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O B I T U A R Y

EDWARD THEODORE DEAN

To the deep regret of his friends and the students of Geography in this country, Mr. E. T. Dean, Editor of the Pakistan Geographical Review, breathed his last on June 15, 1951, after a long period of heart disease. Professor E. T. Dean was Head of the Department of Geography, Forman Christian College, Lahore, and was associated with teaching in the University Geography Department. He was one of those few persons through whose sincere efforts the subject of Geography was started in the province of Punjab. Professor E. T. Dean's sad demise is a great shock, apart from others, to his students. He imparted knowledge to them in his sickbed until a few hours before his death. His functions as a teacher were both a labour of love and a sincere discharge of duties. He was the author of several books on various branches of Geography. In him the University Geography Department has lost a sincere friend and an able and experienced teacher.

COTTAGE INDUSTRIES OF MULTAN

BY

MISS KANIZ FATMA

The Cottage Industries of Multan are the combined effects of its peculiar climate, soil and various cultural influences, to which the town has been subjected during its chequered past. The various industrial uses, to which its indigenous raw materials have been put, have hardly a parallel in any other district of the Punjab (P).

CLIMATE

Climatically Multan is a part of the Thar Desert. Being an inland station amidst a vast stretch of sandy area it suffers from ~~extremes~~ of temperature. Both diurnal and seasonal ranges are high, the highest in the Punjab. The average range of temperature is 40° F. (seasonal as well as diurnal) but that does not convey a true idea of the extremes experienced in Multan. Summer average temperature is 100° F while the maximum may rise to 118° F during the day. Winter average is 55° F, but the minimum nocturnal temperature may at times fall below the freezing point especially when anticyclonic waves from Turkistan and Caucasia sweep over the area. Such spells of cold weather occur during January and February. Occasionally cold waves bring about January conditions in March.

Rainfall is 7" in all, both summer and winter. During summer the Multan region is a centre of low pressure. The Bay of Bengal Monsoon brings moist winds. Since relative humidity is very low, the high capacity of the air mass over Multan does not lead to condensation and precipitation. The Arabian Sea branch sweeps north-east ward and Multan lies in a sheltered area. Whatever moisture reaches this area rises up convectionally and results in heavy showers, which deposite the total precipitation in two or at the most three rain storms. Hence summer rains are deficient, variable and uncertain. Winter rains are due to temperate depressions from the Mediterranean sea. Total amount is slightly less than summer rainfall, but low temperatures make it of better climatic and hence economic value.

Paucity of rains during summer coupled with high temperatures, results in local whirlwinds. They reach their climax during June, July and August, but the season starts with the advent of summer and lasts till the end of September. Their frequency has led to a fable. A man once remarked to

his friend that there were too many dust storms in Multan. The friend replied, "No! there is only one which lasts from April to September." On the average there is one storm everyday between 4 to 6 p. m. but the whole day long a fresh breeze keeps on blowing. Some of these storms are terrible. They uproot trees, demolish small house, blow off thatched roofs. Birds are smashed against trees and are killed. Atmospheric electric discharges occur during these storms, though there may be no rain. This is due to ionization and accumulation of electrostatic charges high up in the air where moisture is carried and split up by strong convectional currents. Thunder and lightning are the natural consequences of this phenomenon. Due to canals and resultant vegetative growth, there has been some modifying influence on the climate. It is said that some 50 years back temperatures were higher and dust storms more frequent than today.

INDIGENOUS RAW MATERIALS

Climate provides two main raw materials. One is Khajji, and other is camel skin. Stunted trees and bushes form the natural vegetation, but near about water courses deciduous trees and date palms grow in abundance, the latter providing the inhabitants with leaves and branches for various products. Camel breeding and camel rearing is naturally the main occupation in this sandy district. Camel skin was and is an important indigenous raw material. In the past it was used for the making of household necessities, but now camel skin work has attained the height of fine art and perfection.

Another raw material for Multan Cottage Industries is the fine-grained clay spread by the ever changing courses of the rivers. During historical time the river Ravi has changed its course thrice. Its oldest known course was near Tulumba, when it flowed into the Chenab in a wonderfully straight channel. It then shifted and came near Sidda Canal with ever the more straight course for some 12 miles. In 712 when Mohammad-bin-Qasim arrived, Multan was on the left bank of the Ravi, which joined the Chenab a few miles south of the city. In the third shift the Ravi was 20 miles off Shorkot but somewhere in 1658 it occupied its previous channel. Since then it has been shifting westward slowly. Similarly the Chenab has been shifting west. When Multan was on the bank of Ravi, the Chenab and the Jhelum joined the Indus at Uchh, 25 miles south of the present confluence.

These shiftings have given a thick alluvial coating to the whole district. The clays of these forlorn beds are now weathered aluminum minerals—that is felspar and mica. Limestone generally contains aluminum as Kaolinite. The Multan area is a filled arm of the sea. Basal rocks of limestone are overlaid by Indus alluvium. The present clays of Multan are hydrothermal oxidation of both limestone and clays. Plasticity is due to the size of the

grain and "gell"—the colloidal substance—which is lime. These clays are plastic enough to retain the shape which is given, when wet. Deficiency of silica gives high plasticity and least shrinkage.

These fertile clays produce another raw material and that is cotton. The sticky soils, when fed with canal water, produce rich cotton crop, hence the importance of Multan as a Cotton market and weaving a consequent industry.

Wool is also a noticeable raw material, though little is utilized locally. Multan along with its dry suburbs favours extensive sheep rearing which was and is a prominent occupation for many of the people in villages. More than 90% is exported but the fraction utilized in the city is a considerable amount to feed the Cottage Industry. Agricultural and Pastoral activities have made Multan the most important hides and skin market in West Pakistan.

CULTURAL INFLUENCES

Multan is one of the oldest cities of Punjab. It was an important city when Alexander the Great invaded India. At that time it was inhabited by Malooies. Mooltan is said to mean the land of Malooies. Up to the time of the Arab advent history is so sketchy that primeaval Hindu influence is very difficult to gauge at this stage as it has become evanescent by the Arab and Mughal cultures.

After the conquest of Mohammed-bin-Qasim, Multan remained under the Arabs till 900. This was a period of constant wars, so cultural development remained under a wet blanket. This was followed by a short period of Islamic preaching and conversions. Arabs' downfall was followed by the rise of the Shia community called the Qaramatians. Abdullah Qaramati was their leader. They entered Multan in the 10th century. Mahmud Ghazni's attack could not break their strength. Mohammed Ghori gave it a death blow, though their influences were rooted too deep to be erased completely.

During the reign of the Pathan Kings, Multan was an important outpost of the Empire. It lay on the route from Baluchistan and invaders from the north-west also travelled south along Indus and used to raid the city for its fabulous wealth. Muslim Kings did not have a storg hold on their Hindu subjects and added to it was the fear of the Mongols, Chingaz and Taimur. The Kings in Delhi wanted to keep this outpost as a sort of buffer region for the protection of their capital. The Governor of Multan therefore was a veritable king. This independence of the Governor led to rapid rise and fall of various dynasties. Many a time Multan became an independent democratic state and many a time it fell into the bloody hands of anarchy.

In 1443, Sheikh Yusuf was elected as Amir of Multan. But soon Rai Shera, a prominent Sardar of the Laugat dynasty captured the fort. The Sheikh had to fly to Delhi and Rai Shera became king under the name of Qutub-ud-Din Laugat. There was peace and prosperity during the reign of Laugats. The last of the line was an easeloving luxurious ruler, under whom many Sardars revolted and internal administration became weak. The Arghun Turks assaulted the city and murdered the king. Shams-ud-Din Arghun was proclaimed king, but within a few hours, he was banished by another Sardar. Seeing these tragedies the other Arghun Sardar handed over Multan to Babar, then King in Delhi.

The Mughals also kept Multan as an outpost but the Governors were often royal Princes and the central government was strong. The province now developed in various aspects. Once more this city passed through a period of tumult. After the downfall of Mughal Empire in the hands of Sikhs till in 1849 the English conquered and annexed it to the Province of the Punjab.

In this historical sketch we can distinguish four periods of Industrial and cultural development :—

1. *Arab Period.*—There was free intercourse between Arabs and Multanis. The latter learnt the arts of Polishing, Painting and coloured brick making etc.
2. *Period of Independent Kingship.*—Sardars and petty kings encouraged the making of fancy articles. Khes, Lungies, Daryai cloth are the remarkable handicrafts of this time.
3. *Moghal Period.*— Old handicrafts were refined and new designs were introduced.
4. *British Period.*—This marks a rapid change in the style and design of the goods produced. Camel-skin electric lamps are among the latest products of this period.

The reasons why these industries have been localized in Multan for a long time are :—

1. There have always existed two classes, the rich landlord and the poor artisan. The former demanded fancy goods for the decoration of their palacial buildings, which the latter supplied to share a part of the landlords wealth.
2. The rich were ready to encourage the artist by purchasing the fruit of his labour at a good price.
3. Multan was a commercial centre which facilitated purchase of raw material and sale of finished products.

Present cottage industries are of the following type.

1. Khaffi Works.
2. Earthen Ware.
3. Embossing.
4. Camel Skin Work.
5. Carpet making.
6. Weaving.
7. Wood Work.
8. Making of Oils and Soaps.

KHAFFI WORK

Leaves of the date palm are called Khaffi. They are woven to form baskets and trays. This type of work is carried on by women in almost every house. Extraordinary use of Khaffi is weaving of one inch broad ribbon which is used for knitting Charpayes. Ropes are also prepared—an inferior substitute of jute ropes—to be used for the striging of beds as well as for drawing water from wells. Another product is matting which employs a considerable number of workers. Mats are used in various ways, by the poor to sleep on, to line ceilings, to serve as curtains for protection from summer heat and winter cold, by the rich to spread on floors strewn with wet sand—a method of keeping the rooms cool in summer which even in these days of electric fans is still in vogue—or to spread under carpets to protect them from whiteant. The stem of the palm leaves are not wasted. They are split into finer sticks to be made into 'chicks', which are in no way inferior to the bamboo chicks made elsewhere in West Pakistan.

EARTHEN WARE

Making of glazed earthen ware is perhaps the most ancient art of Multan. It is very difficult to trace its origin, though it may be said to be the result of Sindhi and Persian influence. Similarity of the work to Iranian and Syrian work goes to prove that the Multanis learnt it from Muslims in the times of Abbasides. At first coloured tiles were made to embellish mosques and tombs but a later development was the preparation of vases and pottery of great beauty and charm. The usual colours employed in the past were blue and greenish blue. This combination is locally called "Astari". Today other shades are also used. Light blue, Pink and green floral designs are often laid on a mustard background. This combination is called "Hala", a colour scheme that has been recently borrowed from the Sindhis.

Glazed clay is prepared in a lengthy process. Limestone is grounded and mixed with Soda in the ratio of 1:2. This is kneaded into big balls which are dried in the sun for a fortnight and bleached to a whitish grey colour by firing.

Cold water is poured on the hot balls which crumble and are ground once again with various chemicals. The final shape is given on the potter's wheel. Painting and varnishing are done by "Kashigars", who are too conservative to impart a knowledge of their art to others. A few years back a "Kashigar" was sent to the Mayo School of Arts, Lahore, to teach this art to the students. He remained faithful to the family tradition and never taught the real thing. So the art descends from father to son as a secret. Before the first World War, the products of glazed clay were in great demand even in European countries. After a few years setback the industry is again flourishing though natural kaolinite clays are used now. Vases of different shapes, flower bowls etc. have a fair market in and outside Multan.

EMBOSSING

It is said that some 400 years ago a goldsmith named Nautu invented embossing in ornaments and utensils like bowls, dry fruit plates etc. Embossing is done by means of dies. The designs are stamped on silver or copper in which gold inlay work is done, and filled with different colours for further charm. Highly attractive floral designs are worked in stages. The industry needs time and skill of a high order. Before partition Multan supplied charming specimens of this exquisite art to the whole of the sub-continent under the management of Hindu capitalists. The present trend is towards making of cheap articles of everyday use—buttons, studs and drawing rooms decorations. The finer and more expensive forms are fast disappearing and it will not be long before they cease to be produced altogether.

CAMEL SKIN WORK

For long the use of camel skin was confined to oil skin and beddings. Some 60 years ago when papier-mache work became known to Multanis, they learnt to use camel skin for the same purposes. They shaped it into vases of all sizes and forms, flower pots, bowls etc. The sever transparency of camel skin enabled it to be utilized for the making of electric lampshades and holders. Coupled with charming designs in Multani painting, the skin industry finds in its modern form a flourishing market in the whole of West Pakistan. New floral paintings, scenes and combinations of colours are introduced everyday.

CARPET MAKING

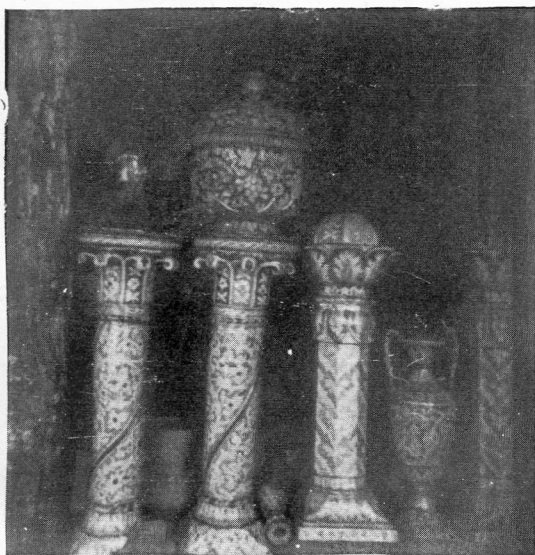
During the reign of Pathan Kings, Multan was a trade centre for carpets from Turkey and Iran. This induced the artisans of Multan, where cotton and wool were easily available raw materials to start a carpet industry of their own. A finer thread was prepared by mixing cotton and woollen fibres and textures woven from these were of high durability. They suited the taste of Multanis but were not liked by Europeans. So this industry of Multan was



CAMEL SKIN WORK



Embossing



purely local. In early 20th century it suffered a setback as Amritsar carpets and jute carpets made in jails began to enter the market. With the establishment of an industrial school, the trade revived to a certain extent and carpets began to be made after foreign designs, and displayed in European exhibitions. Since Partition a decline has set in and people seem to prefer lighter floor covering yet the carpets of Multan deserve a better future for their beauty and durability.

