY SIDE):**

The soils recognized as Etah type 1 occur in the tracts located mostly along with the river Ganga approaching Burhganga, which is an intermittent stream flowing in the old and abandoned beds of the
Ganga. The water table in the whole area is high except in places lying on comparatively high lands on the crest of the watersheds.

The soils in these areas are of a very recent origin and have been deposited by the Ganga while receding from south to north. The soils are very light and shallow overlying Pure Ganga sand. They are newly laid out alluviums and soil-forming factors have not yet been able to play their full part in stabilizing very definite horizons. The colour, in general is gray on the surface while lower layers tends to be lighter gray. Texture of the surface soils in general is loamy sand but becomes coarse sandy below. The PH values of these soils vary between slightly to mildly alkaline due to their comparative richness in bivalent cations. Salt efflorescence is noticed in depressed areas near the river where the water table is very high. The salts consist mostly of bicarbonates and chlorides and, unlike the reh deposits found further inland, are only very slightly alkaline. C-N ratio is about 7 on the surface, but decreases slightly with depths.

The water-soluble salts like high carbonates are found in the second and the third layers and also in terraces. Sulphates are conspicuous by their absence. The salts accumulation is, however, noticeable in small depressional pockets near the Burhganga due to a very high water table. The exchange status of these soils is low as expected as light textured soils, but the complex is highly saturated with bivalent cations.

**ETAH TYPE 2 (ETAH LOAM):**

The soils constituting this type are found to occupy the country between the old crest of the Ganga bank in the north and Kalinadi in the south, except for the immediate to neighborhood of soil boundaries and some other interspersed spots. High lying sandy belts also mark the crest of Kali. As the tract between the Ganga cliff and Kalinadi
broadens out the soils improve in texture. In the north west where the tract is narrowest sandy soils predominate and even sand hill formations can be found; while in the south-east where the distance between the two rivers increases, soils with loam texture predominate. Taken as a whole, soils with loam texture with heavier sub soils dominate the area although lighter texture soils with sand deposits can also be found which seems to have been formed as a result of the deposit laid down by sand-borne winds from the two rivers.

The colour of these soils is mostly gray to brownish gray with occasional yellowish tinge in the lower layers. The soils are neutral in reaction except for interspersed depressional areas, not a few in numbers that contain alkaline soils. The soluble salts composed mostly of bicarbonates with some chlorides and sulphates are average to slightly light in the upper regions. Carbonates are absent except in low-lying areas where infestation with reh may be encountered. Total exchange capacity is comparatively high. Calcium accounts slightly more than 50 percent and the rest being accounted for by magnesium. Organic matter is low being only about 0.3 percent and is almost uniformly distributed. Total nitrogen is also more or less uniform, lying between 0.04 and 0.05 per cent except for the bottom layers where it may be slightly less. C-N ratio is in the neighborhood of 10 at the surface falling with the depth. The soils have moderate moisture retentive capacity, the value increasing gradually with the depth. Lime is slightly below 0.5 per cent but is uniformly distributed throughout the pedophile. Magnesium is throughout more than lime and shows displacement from surface to the lower layers.
ETAH TYPE 3 (ETAH CLAYEY LOAM):

The soils belonging to this type are ash gray to dark gray in color depending on the humification of the organic matter brought about in presence of different soluble salts. The soils are clayey loam in texture but at some elevated spots, even loam soils may be encountered and usually attain a cloddy structure. These become very compact and hard on drying and are then rendered difficult to plough. The soils are clayey in upper regions of the profile and the regions lying below may contain comparatively larger quantities of coarse sand. The soils are alkaline, the PH value in the normal cultivated soils being in the neighborhood of 8.5 per cent. The organic matter and total nitrogen contents are average but the C-N ratio is narrow, being of the order of six at the surface and still less in the lower horizons. Lime contents are maximum in layers below the fourth. Magnesia follows an increasing trend up to the fifth layer. It is more than lime in the upper three layers and less than lime in the regions of lime nodulations. The soils in general, are very ill drained but seem to be capable of improvement.
## Table 2.5

