PAKISTAN GEOGRAPHICAL REVIEW

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(*i*) **Papers** which contain the results of an original investigation mainly on Pakistan, principally on West Pakistan not exceeding 10,000 words.

(*See inside of the back cover.*)

Pakistan Geographical Review

Volume 18 JANUARY, 1963 Number 1

LAND USE IN THE SEMI-ARID ZONE OF WEST PAKISTAN

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Practically the whole of West Pakistan, excluding the southern flanks of the Himalayan axis and the narrow sub-montane belt, lies in the arid and semi-arid zone. The semi-arid zone, on the basis of Thornthwaite's moisture index includes the middle section of the Doabs or the Punjab plain and the western bordering mountains widening itself in the hilly lobe of north-east Baluchistan. The Safed Koh in Kohat, partly a sub-humid region, drives a wedge east-ward separating the Peshawar plain from that of Bannu. The chief determinants of land-use are physiography, soils, climate and water-supply, the last one being the most important in a semi-arid region like the one under study.

Physiography

The semi-arid lands consist mainly of an alluvial plain stretching from the Suleimans towards the east and a small mountain region to its west. The plain is very flat with an average gradient of one foot per mile. Between the Sutlej and the Jhelum, the Ravi and the Chenab divide it into three doabs. The physiographic features of these regions include (*i*) active flood plains (or bet lands), the land lying adjacent to the rivers and inundated in most summers. It is composed of the youngest alluvium, (*ii*) the meander flood plains or recently abandoned active flood plains, exhibiting distinct evidence of river action. They may be adjacent to the flood plains or far from it, (*iii*) the cover flood plains, former meander flood plains which have been subjected to wide-spread sheet flooding and obscured by a blanket of alluvium. They now form flat, level expanses, (*iv*) scalloped interfluves (or bar uplands), uniform plain occupying the central parts of the doabs, rising higher than the adjacent flood plains, from which the interfluves are at places separated by sharp river cut

bluffs. These consists mostly of old alluvium but part of the deposits may be wind-borne.

Fig. 1. is a generlized diagram showing land forms in a doab.

Between the Jhelum and the Industhe Sind-Sagar Doab or Thal is physiographically different. Its northern partincluded in the semi-arid zone consists of rolling sand plain. The aeolian sand has been derived from the alluvium. The surface soils have been reworked to form low dunes. A large part of it has been levelled up to be brought under cultivation by the construction of canals.

West of the Indus upto the Suleimans lies the piedmont alluvial plain. It consists of sediments carried down from the mountains by rivers and hill torrents.