WEAVING INDUSTRY

As regards weaving, Multan stands high for the quality as well as quantity of its work. It produces Silk, Cotton and Woollen Fabrics.

Silk weaving developed during the reign of Pathan Kings, when merchants from Afganistan and Turkistan used to trade in Silk. Nearly 700 maunds of silk was sold in Multan every year. Bokhara Silk was the best in quality. To meet the local demand Silk was woven into Lungis, Khes and Daryai Cloth, the latter called "Dhoop-Chhaon" when two different colours were used, one for warp and the other for woof. Different dyes were extracted from herbs. Koochi ripal was renowned for the red dye, which was most appreciated and hence most commonly used. Silken Lungis and Dupattas which were fancied by the rich had very often gold and silver thread inter-woven along the margins. Silk Khes were also greatly priced. They were matchless as regard design and colour. But Japanese and English competition destroyed this industry. These costly goods could not retain the market against the huge imports of rayon yarn and fabrics. Multan does prepare Silk Khes and other fabrics even today but the silk used is artificial and the stuff produced is inferior to the old.

Cotton and rayon goods are in great demand. From very rough Khaddar to Fine Satin are produced. Hand looms are working in numerous houses. They utilize handspun thread and the coarse cloth produced is used by farmers and labourers. A better quality Khaddar called "Markeen" is also woven from imported yarn.

Since Multan is a Cotton Market export of raw cotton leads to import of yarn which facilitates development of the cotton textile industry. Since handloom cloth is not as fine as imported mill cloth, there is a natural tendency to produce other than Suiting and Shirting fabrics.

The favourable circumstances mentioned above have led to the establishment of several small companies :—

1. Gultex Fabric Company.
2. Taj Company.
3. Mumtaz Company.

Gultex founded some 25 years ago is the oldest establishment. Earlier products consisted of Cotton Khes and Markeen. These were followed by bed covers and bed sheets. Today a great variety of articles is prepared, Duries Khes, bed covers, bed sheets, table cloths, pillow cases, towels and curtains. Some 500 men are employed. There is considerable specialization of labour. There are separate departments for warping, weaving, dyeing and finishing. Sewing machines are working for the making of bed covers, table cloths and pillow covers. Grey goods are washed and then put up for sale. A few decades back, the yarn used was all imported but now cotton yarn and some silk is available locally. Average daily consumption is 5 maunds. Finished goods are fine enough to compete with similar goods from foreign countries. There is a tendency to revive the old Silk Khes manufacture as well as to produce Suiting and Shirting Cloth. The advent of 1950, marked the production of Staple and Satin both coloured and white. Before the second World War, Gultex products were sent to America. The war caused an interruption but it is hoped that Multan will soon begin to export these cotton products again.

Following Gultex other companies have also started working. The Taj and Mumtaz Factories are turning out bed sheets, bed covers and Khaddar of various designs. The future of the Cotton Textile Industry of Multan is promising due to certain natural factors :—

1. Multan is a huge Cotton market.
2. The demand for yarn is heavy for Cottage Industries.
3. Weaving has been an old occupation of Multanis hence the availability of cheap skilled labour.

If textile mills are set up in Multan, Pakistan will reap many advantages. Raw Cotton will be utilized in the Country. Work will be provided for hundreds of people. Cottage industries will get cheaper yarn at home. At Muzaffarabad a big mill has been recently established. So far it produces yarn only but the plan is to prepare Cotton Cloth as well.

Woollen goods are also produced in Multan but this industry is yet in its infancy. Woollen Yarn is spun locally for rough blankets. Recently Gultex Company has taken a forward step by using finer yarn to prepare shawls of a desirable texture.

WOOD WORK

Like other local industries wood work catered to the demand of the upper classes for carved doors and other domestic furniture. In time the artisans passed from takht and bed posts making to high class modern pieces. Today every kind of furniture required in modern homes is available in Multan, but the carving of bed posts and lacquering them according to local taste is still as important as it was some 100 years ago.

OIL AND SOAPS

These two products are of every day use. Multan was a secluded place and had to own civilization. So the preparation of oils and soaps is a speciality. Local scented oils have a good reputation, especially the rose oil, coriander oil and anwala oil. The making of tin flasks locally called "Kuppies" is a complementary industry as Multan oils are sent all over the Punjab. Similarly soaps of various kinds are made for local use, which are of better quality than most other Desi Soaps. They produce richer lather and can remove grease easily.

Cloth Printing is another industry but printing by dyes is better developed in villages rather than in the City proper. After Partition Chintz printing has been started on modern lines.

The above sketch shows that there are vast possibilities for industrial development in Multan. Given proper encouragement the place can grow into a great manufacturing centre, and so contribute to the prosperity of its inhabitants as well as to the wealth and welfare of the nation at large.

STRATEGICAL IMPORTANCE OF KASHMIR TO PAKISTAN

BY

KHALIL ULLAH KUREISHY

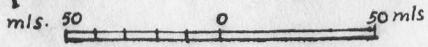
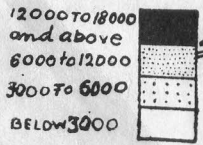
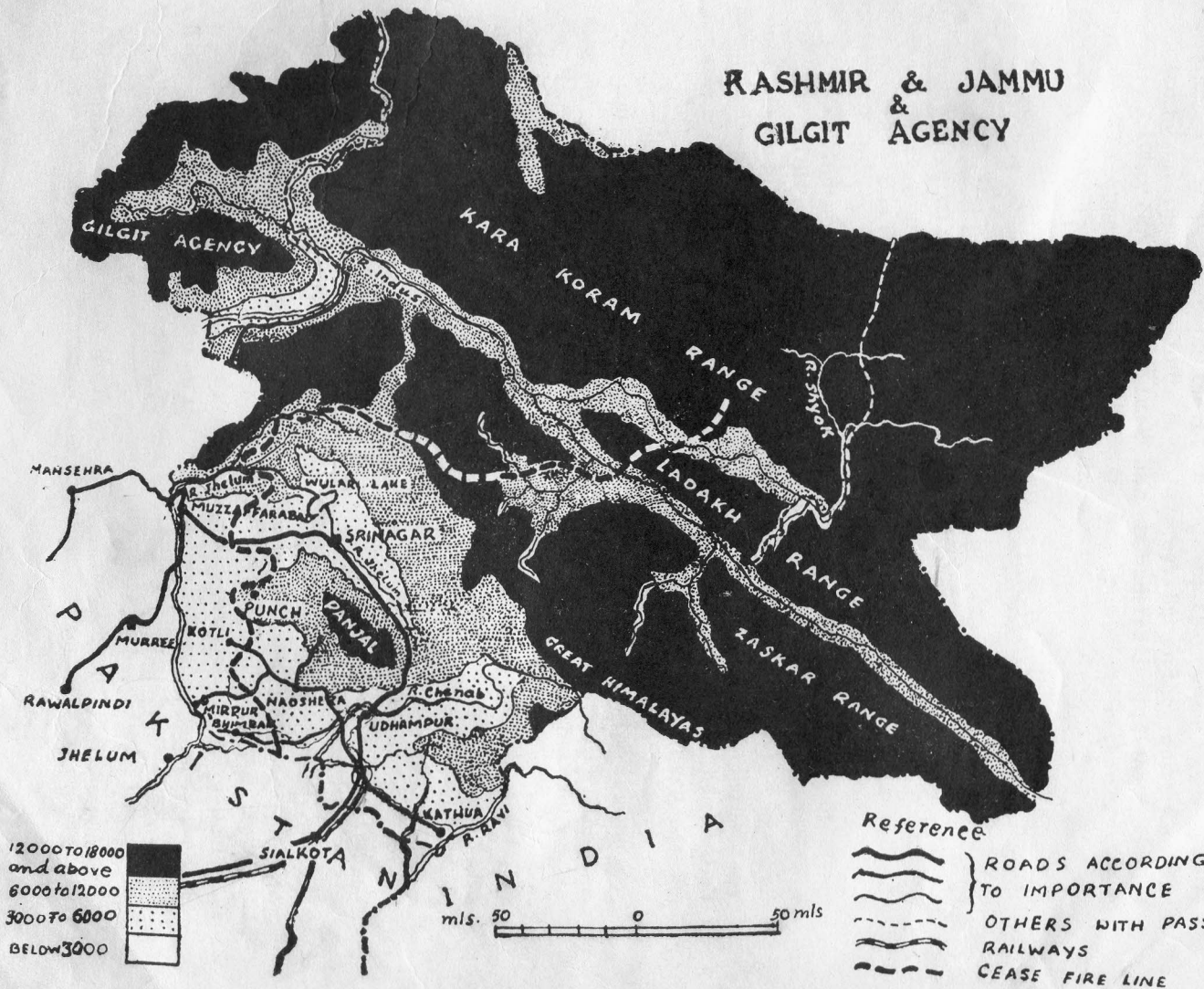
Boundary line

The peripheries of a state are real indices to its vigour or weakness. If one sticks to the old concept of the 'personality' of a state, border areas are the regions where traces of growth or decomposition are best manifest. No power can, therefore, ever afford to be indifferent towards its frontiers. So is the case with Pakistan.

The very fact that the area of Kashmir (84,471 sq. miles) is bigger than that of the biggest province of Pakistan, is quite significant. Strategic and political considerations are important still. The peripheric location of the territory, its hydrographic control on West Pakistan, the naturalness and invincibility of its defence lines, the contact which it enjoys with the big powers of Asia and its richness in men of quality, are factors which determine its very vital importance. (S)

Kashmir is a zone of insuperable natural defences. It seems nature has taken extra-special care in fortifying the region by at least five massive mountainous defence lines fencing in three valleys which are floored with rivers and which act as fosse. The Jhelum, the Indus, and the Shyok are buttressed by the Pir Punjal, the Great Himalayas, the Zanskar, the Ladakh and the Karakoram ranges varying in altitude from fourteen to over twenty thousand feet above sea level. All along the length of the northern rampart of the sub-continent the Himalayas are not so distinctly divided into well marked ranges as they are here. Similarly nowhere do they attain such a width as they do here. The entire history of the sub-continent bears testimony to the impregnability and the invincibility of these barriers. All the countless hordes from Central Asia who came to the rich lands of the Indo-Gangetic plains followed the route from there via the Oxus to Afghanistan and thence to the sub-continent. Some of them are believed to have started from points far to the east of Samarkand. In early mediaeval times the Chinese pilgrims to India were also compelled to avoid the shorter route through Kashmir and to follow the much more circuitous way through Afghanistan. The utilisation of the Khyber and other passes in the western off-shoots of the Himalayas in the later period of history also throws ample light on the impenetrableness of the Kashmir maze of mountains and valleys.

RASHMIR & JAMMU & GILGIT AGENCY



- Reference
- ROADS ACCORDING TO IMPORTANCE
 - OTHERS WITH PASS
 - RAILWAYS
 - CEASE FIRE LINE

Just as these mountain ranges are of positive value in safe-guarding the security of Pakistan from any attack on this side of the State, negatively they are equally dangerous in harbouring the enemy if they belong to any foreign power. Unlike the plain boundaries the mountain borders act as an 'iron curtain'. Any manoeuvre on the other side of the border can be easily detected by our intelligence units in plain areas but on the contrary a lot of military activity can go on un-noticed and unhindered behind the 'screening' ranges. The annexation of Kashmir by any power other than Pakistan, therefore, means a strangulation of our State.

CONTACT WITH OTHER ASIAN POWERS

ent' contrary to received opinion
or Paradoxical though it may seem it is quite credible that inspite of its immunity to an attack from outside the sub-continent, the territory of Kashmir does not suffer from isolation. On the other hand it is the meeting place of five powers of Asia viz. India, Pakistan, Afghanistan, China and Russia.

With India the boundary of Kashmir runs for a distance of about 250 miles. This numerical expression is, however, misleading as the region of contact is too hilly, having an altitude of more than 15,000 ft., to be considered as conducive to any inter-relations. Only a stretch of about 20 miles is really passable and that too with difficulty. The difficulties entailed in the construction of Kathua Road across the Ravi bear out this assertion. Even after all these troubles it serves only as a military road which is susceptible to an easy attack from Pakistan in case of War. There is no alternative line of communication and supply. The only link between India and Kashmir is like the stem of a tree which when once cut the whole tree with all its branches of campaign ramifying through Kashmir is doomed to suffer a magnificent fall. The cutting of this Indian life-line only means the entrapping of the entire forces inside Kashmir. Nor can it manage to escape that fatal 'psychological dislocation' which is a natural corollary to entrapment. In defending this trunk road the Indian armies can be easily put on the 'horns of a dilemma' as there are more than one approaches to the line—through the Ujh Valley to Jasmergarh, through the Degh Nulla to Samba and through the Sialkot-Jammu Tavi Road—all avoiding Indian territory.

All these approaches to the Kathua-Jammu-Srinagar road are more or less transverse signifying that the defenders of the road will have to fight parallel to their line of retreat which is a definite strategic and tactical disadvantage. The vulnerability of the road is further accentuated by the fact that any forces, stationed in the pocket to the north-west of the Beas outside Kashmir are not strategically well disposed as there is very little freedom of movement for these forces to move outside the pocket for defence purposes. These are the drawbacks which render the link between Kashmir and India

impracticable even for military operations. On any showing, it does no promise to become a commercial highway in near or distant future.

Whatever nominal contact India has with Kashmir is almost brought to nought owing to the peculiar disposition of the surface features of the latter region. Even a cursory glance at the configuration of Kashmir reveals that the natural orientation of the State is not towards India. It is away from India. The lines of least resistance—valleys etc.—not only predominantly but wholly run from east to west and nowhere from west to east. This orographic set up results in rendering the greater part of Indo-Kashmir frontier as inaccessible. Nevertheless, Kashmir is not altogether cut off from India in so far as it can feel the pulse of events in that country through whatever opening Sir Cyril Radcliffe has curiously provided by allocating the district of Gurdaspur to India.

The Tibet-Kashmir boundary is almost as long as that of Indo-Kashmir and is equally or even more prohibitive than the latter for purposes of any organised mass movement. The sparse population of Tibet, the irregularities of its terrain and above all the hostility of climatic conditions are all almost deterrent to any military movement from across this border.

The boundary along Sinkiang and Russian Turkistan though about 500 miles long is also not fit for military activities. The upper Shyok and the Hunza are the two transverse valleys on which depends the accessibility of Northern Kashmir from Chinese and Russian Turkistan respectively.¹ The valleys afford difficult access as they are not even snowed up owing to the too much dry climatic control.