THE BROAD DIFFERENTIAL CHARACTERISTICS OF THE ABOVE MENTIONED FIVE MAJOR SOIL TYPES ARE GIVEN IN THE FOLLOWING STATEMENT

<table>
<thead>
<tr>
<th>Particulars/textural name</th>
<th>Etah type 1 (Ganga loamy sand)</th>
<th>Etah type 2 (Etah loam) clayey loam</th>
<th>Etah type 3 (Etah sandy loam)</th>
<th>Etah type 4 (Etah sandy loam)</th>
<th>Etah type 5 (Yamuna)</th>
</tr>
</thead>
<tbody>
<tr>
<td>profile development</td>
<td>Immature</td>
<td>Slightly mature</td>
<td>Mature</td>
<td>Mature</td>
<td>Mature</td>
</tr>
<tr>
<td>Colour</td>
<td>Brownish grey to yellowish grey</td>
<td>Brownish grey to yellowish grey</td>
<td>Ash grey to grey brown</td>
<td>Brownish to reddish</td>
<td>Light grey to grey</td>
</tr>
<tr>
<td>Texture</td>
<td>Sand to loamy sand</td>
<td>sandy loam to loam</td>
<td>Loam to cley loam</td>
<td>Sandy loam to sandy loam</td>
<td>Sandy to sandy</td>
</tr>
<tr>
<td>Concretions</td>
<td>Nil present</td>
<td>Brown nodules present</td>
<td>Kamkar nodules lower layers</td>
<td>Brownish nodules in Nil</td>
<td></td>
</tr>
<tr>
<td>Cemention</td>
<td>Not cemented</td>
<td>Weekly cemented</td>
<td>Indurated below</td>
<td>Not cemented</td>
<td>Subsoil compact</td>
</tr>
<tr>
<td>Consistency</td>
<td>Loose</td>
<td>Slightly hard below</td>
<td>Very hard</td>
<td>Loose</td>
<td>Loose</td>
</tr>
<tr>
<td>Sesquioles</td>
<td>Low: irregular distribution</td>
<td>Average: slightly illuviated</td>
<td>Average very slightly illuviation</td>
<td>Average: marked illuviation</td>
<td>Low: Illuviation</td>
</tr>
<tr>
<td>Lome</td>
<td>Average to high Fused</td>
<td>Low: average below bottom</td>
<td>High: more towards</td>
<td>Low throughout</td>
<td>Average throughout</td>
</tr>
<tr>
<td>Magnesia</td>
<td>Average to high less than lime</td>
<td>Average: more then lime</td>
<td>High: more then lime in the upper</td>
<td>Average: more then lime</td>
<td>Average: slightly more than lime</td>
</tr>
<tr>
<td>PH</td>
<td>Slightly alkaline</td>
<td>Low to slightly high</td>
<td>High</td>
<td>Medium</td>
<td>Medium to high</td>
</tr>
<tr>
<td>Clay</td>
<td>Low: negligible in Lower depths</td>
<td>Low to medium slightly illuviated</td>
<td>High: very slight displacement</td>
<td>Low: illuviated</td>
<td>Low: illuviated</td>
</tr>
<tr>
<td>Drainage</td>
<td>Imperfect</td>
<td>Fair: External drainage restricted</td>
<td>Impeded</td>
<td>Excessive</td>
<td>Slightly restricted</td>
</tr>
</tbody>
</table>

Source: District Gazetteer Etah 1990
The salts consist mainly of carbonates and bicarbonates but also have substantial quantities of chlorides and sulphates of chlorides and sulphates which lend support to the belief that these soils are perhaps intermediary in the genetic development of a solonised phase from the normal zonal soil. The soils belonging to the saline-alkaline group of soils and the good patches only are suitable for cultivation.

**ETAH TYPE 4 (ETAH SANDY LOAM):**

It occurs comparatively on higher elevations, the strip parallel to and adjoining the Kalinadi and in the extreme southwest corner of the district in the Jalesar tehsil. The colour varies from brownish gray to brown tending to be reddish brown and the soils have a lighter texture. Although sand fractions in the profile are small, finer grained sand particles are as much as 83 per cent at the surface. In the lower depth, however, fine sand content decreases with consequent increase in clay contents. Silt also increases from 6.6 per cent at the surface to 29 per cent in the fourth layer after which the value declines again.

The drainage conditions of the soils are extremely good presenting a porous nature, and the water very rapidly drains out both laterally and vertically. The soils have a poor water holding capacity and are neutral at the top and slightly alkaline in lower layers indicating the downward movement of soluble alkaline salts. Organic matter is very low decreasing with depths, becoming almost negligible in the bottom layers. Nitrogen contents are also low, the value being as low as 0.02 per cent at the surface. C-N ratio gradually drops with the depth of the profile.