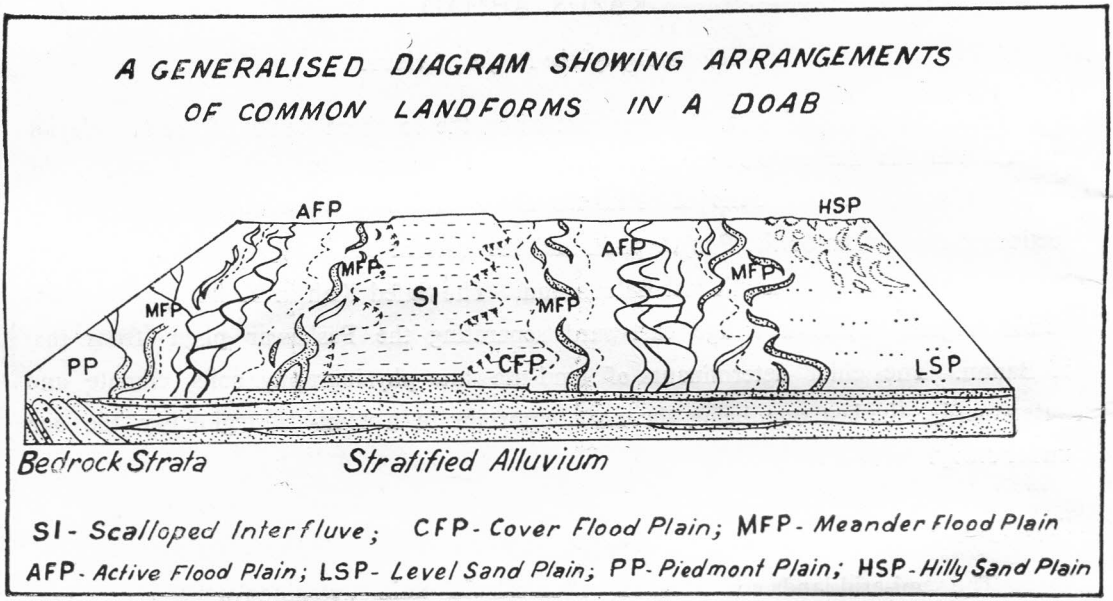


Fig. 1

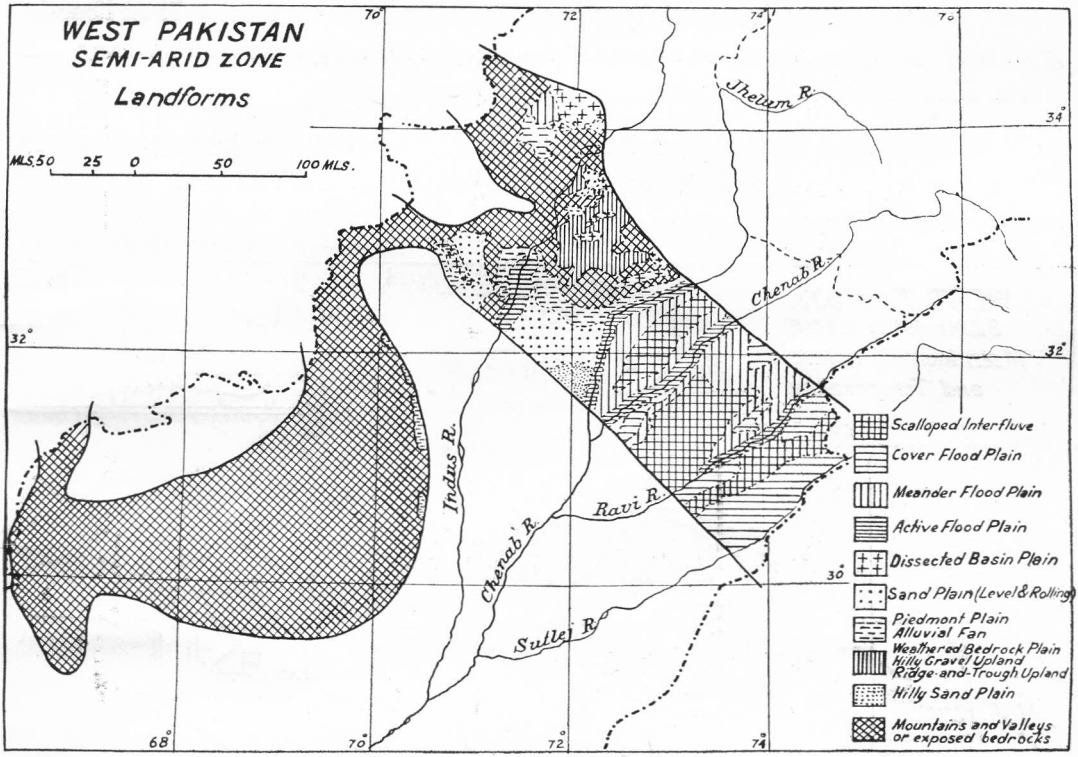
Further to the west and north-west lie the Bannu basin and the Peshawar Vale which consists of alluvial sediments filling intermont depressions. The Potwar, north of the Salt Range, consists of a dissected basin plain in which gully and sheet erosion is widespread.

The region to the west of the Suleimans in the north-east of Baluchistan consists of mountains and exposed bedrocks intersected by numerous river valleys of varying width and intermont plains. The valleys show similar features and consist of flat plain of alluvial soil in the centre, with a pebbly slope or *daman* of varying length rising on either side to the surrounding mountains. It is from these pebbly beds that the supply of water for irrigation is derived through Karezes.

The distribution of these physiographic features or micro-physical regions is shown in Map 1.

Soils

The soils of the plains are generally alluvial, and having been deposited only recently, are mostly immature in pedogenesis. Like other semi-arid parts of the world they have high content of calcium carbonate and are quite productive when irrigated. They are, however, low in organic matter, and available nitrogen and phosphate.



Map 1.

The soils of the active flood plains are predominantly coarse in texture, and finely stratified silt forms the largest element. Lenses of silt are often intermingled with strata of sand. The soil is sufficiently permeable and is easily drained of excess water after the floods. Much of this land is cropped during the winter months for Rabi.