The route from Srinagar through Zojila and Karakoram to Yarkand in Chinese Turkistan crosses no less than seven passes and forces its way onward in spite of the natural impediments, obstructed by landlips and rocks, diverted by unfordable rivers, swept by avalanches, exposed to the fierce sun in shadeless ravines and to biting gales on shelterless plateaus². Eastward from Srinagar the road runs viz Zoji-La to Leh in Ladakh for a distance of 252 miles. Zoji-La is at the top of the Valley of the Sind river which is a tributary of the Jhelum. As the lofty ranges in which it occurs are an effective climatic hydrographic and economic barrier a traveller through the pass comes across radically different scenic and environmental conditions on the two sides of the pass.

The route from Zojila to Leh proceeds to the Suru Valley towns of Dras and Kargil where proper bridges carry the road across the river. After Kargil the easterly route crosses the Indus at Kalatze where the river is ferried.

1. Lyde L.W., The Continent of Asia, p. 370.

2. Neve, Picturesque Kashmir, p. 105.

Beyond this point the route lies in a west to east direction clinging mostly to the northern bank of the Indus Valley till it reaches Leh—the capital of Ladakh. It is an important town at the height of 11,500 ft. and is the meeting place of Caravans from Yarkand to the north, Lhasa to the east, Pakistan to the west (*via* the vale) and India to the south (by way of Kulu). The Central Asian Caravans arrive here in autumn when the Bazar becomes busy. "Leh is to Yarkand road what Hong Kong is to the Far East."¹ From here the route turns towards north with many zigzags in it. Along this difficult reach it crosses the mountainous obstacles at two mentionable passes—the Kardongla and the Sasirla till it utilises the tributaries of the Upper Shyok and ultimately reaches the Karakoram pass which is as high as 18,290 ft. Further north-ward beyond the Karakoram the slippery track leads into Chinese Turkistan.

Thomas Holdich has given a picturesque description of the track in these words²—"Mile upon mile a white thread of a road stretches across the stone-strewn plains, bordered by the bones of the innumerable victims to the long fatigue of a burdensome and ill fed existence—the ghastly debris of former caravans. It is perhaps the ugliest track to call a trade route in the whole wide world. Not a tree not a shrub exists, not even the cold dead beauty which a snow-sheet imparts to highland scenery, for there is not great snowfall in the elevated spaces which back the Himalayas and their offshoots."

The hostility of the environment, the severity of climate, the rarity of the atmosphere at high altitudes the difficulty of terrains the thinness of population in the neighbouring countries of Chinese Turkistan and Tibet, all combine to make the route very difficult for the passing of large bodies of troops.³ Nevertheless, it is one of the northern gates of Pakistan through Kashmir which has been kept at least half open by the indomitable perseverance of what may be described as trade. Recently its importance has much increased as the developments in Tibet and the effective hold of Turkistan by Red China have now amply demonstrated the truth of the words of Wendell Wilkie—"Sinkiang is one of the areas in the world, where politics and geography combine to make a kind of amalgam full of meaning to those who are curious about what is going to happen to the world."

The route from Abbottabad north-ward through Kunhar Valley—*via* Chilas—to Gilgit is capable of serving as a strong link between Pakistan and Russia and China through Kashmir. The Babusar Pass at the border of N.W.F.P. and Kashmir is 13,690 ft. above sea level and does not afford much difficulty in transit. The river Indus is fordable at Chilas, and at Gilgit the

1. Featherstone B. K. An unexplored Pass, p. 208.

2. Gates of India, pp 3 and 4 by Thomas Holdich.

3. It should not be concluded from this statement that the pass is impracticable for small armies. A Mangol army tried to traverse the northern most section of the pass with the idea of conquering Tibet but it was destroyed in the way. Similarly in the year 1543, an attempt was made to conquer Ladakh.

route bifurcates into two branches—one following the Gilgit Valley reaches Gilgit Agency and the other leads upto Russian Turkistan through the Hunza. For obvious reasons the route is, upto now, not fully explored and properly utilised. In future too it may not be quite important from purely military point of view but at the same time it is destined to play a significant role in fostering better political relations between Pakistan and U.S.S.R. by making the territorial contact between the two powers more effective. ✓

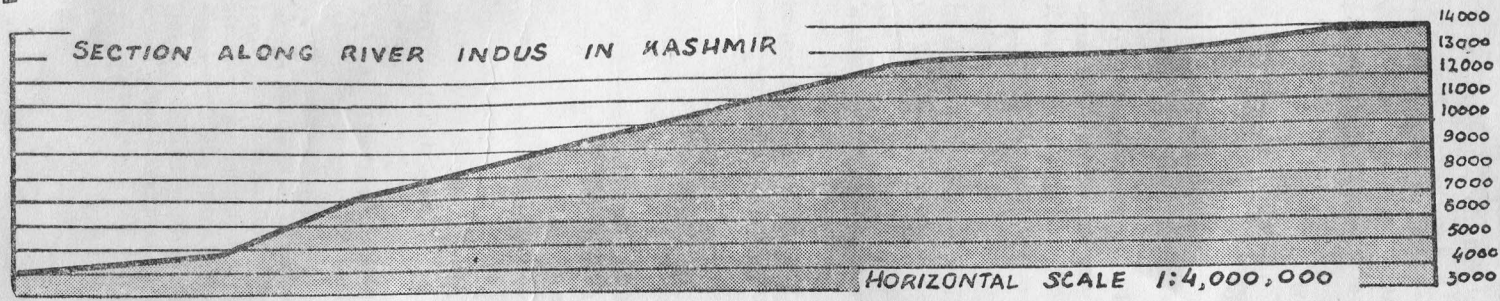
The long superattenuated limb of Afghan territory known as the Wakhan peninsula, which is at one place only 8 miles broad, lies in the north-west of Kashmir. It is too narrow to afford a real contact between Kashmir and Afghanistan and is too mountainous to be effectively garrisoned by the latter power. It can easily be sliced off at a time of stress. It was the creation of British policy to avoid a direct clash between the 19th century Imperialist Russia and British India. It still serves the purpose of avoiding the border clashes between Russia and Pakistan but does not stand in the way of furtherance of the mutual political interests of the two powers, as it just prevents a direct contact between them. The area of Pamir Loop or Taghdambash where the territories of Russia, China, Afghanistan and Kashmir come close to one another merits special consideration. The longitudinal mountains of Bolar or Sarikol run from north to south making a natural divide between Sinkiang and Russian Turkistan. In their southerly reaches they make a favourable detour towards the west before actually reaching the Kashmir border. It is this turning to the west which creates the loop and makes possible for the aforesaid powers to mutually receive and radiate political impulses.

TIES WITH PAKISTAN

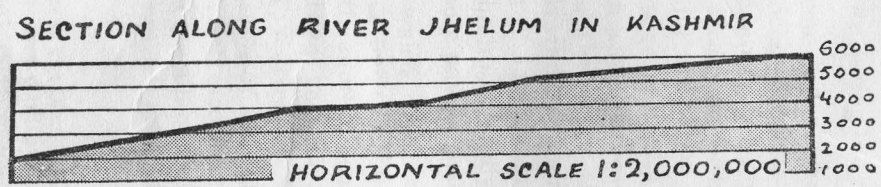
The length of Pak-Kashmir border—350 miles—is not much more than in other cases but it is here that real geographical, economic and ethnographic relationships exist. The innumerable enclaves and exclaves particularly along the N.W.F.P.-Kashmir border manifest the real bending of the two regions. The bends in the boundary are so dovetailed that the two regions seem to have been merged into one inseparable entity.

The orientation of Kashmir is towards Pakistan. The rivers of Kashmir—Indus, Jhelum and Chenab through which flows the life blood of the state—all flow towards Pakistan. Normally rivers are important arteries of commerce and trade but they are particularly so here owing to the ruggedness of surface in Kashmir, where other means of communication are only a few. To a 'mesopotamic' state like Pakistan the sources of the rivers and the upper reaches of the rivers are matters of very great concern and as such Kashmir deserves our fullest attention. It is here, that suitable sites for constructing canal headworks are located. It is here that the rivers can be tamed to control floods by constructing dams across them and it is also here that potential

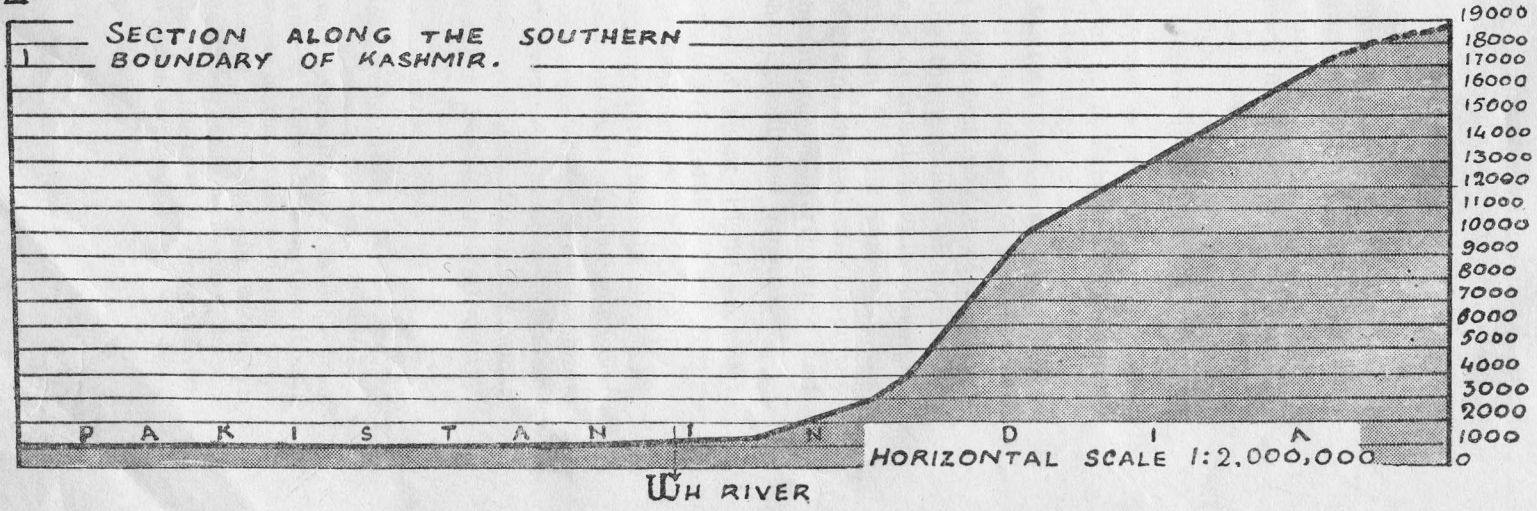
I



II



III



hydro-electric sources lie. If such areas belong to any power inimical to our interests even a change in the course of rivers is not beyond the scope of modern technical perfection.¹

The means of communications of Kashmir also open towards Pakistan. The Sialkot-Jammu Road which extends as Banihal road further inward, the Gujrat-Bhimbar Road, the Jhelum-Mirpur Road, the Jhelum Valley-Route and the Abbottabad-Mansehra-Muzaffarabad road are all links between Pakistan and Kashmir which are too well known to be discussed at greater length here. Suffice it to say that even the artistic impulses for which Kashmir is so much reputed came to it from Iran through these routes particularly through the Jhelum Valley route during the reign of Zain-ul-Abidin.

The economics of Pakistan and Kashmir are so interlinked that their separation through any artificial political alignment is highly unimaginable. Kashmir is deficient in food stuffs. Owing to the ruggedness of terrain and aridity of climate over a vast area, only 4.9% of the total land is under plough. This has resulted in a careful utilisation of every square inch of useful land. In the absence of comprehensive statistics, the intelligent device of 'floating farms' on rivers and lakes with a view to enlarging the expanse of cultivable land, is a sure testimony to the acute shortage of arable land in Kashmir. Naturally, then, Kashmir is dependent upon Pakistan for the supply of the net annual import of about 2 lakh maunds of grains and pulses. Given the requisite amount of food, Kashmir can easily concentrate on horticulture and floriculture which are much more paying than other agricultural pursuits.

The forests of Kashmir which cover an area of about 10,274 sq. miles and which account for about one third to one half of the total revenue of the State can best be utilised for the mutual benefit of Kashmir and Pakistan only if the logs of wood are flown down the rivers opening into this country. The maintenance of Jhelum and Wazirabad as great markets of Kashmir wood will vouchsafe the annual income of more than one crore of rupees to Kashmir people and at the same time will meet the requirements of Pakistan in timber, bamboo and willow ash. The availability of soft wood, fir trees and wood pulp will brighten the chances of establishing paper manufacturing industry in West Pakistan.

1. The diversion of the water of the Chenab is comparatively easier. Two subsequent streams belonging to the Chenab and Ravi system respectively in their natural process of cutting backwards into their common watersheds, have come sufficiently close to each other to the south of Bhadarwah in Udhampur. The construction of a dam across the Chenab near Doda and the tunneling of the distance between the sources of the above said subsequent streams, can accomplish the task of diverting the water of the Chenab into Ravi which meanders in the plains of India before entering Pakistan. A Press communique issued by the Govt. of Pakistan on August 17, 1951, expressed that India has already a project in view which would divert part of the supplies of the Chenab into Indian territory.

The tourist industry which is one of the major sources of income to the Kashmir people and which earns an annual revenue of about Rs. 60 lakhs for the State Government is the gift of Kashmir's contiguity with Pakistan.

In return for what Pakistan can do in order to guarantee a better economy to Kashmir, she can help the former in more than one way. The conservation of vegetable cover on the Siwaliks which mostly belong to Kashmir will be of very substantial help to Pakistan in checking soil erosion and in controlling floods. The Hydro-electric power generated at Muzaffarabad, Jammu and Mohra may be extended to ease the shortage of power in West Pakistan. The Mangla Headworks which in the circumstance of a foreign power possessing Kashmir is dangerously exposed, will be safe in our hands and the supply of irrigation water to 300,000 acres of land in the northern parts of Chej Doab growing excellent crops of wheat and American cotton will be ensured. The huge deposits of a strategic mineral like bauxite in Jammu will be a valuable asset to a country like ours which does not possess enough minerals to spend and to spare.