Lime contents are low, but the lower layers have better lime status than the surface. Magnesia is more than lime throughout. Carbonates and sulphates are practically absent and the entire
dissolved salts consist of bicarbonates and chlorides, the later being very low.

The soils are fertile but stand in great need of irrigation. Good Rabi and Kharif crops are obtained where irrigation facilities are available.

**ETAH TYPE 5 (YAMUNA SANDY LOAM):**

This type of soil occupies the area lying between the Isan and the western boundary of the district. The Isan in fact marks the center of Yamuna and Kalinadi doab and the former river influences areas of this river. The soils, in general, are of a light texture, stiffer and heavier in the subsoil. The well water in this area is brackish and is not suitable for irrigation. The soils are calcareous and consist of soluble salts. Calcareous concretions also found. The colour of the soils is light gray on the surface and gradually becomes darker in the lower depths. The surface soils are sandy in texture, coarse fractions being as much as 83 per cent, subsoil is of loamy nature and water retention capacity is poor. The soils of the entire profile are all along moderately alkaline. Both organic matter and nitrogen are inadequate and the C-N ratio is very narrow, the value ranging between 4 and 2. iron and aluminum oxide show similar trends. Lime contents are adequate throughout the profile and magnesia in general is slightly more than lime. Sulphates are almost absent.

The tahsil-wise distribution of these soil types is as under:

**TAHSIL KASGANJ:**

In the northern boundary of the tahsil along with the Ganga, there is a patch of fresh alluviums parallel to the river and there is a also a belt of loamy sand soil. The soils designated as Etah type 1 are sandy in nature formed by recently laid alluviums and comprise 20.25
per cent of the total land area of the tahsil. The rest of the land area of the tahsil is occupied by mostly Etah loam or Etah type 2 and comprises 70.75 per cent of the tahsil area. Some patches containing Etah clayey loam or Etah type 4 soils are also found in the middle of this tract and a patch of Etah sandy loam is found near Kasganj town. The soil type covers nearly 5.10 per cent of the total area of the tahsil.

TAHSIL ETAH:

The bulk of the soil found in Etah tahsil consists of Etah clayey loam or Etah type 3, which forms the entire southern boundary of the tahsil comprising about 70.80 per cent of the area. The soil northern portion of the tahsil beyond. Etah town contains Etah sandy loam or Etah type 4 soils and comprises about 20.25 per cent of the area. There is belt of fresh alluvium deposited near the northern boundary comprising 5.10 per cent area designated as Etah type 1 soil.

TAHSIL ALIGANJ:

Tahsil Aliganj is situated near the north-western boundary of the district and the pattern of soils is similar to that of Etah tahsil. In the northern portion of the tahsil along the Ganga, fresh alluvium is found in a belt. Below this belt, in the southern side, loamy sand soil is found. The Etah loamy sand or Etah type 1 soil is to be found in about 40 per cent of the total area of tahsil. Towards the south-west side there is a belt of Etah sandy loam or Etah type 4 soil covering not more than 10 per cent of the tahsil area. The rest of the tahsil is formed by Etah loam or Etah type 2 soils up to the boundary of Mainpuri district. There is an interzonal patch of Etah clayey loam or Etah type 4 towards north-west side of the tahsil near Aliganj town.
TAHSIL JALESR:

Jaleasr is the southernmost tahsil of the district and is surrounded by Aligarh, Agra and Mainpuri districts. There are only two types of soils found in the tahsil. About 50 per cent of the area in the northern part of the tahsil is covered by Etah clayey loam or Etah type3 soils. In the south of the tahsil there is Etah sandy loam or Etah type 5 forming about 50 per cent of the tahsil area.

In the alluvial tract of Uttar Pradesh, in which the district is situated, there are vast lands lying unsuitable for cultivation. There are saline, alkaline or user soils and there occur interspersed in between, loam, clay loam and sandy loam alluvial deposits. The soils form about 5 per cent of the total cultivated area of the district. Such soils are mostly found in Awagarh and Jalesar areas of the district though they are also found in Kasganj, Etah and Aliganj tahsils.
Reference:

1. Krisna, M.S. (1960), Geology of India and Burma, p.-573