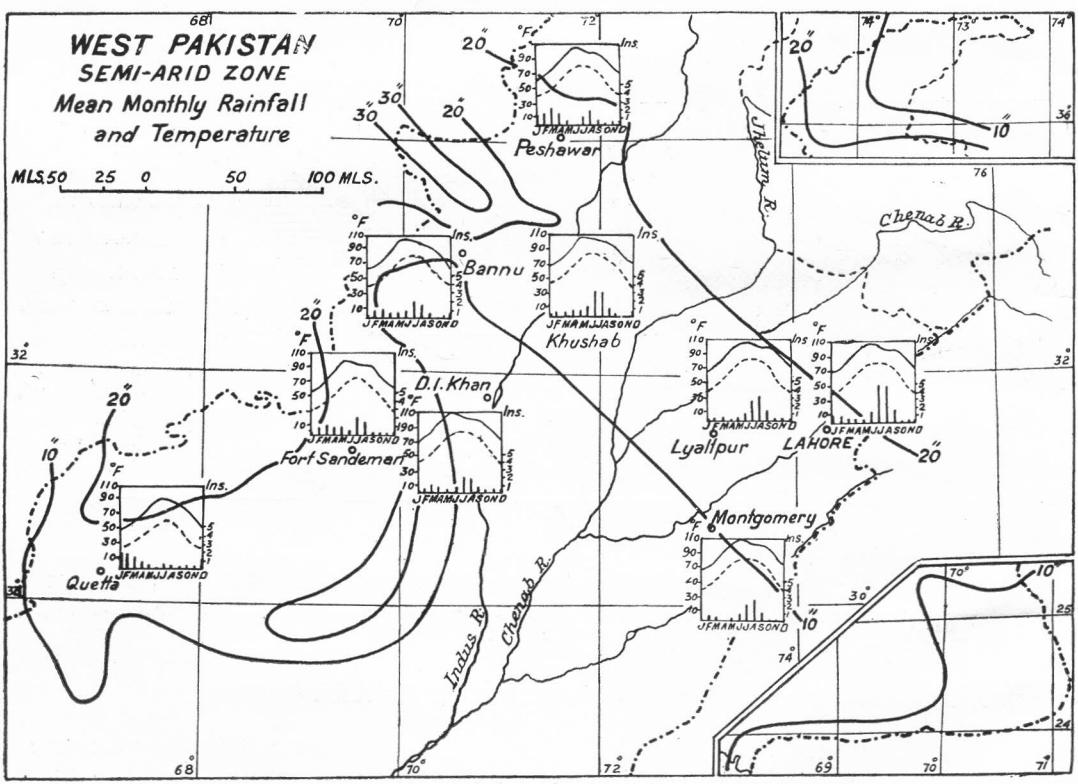
The soils of the meander flood plains generally range between medium and coarse though there may be found in it lenses of fine textured materials. They are finely stratified and their pattern is exceedingly complex. Areas of like profile are small.

The soils of the cover flood plain differ very much in texture both laterally and vertically. Shallow basins have thick strata of fine-textured soils.

The soils of the scalloped interfluves are extremely uniform in texture. They vary from moderately coarse to medium texture with a high percentage of sand and silt. There are some coarse textured materials in the dune areas. Sand is the characteristic soil of the Thal region. The Bannu basin and the Peshawar Vale consist of mountain outwash material, the coarse textured having deposited at the foot of the mountains and the finer textured in the central parts.

In the Quetta-Zhob region the river valleys and plains consist to a great extent of fine grained alluvial silt and clays specially towards the centre of the flat areas. These deposits grade into coarser accumulations towards the margins of valleys and plains passing into taluses of boulders skirting the hills.

In the irrigated lands, as a result of percolation from canals, waterlogging and salinity pose a very serious problem. Rechana and Chaj doabs are much affected from water-logging, poor drainage and salinity.



Map 2.

Rainfall

The semi-arid zone fairly corresponds with the rainfall of 10 to 20 inches. The monthly distribution of rainfall is shown in Map 2. In the plains it is concentrated in the

summer half of the year, though the winters are not dry. Winter—Spring rains become more and more important towards the west and there is secondary maximum in spring or winter. The plain has 40 per cent or more of its precipitation in late summer during the prevalence of monsoons while the highlands in the Quetta-Zhob region have 40 per cent of its percipitation in the cold season. Snowfall is an important element bearing on the landuse as the melting snows keep the Karezes running. South of Safed Koh, the Suleimans and the neighbouring belt of mountains is a zone of evenly distributed precipitation so favourable to the growth of grass. North of Safed Koh there is a spring or early summer maximum.

In the region under study the average annual variability of rainfall is 30 to 50 per cent.