◀ SOME OTHER CONSIDERATIONS

However strange it may sound but the fact remains that Kashmir which is the hotbed of conflicts today has been a region of enduring peace and tranquility through the ages. This stability and security are mirrored in the high civilisational, cultural, and artistic attainments of Kashmiris. This fact brings into eminence the possibility of constructing an arsenal here as a part of the long range development schemes. The construction of arsenals by Russia to the east of the Urals signifies that such plants are to be erected in the safer regions which are shrouded with top level secrecy on all sides. Much of the Kashmir territory is safe and sheltered but Ladhakhistan is safest. The very absence of walled villages in this part of Kashmir reflects the degree of safety and security of the region. Again, the necessity of establishing a joint Air Force, Naval and Military training centre, focusses one's thoughts at Dal which is the best inland centre for the purpose throughout south-eastern Asia. The scenic beauty and the bracing climate are simply invigorating.

Fantastic and farcical though the cry of Pakhtoonistan is, its tempo has considerably been synchronising with the ups and downs of the changing Kashmir situations. This gives us a clue to the understanding of the nature of the problem. The hold of Pakistan on Kashmir will eliminate the impact of foreign influence on Kabul radio and it will automatically cease parroting His Master's Voice. The unfounded cry will, thus, die its natural death.

In the final analysis comes the most important source of strength of the region *i.e.*, man power. Kashmir, according to the 1941, census is inhabited

by 40,21,616 persons out of which 32,00,000 (about 77.11%) are Muslims, the remaining being mostly Hindus (20.12%). The two religious groups have for long been quite distinct from each other. Their difference are not, however, based on any racial dissimilarities. They are the outcome of a long history of about a century of iron rule by the Hindu minority after the purchase of the territory of Kashmir by Gulab Singh in 1846, for a paltry sum of Rs. 7,500,000 looted from the Lahore Treasury.¹

This protracted period of a tyrannical Dogra rule marked with a policy of sustained exploitation of the Muslims resulted in a stratification of the society into distinct classes of the exploiter and the exploited with all the venom and bitterness that it could entail. Mr. Wingate in his preliminary report of Settlement Operations in Kashmir wrote:

“The revenue system is such that whether the Kashmir cultivator works much or little, he is left with barely enough to get along until next harvest. He is a machine to produce *shali* (unhusked rice) for a very large and mostly idle city population. The secret of the cheap *shali* is because if the price were allowed to rise to its proper level the whole body of Pandits would compel the palace to yield to their demands”.

“The Muhammadan cultivator is compelled to grow *shali*, and in many years to part with it below its proper market rate, that the city may be content. If the harvest is too little for both, the city must be supplied and is supplied with any force that may be necessary and cultivator and his children must go without”.

The social discrimination and the consequent hatred of Muslims against Hindu Raj have made an overwhelming majority of the population look to Pakistan² where their co-religionists and their very blood relations are masters of their own destinies under a flourishing democracy.

Kashmir is a northerly and north-eastern continuation of the ethnographic region of Pakistan, with Muslim preponderance everywhere including

1 “Of this Gulab paid £ 400,000 which he had raised mainly by plundering and murdering British subjects in British territory. While professing the most grovelling loyalty and sincerest friendship for the English, he sent down from Kashmir a native contingent to fight on the side of Sher Singh against them in Chilianwala Campaign, of 1849.... Speaking afterwards of Gulab Singh the Governor General used these words : “He is the 1st scoundrel that ever drew breath, a scoundrel from a kingdom down to a halfpenny”. Lee J.F., Imperial Military Geography, p. 57.

2 J. Fitzgerald Lee wrote in Imperial Military Geography on p. 58 : “When the hurricane bursts over Central Asia the new Republics—all Muhammadans, to a man—will endeavour to see to it that their brother Mussalmans in Kashmir are liberated...” The prophecy came out to be true in Oct. 1947, in a slightly different way when the Muslims of the adjoining Pakistan territory came to the rescue of their oppressed brothers.

Jammu, like a tongue of plains penetrating into mountains—a feature of frequent occurrence in nature. The similarity of cultural landscape on both sides of the Pak-Kashmir border, the heroic display of bravery of the people during the course of the present liberation movement, and the leanings of Kashmiris towards Pakistan are all important considerations from military standpoint.

It is not merely the number but also the quality of people which counts. "In intellect the Kashmiris are perhaps the superior of the natives of India". The artistic skill and excellent craftsmanship of Kashmiris is the outcome of a superb genius. In them are combined the qualities of mind and body. Kashmir has produced the embodiments of physical perfection like Gama, the wrestler, and intellectual giants like Allama Iqbal, the philosopher-poet of international fame. The sway of Iqbalian philosophy of life over Pakistani intelligentsia is complete which means that we already owe a lot to Kashmir. It will be a source of added strength to us—numerical as well as intellectual—when we enjoy that oneness with Kashmiris which is the ultimate aim of all strategy.

NEED FOR THE DEVELOPMENT OF CHITTAGONG HILL TRACTS

BY

NAFIS AHMAD AND A. I. H. RIZVI

Eastern Pakistan mainly consists of alluvial plains. The Chittagong Hill Tracts along with the adjoining area of the Chittagong district, is the only part of the province which has a hilly upland surface. The absence of hills in the rest of the province lends significance to the potentialities of the Hill Tracts in several directions e.g. agriculture, forests, minerals, industry and power development.

The Hill Tracts district lies between $21^{\circ} 25'$ and $23^{\circ} 45'$ N. Lat. and $91^{\circ} 45'$ and $92^{\circ} 5'$ E. long.

The area is bounded on the north by the State of Tripura, on the west by the district of Chittagong, on the east by a similar belt of hilly country, called respectively the Arakan Hill Tracts and the Lushai Hills; the province of Arakan in Burma covers the southern corner.

Physically, the area may be divided into four main river valleys namely, the Feni, Karnafuli, Sangu and Matamuhari rivers and their tributaries. Almost parallel chains of hills traverse the district from north to south with a north-west to south-east trend. Well defined longitudinal valleys are formed by the Sangu and the Matamuhari, while the Karnafuli and the Feni flow transversely across the main lines of the hills. Several large tributaries of the Karnafuli which join it almost at right angles to its course, also form longitudinal valleys conforming to the main trend of the hills. The hills range between a few hundred to a little over 4,000 feet in height. The highest point is Keokradang 4,034 ft. lying on the eastern margin of the district. Other prominent elevations are Rakhamoin Tong (3,017 ft.) and Polytai (2,857 ft.).

Geological information about the region is scanty and there has been lack of a systematic investigation in the years preceding partition. But it is generally believed that the geological formations resemble those of the Arakan Yoma and consist chiefly of sandstones belonging to the lower Eocene of the Tertiary Age.

The area of the district is 5,007 sq. miles but the population was only 247,053 in 1941, giving a density of 50 persons to the square mile. Much

increase has not taken place in recent years. This scarcity of numbers presents an interesting disparity with the general demographic picture in Eastern Pakistan. With an area of 54, 115 square miles, the province's population is approximately 46 million. Excluding the Hill Tracts, therefore, the density rises to nearly 980 per square mile. Several districts have densities higher than 1200 and in small tracts densities over 1500 are common. There are also areas with densities exceeding 3000. Thus Eastern Pakistan is amongst the most densely populated areas of the world.

The Chittagong Hill Tracts have remained so far in the back waters as regards economic development. There is only one town with a population of over 10,000, not a mile of railways, no metalled roads, no factory, industry and no power station. The population is mainly organised in tribal groups and the backbone of the economy is primitive agriculture and haphazard collection of forest produce. Much of the area remains remote and isolated and the general benefits of civilized life are non-existent.

FUTURE POSSIBILITIES

But the Hill Tracts may be said to be Eastern Pakistan's land of promise. If the crude, primitive, and shifting cultivation called 'jhum' is replaced by settled cultivation and the problem of soil erosion is met by terracing the hill sides which are extremely fertile, some of the plain's growing population can possibly be absorbed in the thinly populated areas. What is needed is a scientific approach and a planned effort firstly, to make the Hill Tracts an agriculturally useful area. The valuable forest resources also need proper exploitation.

An extensive geological survey of the region is also necessary before an estimate of its mineral wealth could be made. It is believed that deposits of lignite ranging from moderate to poor quality exist. Limestone, petroleum, iron and iron oxides and other useful minerals may also be found.

Development of Water Power :—Many rivers of the Chittagong Hill Tracts like the Feni, Karnafuli, Sangu and Matamuhari and some of the tributaries of the Karnafuli flow with considerable volume of water throughout the year. Except during the rainy session when water level is much increased, the rivers carry to the sea more or less constant volume of water. There are numerous waterfalls and rapids specially in the upper courses of these rivers. These conditions seem to be favourable for the development of water power projects. On the lines of the Karnafuli project other schemes may be planned. The availability of cheap power might lead to the industrial development of certain areas of the district apart from larger benefit to the province as a whole.

A Plan of Development :—In view of the above consideration it seems necessary that firstly, an assessment of the natural resources of the Hill Tracts should be made as then alone can a development plan be drawn up. But planning is not merely a matter of personnel and ideas but resources and their full appraisal and intelligent direction. It also involves the necessary sanction and authority to support systematic programmes of development. Therefore, the creation of a Hill Tracts Planning Authority sponsored by government would be essential.

The accompanying plan of regional Survey envisages the tackling of a programme of development primarily on a long term basis. But the various steps suggested can be fitted in into a time scale of shorter duration and a considerable amount of preliminary, reconnaissance and survey work can be started immediately to lead to an overall implementation of a plan of development based on the basic information thus furnished.

A SCHEME OF THE REGIONAL SURVEY OF THE CHITTAGONG HILL TRACTS

A PRELUDE TO PLANNING

1. Geographical Background :—

(a) Surface and relief (to be studied with the help of available topographic sheets, 1", $\frac{1}{2}$ ", $\frac{1}{4}$ ") : Though these sheets are out of date with respect to some minor details, yet they are of much use for a preliminary study of the area. Sections should be drawn across several areas to study topographic profiles. Visits to a number of selected areas and stations will be necessary to have a concrete and vivid picture of existing conditions.

(b) Drainage and Drainage Pattern : A detailed study of all the important rivers and their main tributaries is necessary with regard to the following considerations :—(i) Sources. (ii) Supply of water during different parts of the year. (iii) water falls and rapids, if there are any and the possibilities of citing dams and projects and their use for the generation of electricity. (iv) Navigability—possibilities of development of inland transport. (v) Expansion of agriculture in the narrow valleys and on the slopes by terracing—availabilities of surface and ground water.

(c) Climate : Collection of all available data and establishment of a number of new observation stations. (i) Temperature ; Mean monthly temperature of the selected stations, diurnal and annual ranges of temperature. Influence of elevation on temperature, rainfall and other local factors. (ii) Distribution of rainfall. In-

fluence of relief on the distribution of rainfall. Failures of rain, if any, and seasonal variation thereof and their effect on agriculture. (Changes in weather conditions are to be studied with special reference to the seasonal distribution of rainfall and all generalizations to be based on the study of sufficiently large number of stations). (iii) *Wind* : Direction and velocity of wind at the surface and at 1000, and 3000 feet above sea level (average for all months of the year). Influence of summer monsoon on the direction and velocity of winds. Storms, their time and duration, tracks and wind velocities and their influence on settlements and agriculture. Influence of topography and vegetation on winds and on storms through afforestation.

2. *Geology* :

A detailed survey of the geology of the area and the resultant rock formations—their relationship with existing geomorphological features :—

Mineral Resources :

- (a) Present position: (i) Location, e.g. of coal, iron oxide and other useful minerals and non-ferrous deposits e.g. sands and gravel etc. (ii) Types and qualities of minerals already exploited. (iii) Factors determining accessibility, geological and economic. Facilities of transport and power. (iv) Local consumption and export.
- (b) Possibilities of future developments. (i) Location of new deposits of coal, iron, petroleum, and limestone, and sandstone etc. (ii) Estimation of reserves. (iii) Problems of exploitation and transport. (iv) The possibility of an increase in the local consumption of minerals through industrialisation based on the increased exploitation of the available resources. (v) Influence of the development of power on mineral exploitation.

3. *Soils* :

Study of the soils of the area—preparation of a generalised soil map. Classification of soils etc.

4. *Vegetation* :

A survey of the plant life of the area—specially from the economic point of view.

Forest resources (i) Kinds of trees and their possible economic uses. (ii) Chances of improving on nature by cross breeding of different strains or by producing other species which grow faster and have higher resistance to insects and to disease and adaptability to climate. (iii) Experiments with plantation such as tea, Cinchona, teak, Mahogany etc. and their future possibilities. (iv)

Exploitation of the possibilities of the various forest products and their becoming an element in the development of the area for the establishment of cottage industries and future industrialisation e.g. match factories, paper mills, lumbering and sawing etc. (v) Relationship between forests and soil erosion.

5. *Animals* :

A survey of animal life of the area : Existing uses of animal transport and the utilisation of animal wealth (elephant capture, sale of ivory, big game, insects, reptiles etc.

6. *Human Patterns* :

- (a) present population—geographical distribution, density, pattern (types and sizes of communities) nature of rural population (tribes, tribal communities and their social and economic organisation). Villages and towns—Religious groups.
- (b) Other demographic features : (i) Composition by sex, age and family. (ii) Population increase, influx and movement (including influence of migration in pre-war years, war time and post-war periods) and estimates of future population. (iii) occupied population ; especially distinguishing male, female and juvenile employment. (iv) Types of skill, adaptability of labour and the significance of changes of war-time employment in certain parts. (v) Inter-regional movement of labour during war years and post-war and post-partition periods.

7. *Agriculture* :

- (a) Physical background (climate, weather, soil-types and fertility).
- (b) Present land utilisation, agricultural production—home consumption and export of agricultural produce if any.
- (c) Problem of soil erosion.
- (d) Form of land tenure and land ownership.
- (e) Possibilities of increase in the cultivable area and in yield per acre of crops. Possibilities of future technological developments in agriculture.

8. *Cottage Industries*.

- (a) Types and location—chief raw materials and finished products.
- (b) Utilisation and marketing.
- (c) Future possibilities of development.

9. Communication and Transport :

- (a) Present position—(Metalled and unmetalled roads, hill tracks and navigable rivers).
- (b) Possibilities of roads, rail, river, ropeway and air transport.

10. Immigration and Settlement :

- (a) Possibilities of immigration and settlement in suitable areas.
- (b) Establishment of new townships and settlements.
- (c) Citing of sanitoriums and health and holiday resorts.

11. Influence of Power Development on :

- (a) Large scale industry.
- (b) Cottage industries.
- (c) Transport.
- (d) Settlement.

(3) Other demographic features: (i) Composition by sex, age and fertility; (ii) Population increase, influx and movement (including migration); (iii) Population in pre-war years, war-time and post-war periods; and estimates of future population. (iv) Occupied population; especially distinguishing male, female and juvenile employment. (v) Types of work, especially of labour and the significance of changes of working employment in certain parts. (vi) International movement of labour during war years and post-war and post-partition periods.

7. Agriculture :

- (a) Physical background (climate, weather, soil-types and fertility).
- (b) Present land utilization, agricultural production—home consumption and export of agricultural produce if any.
- (c) Problem of soil erosion.
- (d) Form of land tenure and land ownership.
- (e) Possibilities of increase in the cultivable area and in yield per acre of crops. Possibilities of future technological developments in agriculture.

8. Cottage Industries

- (a) Types and location—chief raw materials and finished products.
- (b) Utilization and marketing.
- (c) Future possibilities of development.

DISTRIBUTION OF FORESTS IN SIND

BY

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The nature of vegetation and its distribution is mainly governed by the climatic factors. Sind is included in the arid zones of the world. For its climate, therefore, there could not be any thing but the vegetation of the scrub thorny type with stunted growth. But local variation, mainly on account of nature of the soil and availability of water other than rain, have caused appreciable change, resulting in growth of thick vegetation in the nature of forests.

Area of Sind, excluding the state of Khairpur Mirs', is 47,164 sq. miles. The whole of the province can be divided mainly into three physical regions namely (1) The Desert locally known as 'Thar' (2) The Indus Valley locally known as 'Pako' and (3) The Hills, locally known as 'Mael'. To this may be added, a narrow strip of the Coastal Region. The Desert and the Hills comprise about $\frac{2}{5}$ of the area of the province and they constitute the true arid regions of the province. (Refer Map).

THE DESERT

The desert is the south western part of the Great Indian Desert and is some 10,000 sq. miles in extent. It consists largely of sand hills which vary from small dunes to hills 300 to 400 feet high and lie parallel in the general SW/NE direction of prevailing winds. The sand hills are separated by valleys varying in breadth from one mile to a few hundred yards. The sand hills over-lie old Indus alluvium. At places, they over-lie parent rock of the type found in Nagarparkar. At places, continuous backing-in of the rain water, which carries calcium bicarbonate dissolved from tiny sea shells blown on the desert by the Monsoon Winds, results in formation of hard pans, down below 100 to 300 ft. Sometimes, the pans are shallow enough to result in formation of ponds during the Rainy season. The Rainfall averages to 10" yearly.

The population density is 15 to 30 persons per sq. mile. The main occupation is cattle rearing. The desert cattle locally known as Thari is one of the best dual-purpose animal in Indo-Pakistan sub-continent. Sind Desert camel is unparallel in the world, being fast, hardy and docile. For food,

Bajri (*Pennisetum typhoideum*) chester beans (*Cyamopsis psoraliodes*) and Mung (*Phaseolus munga*) are raised on rains. The grass and vegetation continue to be sufficient for the graziers till the middle of winter season after which most of the population migrates to the valley.

The natural vegetation reaching any standard of a forest is confined to areas where shallow ponds appear or where, in the valleys either the sand is shallow or parent Indus alluvium is visible. Where man has not set his hand to destroy tree growth for cultivation, forests in true sense of the word do exist.

Such areas are however small and widely scattered. They are not under the management of the Forest Department. Predominant trees that compose such forests are the Kandi (*Prosopis specigera*) the Rohero (*Tecoma undulata*), the Babri (*Acacia jacquemontii*), the Khumbat (*Acacia senegal*), and the Khabbar (*Salvadora oleoides*). The vegetation along side the ponds is predominant in Khajji (*Phoenix dactylifera*). With these a variety of other tree species also occur and they are Nim (*Azadirachta indica*), Liar (*Cordia rothii*). The growth is, often so thick as to conceal herds of wild life which is mainly the black buck and the common deer. The four horned antelope (Chinkara) is also found in these areas.

The sand hills are not totally barren. They do bear vegetation of stunted type predominant in shrubs throughout the year and grass during and after the rains. The most common shrubs are Thuhar (*Euphorbianerifolia*), Booh (*Aerua tomentosa*), Phog (*Calligonum polygonoides*), Ak (*Calatropis procera*), Kirir (*Capparis aphylla*), Dhilusil (*Cassia obtusa*), Morari (*Lycium barbarum*), Pharr (*Pluchea lanceolata*), and Beri (*Zizyphes nummularis*). The common grasses are Thari (*Agrostis micrantha*), Chhabbar (*Chloris virgata*) Kabah (*Cynodon dactylon*), Gandlur (*Elousine flagerlifera*), Dhukar (*Heloclelea dura*) and Gamol (*Panicum antidetabile*).

THE HILLS

The region of hills is the southern most formation of the Sulaiman and Khirthar Ranges. This region occupies about 10,000 sq. miles.

It consists largely of limestone formations rich in marine fossils. The Ranges lie mainly in north to south direction. The highest peak is near village Baran at the head of the seasonal Baran River. The altitude there is 3662 ft. above sea level. The Rainfall in this region varies from 10"-15" yearly.

The population is thin and mostly consists of the various tribes of Baluchis. Their main occupation is goat and sheep rearing. Agriculture depends on rain water and is confined to the valleys between the hills and on the foot slopes of the hills. The Rain water is collected in terraces by Bunding

at the foot of the hills on gentle slopes. The higher slope above the cultivated fields are used as pasture grounds for goats and sheep. The main crops are the same as in the desert. During the rains and till the middle of winter, the goat breeders stay on hills, rearing goats and raising crops. In the middle or end of winter and beginning of hot weather, they migrate down in the Indus valley, because the pockets of water in the hills and beds of seasonal nullah get dry and the grass on the hills gets scanty.

The natural vegetation reaching any standard of a forest is confined to banks and beds of hill torrents and valleys between the hill ranges. The main flora varies but little from the desert flora. Main species that are found in this region are Babul (*Acacia arabica*), Kandi (*Prosopis spicigera*), Khumbat (*Acacia sengals*), Khaonr (*Acacia farnasiana*), Dhaonr (*Acacia modesta*), various species of Ber (*Zizyphus* spp.) and Rohero (*Teccoma undulata*). The conspicuous species of this region is Kahoo (*Olea cuspidata*).

The hills are rich in shrubs and herbs which are reputed to be of medicinal and economical value. It is said that Baluchi housewife finds every thing needed at home from the hills. The soap for washing cloth is obtained from leaves of certain herbs. A variety of other herbs is used as antedote for a snake bite and scorpion sting. Yet, there are many more herbs used for medicine in skin diseases and as febrifuge and for variety of other uses. This aspect of the vegetation of the hills yet remains to be explored and studied. The prominent shrubs and herbs of this region are:—(1) Kandero (*Alhagi camelorum*). (2) Reho (*Bergia aestivosa*). (3) Dramah (*Fagonia cretica*). (4) Gangethi (*Grewia pepulifolia*).

The vegetation in hills has been destroyed considerably by the goat grazers. There are very few patches bearing thick growth of trees worth naming as forests.

THE INDUS VALLEY

The region of the valley of Indus is the most fertile region of the province. It is comprised of the Indus alluvium. The right bank alluvium is older in formation than the left bank as is evident from the fact that sites of pre-historic old towns of Mo-'an-jo-Daro (misnamed as Mohanjo Daro) and Kahoo-jo-Daro and the old historic towns of Sehwan and Thatt are all situated on the right bank.

The Indus passes approximately through the axis of this region dividing it into 2 unequal halves—the right bank is narrower and stretches towards the hills. The left bank is broader and stretches towards the desert. It is cut up by natural depressions in the form of old river beds and the lakes, which were also old bends of the mighty river. The most prominent and oldest of the river beds is the Eastern Nara which was once a river, then a bye-river, then

inundation canal and now it is one of the perennial canals of the Sukker Barrage system. The prominent among the lakes are (1) Manchur, (2) Kinjhir, (3) Sonahri, (4) Makhi.

The artificial land features in the valley mostly consist of its canals most of which are still seasonal and at the mercy of rise of water in the river. They are what are known as inundation canals. The Sukker Barrage canals command but less than half of the valley region of the province. This zone extends from Rohri to Hyderabad on the left Bank and Sukker to Sehwan on the right bank. The rest of the province is irrigated by seasonal inundation canals taking off direct from the river. The Kotri Barrage under construction, will further assure water supply in the region below Kotri on the right bank and below Hyderabad on the left bank. This will increase the area under Barrage systems in Sind to a little more than half the area of whole of the valley. The tract in the north of Sukker and Rohri on both banks and between Sehwan and Kotri on right bank will even then remain under inundation system, completely at the mercy of rise of water in the river.

The Indus valley region slopes out away from the river on both the banks. The river runs on a ridge. This considerably facilitates flowing of the inundation canals and carrying river water out into the interior for cultivation. On account of this feature of the ground, the valley is always liable to be flooded in vast stretches, away from the river. When there are rains in the Indus catchment the water in the river rises considerably and the water level assumed dangerous heights. But this danger has now been averted by construction of earth bunds along both the banks of the river. These bunds are 12 miles to 25 miles apart from the bank to bank and extend from North to South on both the sides.

The river meanders and changes its course within the strip of the land between the two river protection bunds. Considerable erosion of banks and accretion of new alluvium on the opposite bank occurs year after year with the annual rise and fall of water in the river. Whole of the tract between the bunds is therefore known as Kacho or Daryakhurdi as against Packoice the land outside river protection bunds on both banks.

During the peak season of rise of water in the river, which is known as Abkalani season, if there are normal rains in the Indus catchment most of the Kacho tract, nearly 75% of it, gets flooded and submerged under water. On an average 5' - 6' delta of water is received by the submerged part of the tract. These floods resulting in supply of extra water to the land, coupled with the erosion and accretion activity of the river has a great bearing on growth and rearing of forests in Sind. Most of the rich forests of Sind are confined to this tract. Indeed, they are rich in production of fire wood and charcoal.

The land in the Kacho tract is either occupied by the river and its byes, lakes, forests or cultivation. The land being a new alluvium is very fertile. Before the British took up scientific management of natural forests in this tract, considerable amount of land was cleared for cultivation of Selabi wheat or gram or awarded as Jagirs to big personalities for services done to the rulers. Thus, forests do not occupy a continuous stretch all over the Kacho tract. Only about a third of this tract is occupied by the reserved or private owners of forests.

Upper Sind above the 26th parallel has different climate from the lower Sind. It is characterised by the extremes of climate. The summers are hot. Temperature at many places reaches 120° F during July and August. Hot winds locally known as "Look" blow during the day while during the night either hot winds continue or the atmosphere gets closed. Winters achieve the other extreme temperature at good many places mercury falls below the freezing point. Frost is of a common occurrence.

The Kacho tract in this region bears forests rich in Kandi (*Prosopis spicigera*). The climax type forest of this area are the forests predominant in Kandi but having Lai (*Tamarix dioeca* and *troupii*) as an understory. They are very rich in grasses mainly Dabh (*Eragrostis cynosuroides*), Chabbar (*Chloria virgata*), Kabh (*Cynodon dactylon*). Fires are a common occurrence in this forest during the hot weather.

The newly formed alluvium if formed out of fine silt or clay is invaded by Kank grass (*Sacharum spontaneum*) which grows so thick that no other tree grows in it. Whatever young seedlings spring up during the season, within the grass, get killed when any fire occurs during the hot weather. However in course of ecological succession, with rising of the ground, the site becomes unsuitable to the growth of Kank which give place to Kandi and Lai.

The newly formed alluvium from the loam deposit, creates conditions of growth of mixed forests with Lai (*Tamerix dioeca* and *troupii*) as its main species. Sometimes Bahan (*Populus euphrotica*) gains ground to produce pure popular patches which subsequently yield soft wood timber. Sar grass (*Sacharm Munja*) also appears mixed on such sites. In addition a carpet of variety of annual herbs and shrubs springs up with the recession of water from such areas. Such mixed forests also, in course of time, with the rise of the ground level give place to more hardy tree, the Kandi, when the forest reaches its climeax type.

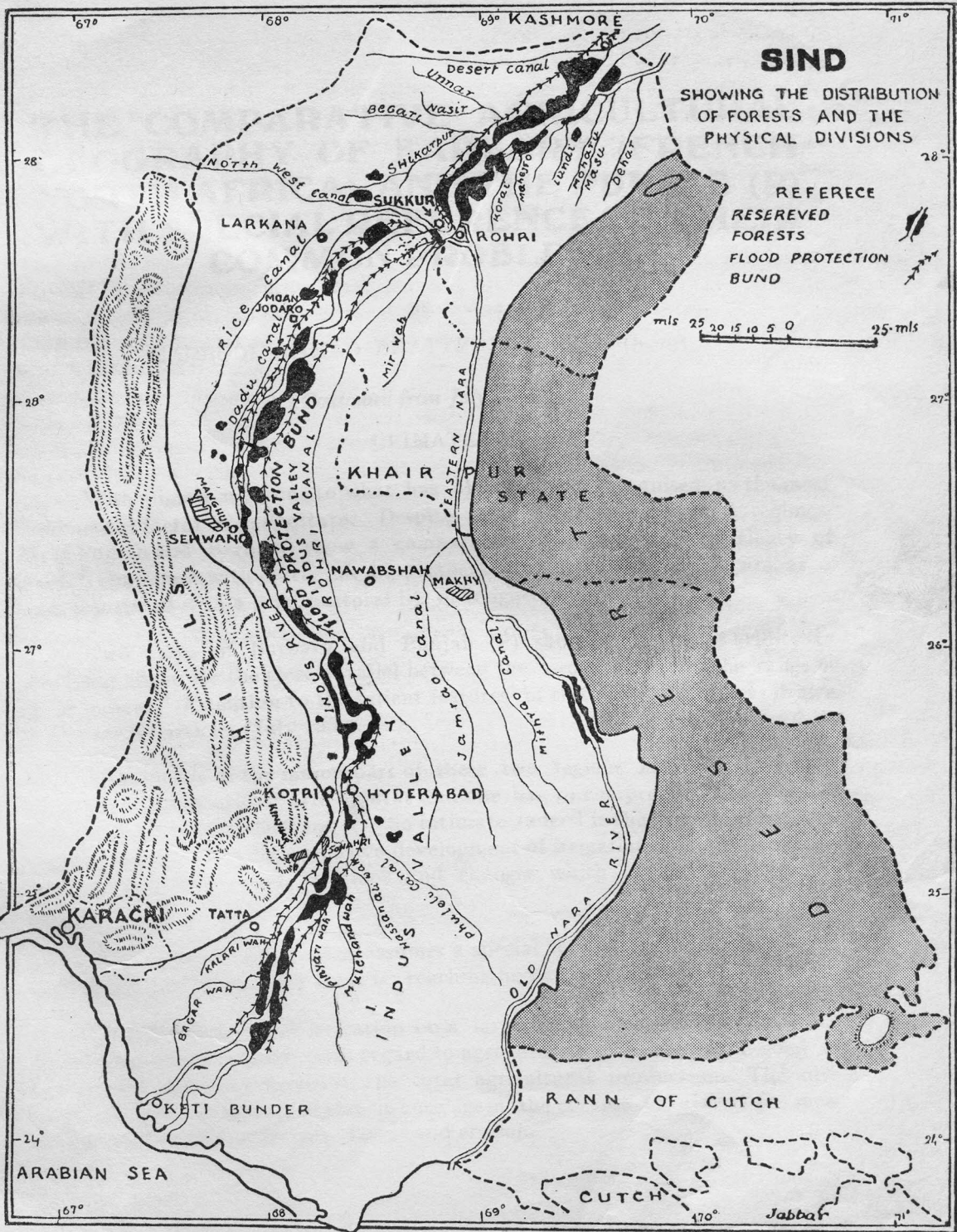
Below the 26th parallel, the climatic conditions are not very severe. This is due to its proximity to the sea. Temperature during summer rarely reaches 120° F. Nights are generally cool and breezy. Winters are mild. Frosts are only occassional. The strip of kacho below this parallel bears the most productive and beautiful forests of Sind. They are the climax type Babul

(*Acacia arabica*) forests. Pure Babul forests occupy large areas and are characterised by absence of undergrowth of any grass. Only annual herbs grow in a carpet immediately after the recession of the flood water. The succession in newly formed alluvium and the abandoned river beds is the same as described above under the forests of the upper Sind.

Certain scattered patches of land have been declared as reserved forests outside the river protection bunds, in the pako portion of the valley region. Except a few that are on the right bank, such forest areas have no arrangements for supply of water to them. The few ones that are on the right bank below Sehwan, receive water from hill torrents, and bear good growth of Babul. In the rest, the soil has degenerated into Kalar and bears nothing but Khabhar (*Salvadora Oboides*), Jar (*Salvadora persica*), Kirir (*Capparis aphylla*) and shrubs like Akk (*Calatropis gygantia*) and Lani (*Salsala foetida*). Such areas now being taken up for converting them into Irrigated Forest Plantations wherever water could be had from the Irrigation Department. Sind has an ambitious plan in hand to create 50,000 acres of such plantations in Sukkar Barrage Zone and another 1,50,000 acres in Kotri Barrage Zone. Small sized irrigated plantations started in 1939 and continued thereafter, exist in every forest division, most prominent of them being near Larkana in Upper Sind and Hyderabad in Lower Sind. Local timber producing trees like Mulberry (*Morus Alba*), Talhi (*Dalbergia sissoo*) Nim (a *Azadirachta indica*) and Sirinh (*Albizzia lebck*) are in these plantations on canal water irrigation. Some of the exotics mostly from Bharat, including Teak (*Tectona grandis*) are also under trial.

THE COASTAL REGIONS

The coastal region bears natural vegetation of the mangrove type. The vegetation in this region has not yet been studied. Patches round about Karachi coast show potentialities for economical working and fuel production. It is hoped this region will get due attention from the Government soon.



THE COMPARATIVE AGRICULTURAL GEOGRAPHY OF BARBARY (FRENCH NORTH AFRICA) AND THE PUNJAB (P) WITH SPECIAL REFERENCE TO THEIR COMMON PROBLEMS

BY

MAQBOOL AHMAD BHATTY, M.A., Ph.D. (EDIN),

(Continued from July 1950).

CLIMATE

With climate we come to what has always been recognised as the most fundamental factor in agriculture. Despite their contrasted seasonal regimes, West Punjab and Barbary show a comparable variability and deficiency of rainfall combined with extremes of temperature, conditions which are, as a rule, associated with a semi-pastoral life or irrigation agriculture.

Two maps of Barbary and Punjab (P) showing indices of aridity to Martonne illustrate the close parallel between the two regions in the range of these indices. Attention to the salient features of this distribution was drawn in the earlier articles (July 1950).

Human life in the major part of these two regions has since long been adapted to a semi-arid or arid habitat and one has to comprehend the facts of climate in order to understand it. So intimate indeed is the relation between climate and man that the extensive development of irrigation has produced an interesting chain of social reactions and changes which present a fascinating field of enquiry.

The study of climate thus assumes a special importance, constituting, as it does, the background for these far reaching human developments.

The development of irrigation on a large scale does not minimise the dominating role of climate with regard to agriculture. The effects of good or bad seasons are still reflected in the total agricultural production. The ultimate source of irrigation water is once again the climate as also of the most serious problems of irrigation—floods and erosion.

BARBARY

In the simplest terms Barbary belongs to the transition zone in which the seasonal alternance of marine westerlies and the continental trade winds produce respectively a mild wet winter and a hot dry summer. This does not take into consideration the influence of air masses whose line of discontinuity give rise to frontal disturbances which are responsible for most of the rainfall. The great complexity of relief is yet another factor which produces considerable variations of climatic conditions over short distance and hence those striking changes in the agricultural landscape one observes in travelling over the region.

Tunisia, Algeria and eastern Morocco form a continuous zone facing the Mediterranean in which the general alignment of relief is from east to west. Consequently most climatic gradations take place in a north-south direction. Western Morocco differs from the rest of Barbary being sheltered both from the Mediterranean and the Sahara by high mountain ranges and in that it owes many of its climatic features to the influence of the Atlantic. This influence has very often been exaggerated because Queney has recently established the climatic unity of Barbary¹ by proving that the climate of the region as a whole is determined by the circulation of the atmosphere between heights of 10,000 and 13,000 ft. where it is not influenced very much by relief. Furthermore, the essential features of the whole region such as the seasonal distribution of rainfall and of temperature are everywhere similar.

PRESSURE AND GENERAL CIRCULATION

The ideal simplicity of the Mediterranean regime of climate does not explain the considerable divergence of weather from the seasonal "normals", nor does it account for the great variations from year to year. The position of the following air masses as well as the nature of contacts between them determine the weather conditions in Barbary at any given time :

1. The cold polar air mass.
2. The two anti-cyclonic masses covering respectively the Eurasian continent (continental air mass, disappearing in summer) and the North Atlantic (commonly referred to as the Azores High maritime).
3. The masses of tropical air which flow between the two anti-cyclonic air masses.²

1. P. Queney "Types de sempois en Afrique du Nord et au Sahara Septentrional" Travaux ed 1 'Institut de Meteorologie, fasc 3, Alger., 1943.

2. G. Bidault et J. Debrache "Climatologie" IL 'Encyclopedia Coloniale et Maritime, "Maroc", Paris 1945, p. 151.

The movements of these air masses is seasonal and with them are associated the lines of discontinuity or fronts of which the two most important are as follows :—¹

- (a) The Polar Front between the polar air and the two anti-cyclonic masses.
- (b) The Trade Winds Front between the N.E. Trades and the South West Anti-trades which exists in the upper air and includes the so-called Mediterranean Front.²

The regime of the Polar Front occurs when this discontinuity occupies a position in Europe southerly enough to affect the climate of Barbary. This happens in autumn, winter and spring. S. S. W. to N. N. W. winds, associated with the Warm Front, bring heavy rains to the north of the Saharan Atlas and sandstorms to the south of it. Sometimes, these polar depressions, travelling in a North-South or N. W. to S. E. direction take a direct W. E. course which produces a contact with the Trade Winds Front and torrential rains occur, mostly in Algeria.

The regime of the Trade Winds Front is in evidence when the Polar Front is confined to the north of Europe and the North Atlantic air mass extends its influence up to eastern Europe. If Trade Winds Front is in the upper air, Barbary is swept by a N. E. or E. wind and the weather is pleasant in the interior and foggy near the coast. Again it may happen that the Front is on the ground but not active in which case the anti-trades blow over Barbary and the weather is hot and dry in summer, cold and slightly rainy in winter. Finally the Front may be active on the ground. It is during such spells that heaviest rains are recorded in the High Plateaux and northern Sahara. The disturbances associated with the Trade Winds Front are most frequent in spring but do not occur at all in summer. No explanation of this phenomenon is forthcoming at present.³

Lastly it sometimes happens that the two fronts co-exist. Each has its own current of disturbances which may either neutralise each other or combine. In the latter case powerful storms are produced towards the east of Barbary. It is the combination of all these phenomena that makes weather conditions so variable.

1. R. Capot-Rey "Etudes Recentes sur le Climat de l'Afrique du Nord et ud Sahara" Ann. de Geog. Vol. LV, 1946, pp. 40-41.

2. R. Capot Rey quotes Queney (Ibid) to say that "The discontinuity which appears sometimes in the Western Mediterranean between the N. E. winds from Europe and the S. W. winds from Africa which is sometimes called the Mediterranean Front may be included in the Front of the Trades".

3. R. Capot Rey. Ibid p. 42.

TEMPERATURE

The most important single factor with regard to the temperature is the sea. Mean annual isotherms are generally parallel to the coast, a fact which is particularly striking in Morocco where they run from north-east to south-west showing thereby that the influence of latitude has been negated by that of the sea. The effect of the sea is most marked in winter and is as prominent on the eastern coast of Tunisia as on the western coast of Morocco. Thus "Tabarka, Mehdiya and Jerba which spread over 3° of latitude have the same average temperature in January."¹

The mean annual temperatures increase from the coast inland and in the case of Algeria and Tunisia a general increase from north to south is also recorded, noticeable even on the eastern coast of Tunisia. Here temperatures increase from 65° F at Bizerta to 67° at Gabes. In Algeria where the latitudinal trend coincides with the distance from the sea a greater difference is observed between the 64° at Phillipeville and 71° at Biskra. The mean annual temperature figures do not constitute a factor of any importance in themselves. From that point of view the seasonal average and extreme temperatures are of much greater significance.

Range of Temperature :—The diurnal range of temperature increases from the coast inland being 7° and 9° respectively for January and July at Algeria whereas it amounts to 13° and 26° for the same months at Setif.² The range inland is much higher during the summer than in winter while it is always low near the coast and is always high towards the Sahara.³ The annual range of temperature also shows a general increase from the coast inwards although some sheltered valleys near the coast possess a marked degree of continentality. The Tunisian and Algerian littoral has an average range of 35°. The Atlantic coast of Morocco, being subject to the influence of the cold Canaries current, has a lower range which amounts to less than 15° in the regions of Mogador and Agadir.

The Extreme Temperatures :—The study of monthly means, even though it constitutes a useful basis for the general study of climate, does not fulfil the requirements for the consideration of agricultural production. Many crops have critical limits and the suitability of a region for their cultivation can only be determined in the lights of the extreme temperatures recorded there in each season.

1. A Bernard, *L'Afrique Septentrional et occidental e* ; p 42.

2. "Le Climat de l'Algeris", Algeris 1946, p 44

3. A very high diurnal range of temperature is usually due to intense nocturnal cooling which constitutes serious danger to the cultivation of certain early vegetables as well as fruits, particularly then accompanied by frost.

The lowest temperatures are recorded in the interior where they often fall below the freezing point—Fez and Constantine for example recorded 23° F and Oujda 19°. On the coast, however, they seldom fall below 32°.

The extreme maximum temperature is everywhere higher than 104° except for certain stations at high altitudes (*i.e.* Ifrane, in Morocco, 97°) and they reach over 120° near the desert or even at places like Orleansville and Taroudant which are situated in low-lying valleys.

The hottest and coldest times of the year are not in mid-summer and mid-winter but occur a month afterwards.

RAINFALL

This is by far the most important elements of climate both for crops and man and Bernard does not exaggerate when he states that rainfall “determines the great natural regions and their limits, the possibilities of cultivation and of sedentary life”.¹

It is preferable when considering the rainfall conditions of Barbary to fix the starting point for the year at the 1st of September “because there is an almost complete absence of rainfall during the summer and the choice permits study of rainfall during a complete vegetative cycle as well as an agricultural year. The total of rainfall according to the agricultural year facilitates its comparison with the yield of crops.”²

Annual Rainfall.—A study of the annual rainfall map of Barbary will reveal the following characteristics :

1. The amount of rainfall increases with altitude but the increase is more marked on the slopes exposed to the rain-bearing winds. In this sense, the rainfall is orographic.

2. Over the whole of Barbary, rainfall decreases from north to south as also with distance from the coast. This is mostly due to the fact that since rainfall in Barbary is largely due to the depressions generated along the Polar Front, those parts which lie further away from the usual west-east path of these disturbances receive much less rainfall.³

3. Excluding western Morocco, a decrease of rainfall is also noticed from east to west. The classic explanation of this phenomenon is the one given by A. Angot⁴ which is still widely accepted. According to him the winds which

1. Op. Cit.

2. Seltzer, Op. Cit. p. 129.

3. Bidault et Debrache—*Ibid* p 155.

4. “Etude Sur Ia Climat de l' Algerie”, *Annales du Bureau Centrale Meteorologique* 1881.

come mostly from the north-west cover much longer distance over the Mediterranean in the case of the eastern half of the littoral of Barbary whereas those which effect the western part have already been deprived of their moisture by the mountains of Spain. This in the opinion of Seltzer¹ does not agree with other observed facts. There is no increase in atmosphere humidity from west-east which should be an essential corollary of Angot's contention. He suggests that the reason for this feature of rainfall can be sought in the greater activity of depressions to the north of Tunis. Furthermore the Atlas ranges in Morocco largely deprive the passing cyclonic disturbances of their moisture so that western Algeria and eastern Morocco are in the rain shadow, not of the Sierra Nevada but of the Middle Atlas.

Taken in the regional perspective, the tracts with moderate to abundant rainfall, are very much limited being confined mostly to the higher altitudes in northern Morocco, eastern Algeria and northern Tunisia. The greater part of these regions has a rugged relief so that it may be said that the zones of higher rainfall are, in general, regions of minor agricultural importance. The most prominent exceptions are the Sebou Basin and the Mitidja Plain. The limit of such regions may be fixed at 20" of annual rainfall.

By far the larger part of those regions which may be considered to be topographically favourable for agriculture have rainfall ranging from 8" to 20" and these constitute the main core of this study.

Among the regions that are completely arid, the most notable from our point of view are the Marrakesh and Tadla plains in Morocco which in several respects come closest to the similarly arid parts of West Punjab in respect of recent developments in agriculture.

Seasonal Distribution of Rainfall :—The statistics of annual rainfall do not in themselves give the complete picture of the suitability of any region for crop production. Rainfall occurs in considerable quantities in spring, winter² and autumn but the summer season from June to August is absolutely dry and combined with high temperatures, constitutes a wholly negative season for all forms of vegetative life. This is the feature typical of the Mediterranean climate, which is the basis for the growth of xerophytic characteristics in the natural vegetation as well as the special development of vine and citrus fruits both of which are well-adapted to this regime of rainfall.

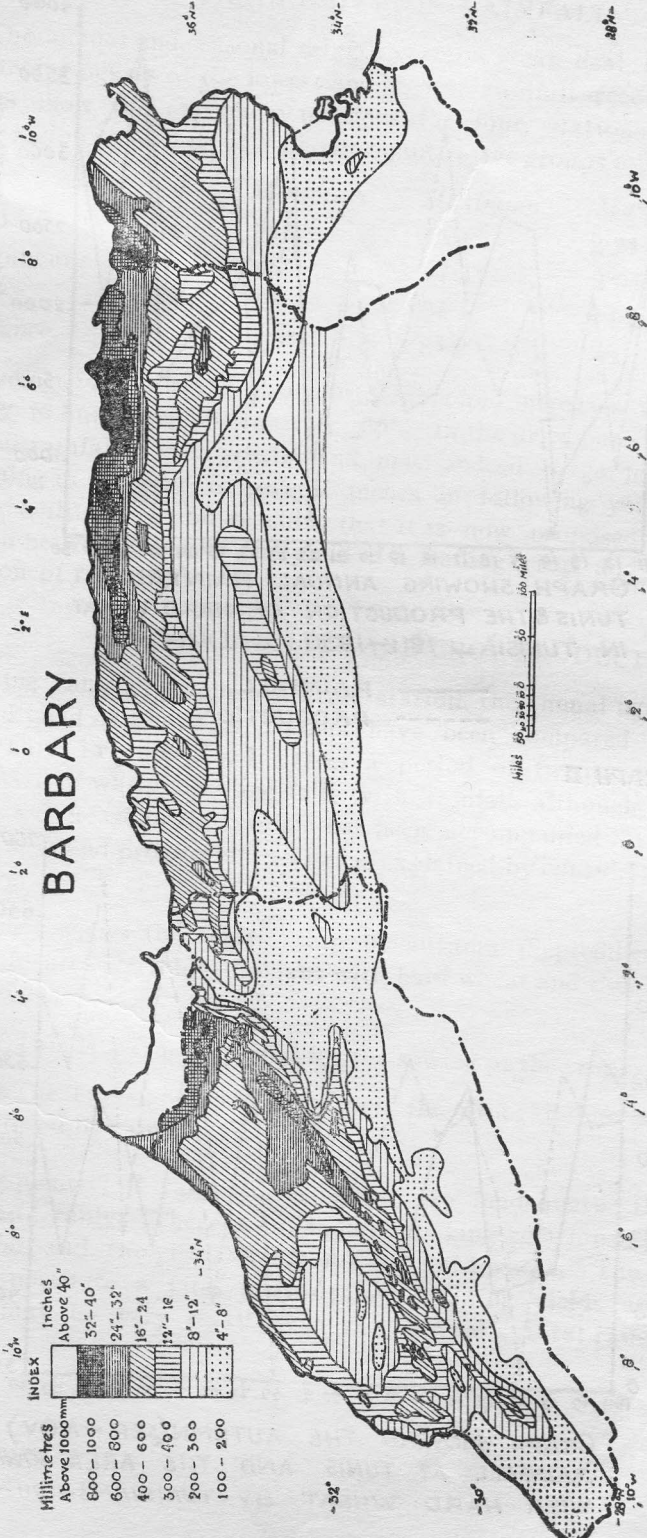
The seasonal distribution of rainfall is not constant but varies considerably from year to year, and has a governing influence on the yield of various crops, particularly cereals.

1. Op. Cit. p. 144.

2. There is usually a short period of lesser rainfall in mid-winter particularly in Morocco, dividing the rainy season into two, one of autumn, one of spring.

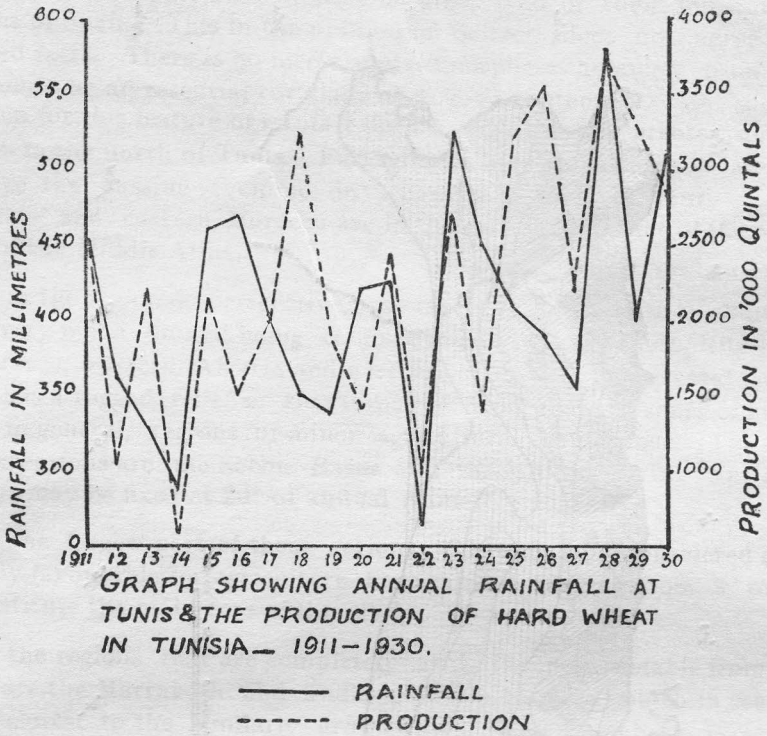
BARBARY

Millimetres	Inches
Above 1000	Above 40"
600 - 1000	32" - 40"
600 - 800	24" - 32"
400 - 600	16" - 24"
300 - 400	12" - 16"
200 - 300	8" - 12"
100 - 200	4" - 8"

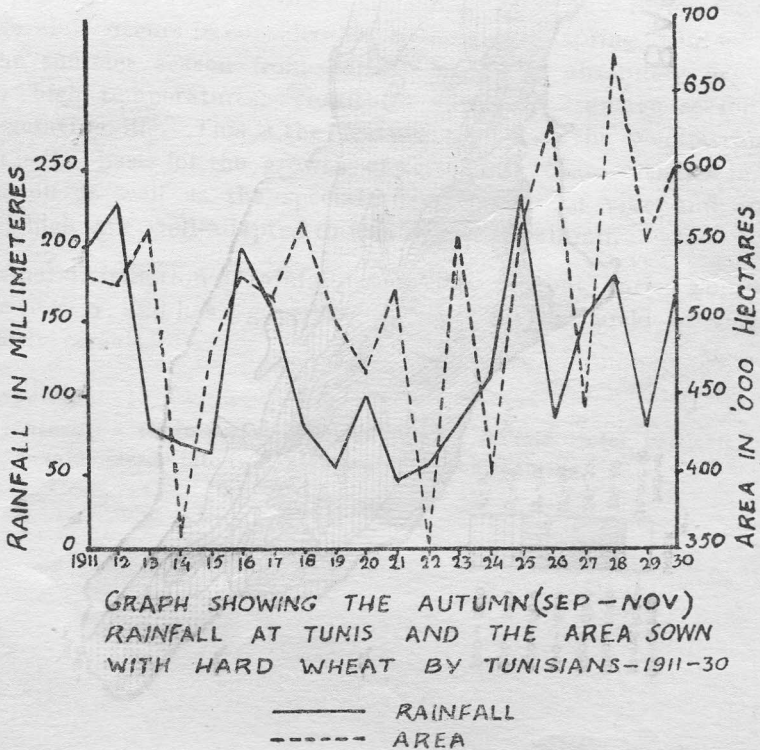


Miles 0 10 20 30 40 50
Kilometers 0 20 40 60 80 100

GRAPH I



GRAPH II



VARIABILITY OF RAINFALL

The annual and seasonal rainfall varies a great deal from year to year. The following figures of the lowest and highest rainfall recorded between 1913 and 1938 show the extreme variations for four stations representative of different regions as well as of different quantitative groups :

	<i>Minimum</i>	<i>Maximum</i>	<i>Max/Min</i>
Algiers	20·4"	45·4"	2·24
Bessombourg	48"	97·3"	2·04
Setif	12"	24·1"	2·01
Casablanca	7·8"	24·2"	3·1

Average variability is also considerable and increases with aridity from below 15% in humid regions to over 30% in the drier parts. The variability of seasonal rainfall is even greater and may indeed range for crucial months from nothing in one year to several inches in following year. The effect of this on agriculture is so far-reaching that it is now proposed to establish some correlation between the area and yield of a leading crop and the amount and distribution of rainfall.

VARIABILITY AND CROP PRODUCTION

Taking Tunis as a representative station, the annual figures of the production and yield of wheat in Tunisia have been compared with the annual rainfall at Tunis in graph No. 1. Over a period of twenty years (1911-1930) the production of wheat rises and falls with rainfall although there are some years when a decrease in the rainfall has been accompanied by an increase in both total area and production. That is explained by considering the seasonal distribution.

Graph 2 shows the relationship of autumn (September to November) rainfall to the area sown by tunisians with hard wheat and this is seen to be a close one because :—

(a) This is a crucial period for the sowing of the crop.

(b) The Tunisians cannot plough the drought parched lands unless they are softened by rain.

Consequently, if rains come late or are inadequate the sowings are reduced considerably. There is an equally striking relationship between early spring rainfall and the yields obtained from hard wheat. The spring rains or the whole constitute a vital factor in determining yields and if they fail, production may be very small even if the year's total rainfall were above normal.

No cyclical rhythm has so far been established in rainfall variability which must therefore continue to be an erratic factor of immense significance. The variability factor is emphasised further by the periodic occurrence of torrential downpours during brief periods causing serious damage to crops and irrigation works. These are usually associated with thunderstorms and several inches of rain had been known to fall within an hour in certain localities.

INVISIBLE PRECIPITATION

Several semi-arid parts of Barbary benefit from the nightly condensation of moisture following unhindered radiation through the cloudless skies. Southern Tunisia where maritime winds bring plenty of moisture receives an estimated 10" to 20" of invisible rainfall in this manner, the amount depending upon the number of cloudless nights. This factor has been mostly responsible for the southward extension of olive orchards in Tunisia. Although the importance of nightly condensation has not been measured in other parts of Barbary, it is obviously a major factor in many areas, notably in the Atlantic plains of Morocco where the moist air enables maize to flourish in a region receiving only 10" to 15" of rainfall.

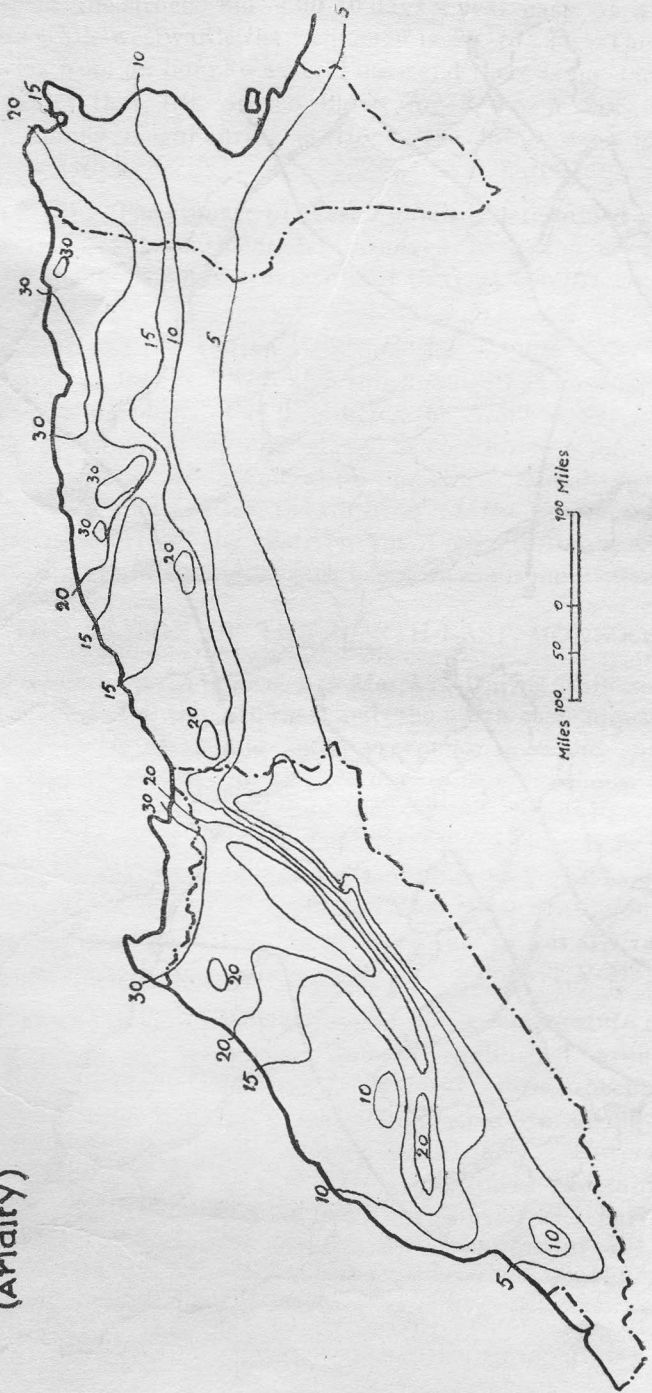
Snow and frost:—Both occur mostly in winter and their intensity increases with distance from the sea and altitude. Snow in the higher mountains persists till early summer and has an important regulating influence on the water of Wadis and rivers. Like rainfall, snowfall varies greatly in magnitude from year to year.

Thunderstorms and Hailstorms:—Thunderstorms occur as local phenomena mainly in summer and are associated with convection. They are most frequent in the higher mountains. Hailstorms are also a localised phenomenon occurring between December and March and are most frequent in the higher altitudes though they may also take place along the coasts.

The Sirocco:—This is a hot dry wind which blows sometimes from Sahara over Barbary with withering effect on vegetation and humans alike. Temperatures may rise to more than 110° and the relative humidity greatly reduced. It is rare in winter and occurs mostly near the coast as a result of depressions in the Mediterranean. In summer when it is most frequent, particularly in July, it is most often encountered in the interior and is associated with depressions developing over the Sahara. The exact origin of the sirocco has not been clearly established, although very often a fohn effect accentuates its normal attributes of heat and dryness accentuated relief is by no means necessary to give it its peculiar character.

The sirocco is known as *Guebli* (southern) in Tunisia and Algeria, and as *sherqui* (eastern) in Morocco. Its frequency varies greatly and is greatest in

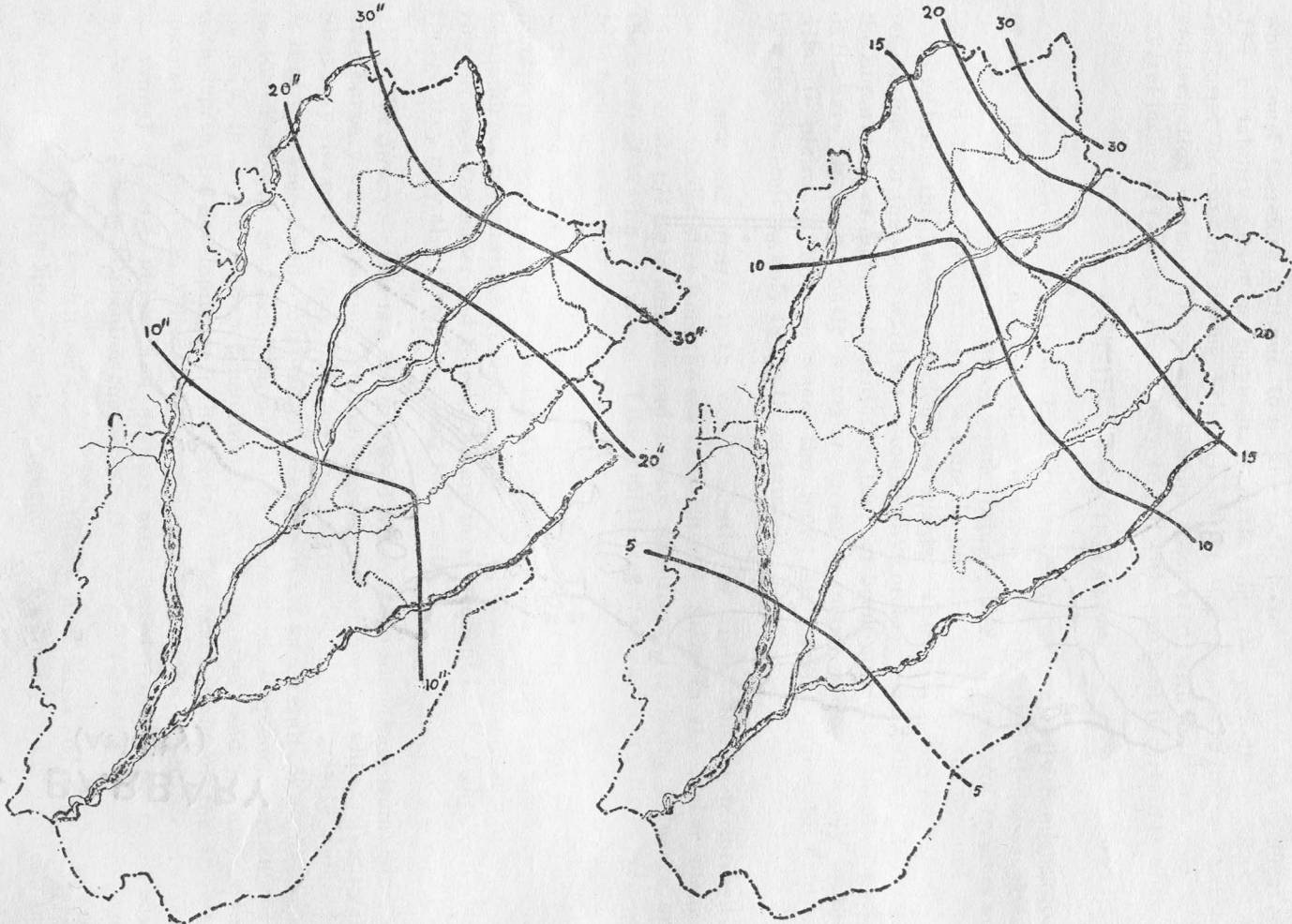
BARBARY (Aridity)



PUNJAB (P)

RAINFALL

ARIDITY



Miles 50 40 20 10 0 50 100 Miles

zones accessible from the Sahara. Thus in Algeria the number of days with sirocco amount to over 40 on the High Plateau but seldom exceed 29 near the coast. In Tunisia, the sirocco blows 30-40 days a year east of a line joining Tunis and Gafsa while westwards the frequency is 20 to 30. The duration of the sirocco varies from an hour to several days and there is no factual foundation for the belief that the sirocco blows for 3, 6 or 9 days. It has been noticed that among neighbouring stations, the lower ones have a higher frequency of days with sirocco.

PUNJAB (P).—The climate of West Punjab is determined by its special position in the Indian sub-continent far removed from the oceanic influence and results from the monsoonal circulation of the entire landmass south of the Himalayas.

The mechanism of the Indian monsoon has usually been explained as a gigantic land and sea breeze. Although this analogy has an illustrative value it over-simplifies the problem. Far from being the result of a single physical condition, the monsoon is "produced by a combination of circumstances involving considerations of temperature, pressure, humidity, geographical relationships between land and sea, the rotation of the earth and lastly but probably the most important, the distribution of mountain ranges."¹ The year may be divided into the following seasons based on monsoonal changes.

I. THE SEASON OF THE NORTH-EAST MONSOON

(A) Cold weather season—January to March:—During this season a high pressure is established over the province and the north-east monsoon is in full swing. The weather is clear and sunny except for periodic shallow depressions which originate mostly in the Mediterranean. About 20 to 30 of these are recorded every year during these months and they bring rainfall which proves valuable for winter cereals. The parts benefiting most from these light rains are the Potwar Plateau and sub-montane tract. The mean temperature in the Punjab is around 50° F in January but rises continuously towards March. Under anti-cyclonic conditions, great diurnal ranges are recorded—25° to 30° and night frosts are common, especially in the Potwar Region.

(B) Hot weather season—April to June :—While temperature rises steadily the pressure falls and by May a deep low is established around Multan. Winds become variable and a large number of local storms occur, mostly in the form of thunderstorms and duststorm. Rainfall is low during this season and is again associated with periodic western disturbances. The general condition is that of marked drought and heat with temperatures exceeding 95. This makes South-western Punjab one of the hottest regions of the earth. Extreme temperatures ranges from minimum of below 80° to maxima of over 120°.

1. G.C. Simpson. "The south-west Monsoon" Q.J. Roy. Met. Soc, No. 199 Vol 47, 1921, P. 152.

2. THE SEASON OF THE SOUTH-WEST MONSOON

(C) *The Rainy season—July to September* :—As the heat assumes an intolerable intensity, the monsoon bursts. It is associated with a highly developed low pressure over this region and comes from the south-west due to a rotational deflection. Wagner, a German meteorologist, has drawn attention to this role of a “monsoon front” between the continental and marine air masses. This is supported by upper air observations and helps to explain the pulsatory character of the monsoonal rains.

The rainfall takes the form of heavy showers with intervals of damp heat. From two-thirds to three-fourths the total annual rainfall takes place during this season. The effect of the rainfall is to bring down temperature.

(D) *The season of the retreating monsoon—October to December* :—This quarter of the year has the “most settled weather of the year the serenity of the climate is seldom disturbed.”¹ A weak high replaces the low pressure conditions and N.E. and N. W. winds prevail. The monsoon ceases to be active by the end of September and October and November are the driest months of the year. The western disturbances commence their activity about this time and become frequent by December when some rainfall takes place to the great benefit of winter cereals. The temperature falls steadily to the cold weather conditions and diurnal range is high. Winter frosts commence towards the end of the season.

Annual Rainfall and variability :—The annual rainfall map shows that the rainfall decreases from the north-east to the south-west the isohyets following the strike of the mountains. Rainfall is very low in the south-west where desert conditions prevail.

As in Barbary, rainfall is marked by high variability. The highest percentage of variability is in the drier districts—30%. On the whole, variability combining with deficiency of precipitation makes irrigation more or less essential for agriculture.

Storm phenomena :—Thunderstorms in summer and hailstorms in winter are fairly frequent the highest frequency occurring with the highest rainfall. The Potwar Plateau records the largest number of these storms over the year. They are associated with rapidly rising currents of moist air resulting in instability.

Between April and August, convection also gives rise to large numbers of duststorms. These are most frequent in the south-west.

1. H.F. Blanford. The climates and weather of India, Ceylon and Burma. London 1889.

**PROCEEDINGS OF THE MEETING OF THE GEOLOGY,
GEOGRAPHY AND ANTHROPOLOGY SECTION OF THE
THIRD PAKISTAN SCIENCE CONFERENCE AT DACCA,
JANUARY, 1951.**

On Wednesday 10th January, the section met in the Geography School at 2 p.m. The following papers were read :—

1. "Geophysics for the Geologist in Mineral Exploration" by S. J. Mayne.
2. "Coal, Iron and Bauxite in the East Indies" by S. J. Mayne.

Mr. Patel remarked, on the conclusion of this paper, that the possibility of the East Indies supplying East Bengal's needs should be explored.

3. "Folksingers of East Bengal" by Mansooruddin.

On Thursday 11th January the section met at 9 a.m. in the Geography School. The following papers were read.

4. "The Development of the Chittagong Hill Tracts" by Nafis Ahmed and A. I. H. Rizvi.
5. "The Mineral Prospects of East Pakistan" by Nafis Ahmed.

Mr. M. Haque, in the following discussion, stated that in his opinion there was little hope of iron ores being found in East Bengal, but that the chances for Lignite and Petroleum were bright.

6. "The Lignites of East Pakistan" by M. Haque.
7. "Geographical Background of the Geological survey of Pakistan" by Dr. Crookshank.
8. "Physiographic Divisions of the Baluchistan Plateau" by Dr. M.B. Pithawalla.
9. "Classification of the Climate of Pakistan from the Physiographic Standpoint" by S. N. Naqvi.

Mr. N. Ahmed warned against the extreme application of physiographic divisions because of the fallacious deductions which could be made from them.

On Friday 12th January the section met at 9 a.m. in the Geography School. The following papers were read :

10. " Climatic Regions of West Pakistan," being the Presidential address, by Dr. K. S. Ahmed, Reader in Geography, University of the Panjab.

11. " A Workable Analysis of the Precipitation Data for Quetta " by Dr. Pithawala and A. A. Hossain.

12. " Strategic Importance of Kashmir " by K. Kureshy.

In the discussion that followed Mr. N. Ahmed opined that more had not been said on the frontiers and passes adjacent to the USSR.

13. " Physiography and Soils of the Dacca District " by M. I. Chowdhury.

Mr. S. J. Mayne drew attention to the need for collecting all data relating to bores, wells and other excavations in the Delta before any attempt at unravelling its geological conditions and history could be made.

The days doings were completed by the holding of the annual meeting of the Pakistan Geographical Association.

On Saturday 13th January the section met at 9 a.m. for the last day of the conference, in the Geography School. The following papers were read :

14. " The Human factor in Pakistan Agriculature " by A. T. Omar.

Dr. K. S. Ahmed drew attention to the valuable part the Post Office could play in a drive for the general education and development of rural inhabitants.

15. " Pakistan's Jute and Its Rivals " by F. R. Khan

16. " The Value of Geographic Training, and Careers for Geographers in Pakistan " by Nafiz Ahmed, introduced symposium.

Mr. Mansooruddin spoke on the need for a Text-book on the geography of Pakistan. Mr. Nooruddin referred to geography as being the mother of sciences.

Mr. Patel spoke of the wide basis of geography combined with its ample scope for specialization, and deplored the attitude of those who pretend not to expect too much from a geographer. Geography, he said, assimilated all the useful generalities of other sciences, and in his view candidates for the Foreign Service should have to take a course comprising History, Geography and Economics. It is necessary to provide some suitable incentive to attract students to take up geography. The president, Dr. Ahmed, said that in order to be a Nationalist and an Internationalist, one must needs be a geographer. One of the world's great problems is that of refugees and their rahabilitation and the best officer to deal with these matters should be a geographer as he knows the country and the society in which the refugees lived and will live. Dr. Ahmed gave an example of the potential usefulness of a Geographer during the Lahore

Floods. Those in charge of operations chased the Flood waters futilely from place to place, whereas a geographer incharge would have been able to save large areas by digging a drain in a certain position. Dr. Ahmed spoke of the importance of Geography for the Army and illustrated his point by mentioning the contrasting condition in East and West Pakistan. He referred to numerous articles and books written during the last decade wherein famous generals have praised geographers. Concluding his remarks, the President said that for further advancement in a modern state there must be a Director of Planning. For Planning it is necessary to have geographers and in the last resort the ideal Director would be a geographer.

17. "Training of Geologists in Pakistan" by S. J. Mayne.

Concluding the session, the following resolutions were passed :—

- (1) That the Universities be urged to introduce Post-Graduate classes in Geography and Degree classes in Anthropology.
- (2) That the establishment by the Central Government of an Institute for Training and Research in Geology at Quetta be undertaken at an early date.
- (3) That Provincial Governments be urged to provide facilities to College-teachers and Government officials to attend meetings of the Pakistan Science Conferences.
- (4) That the Pakistan Government be requested to consult the Pakistan Geographical Association in all matters relating to Geography and the representation of the country in International Geographical Conferences.