Temperature

The mean minimum temperatures in January vary from 40·1°F in Lahore to 27·6°F in Quetta, the two stations which are fairly good representatives of the plain and hilly sections respectively, the mean maximum temperatures of the hottest month are 105·9°F and 91·6°F, respectively.

Rainfall and temperature both play an important role in the determination of land use and its several characteristics. The region suffers from the lack of adequate rainfall. There is a general water deficiency of 25 to 30 inches. There is, therefore, almost complete dependence upon river and torrent resources of water for agriculture. Apart from the amount, the seasonal distribution and reliability of rainfall have important bearing on agriculture. Though cultivation without irrigation is practised in many areas, it is extremely precarious. Even the irrigated areas are not independent of rainfall, and protection afforded by canals is not complete. High average temperatures in the plains makes cultivation possible all the year round. But great extremes of temperature determine the type of crop to be grown in the two seasons.

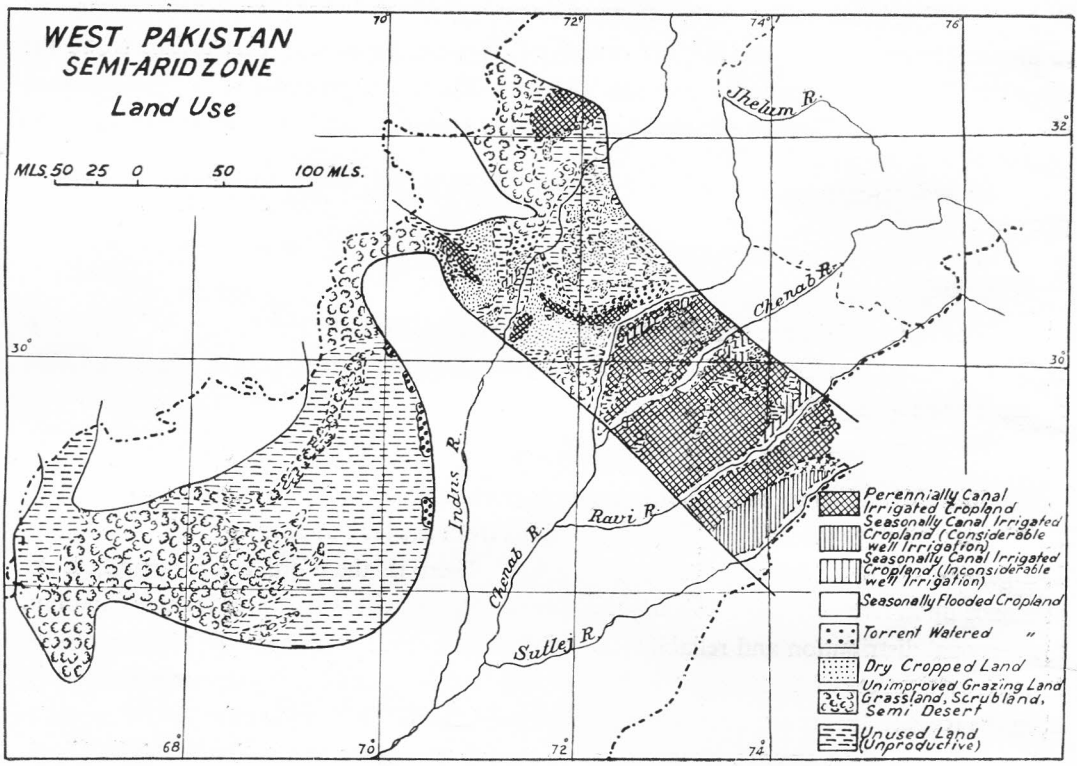
Land Use

The classification of land-use has been done according to the categories adopted by the International Geographical Union's Commission on world land use survey, modified to bring into focus the special features of Pakistan. (Map 3.)

1. *Settlements and Associated non-agricultural lands*

According to the Census of 1961 the urban population of West Pakistan represents 22·5 per cent and rural 77·5 per cent of the total population. The process of urbanization has been gaining momentum ever since independence, but has been specially marked during the decade 1951-61. The process of industrial growth has involved radical shifts in the use of man power and natural resources. There have been large scale movements from predominantly rural to urban centres of rapid industrial expansion. The social effects of

industrialisation and the improvements in the standard of living have led to an appreciable change in the structure of settlements and the use of land in urban areas. The suburban lands which were formerly put to intensive farming, have been taken up for the building of residential, commercial and industrial units.



Map 3.

In our semi-arid lands, there, occur 5 cities with Lahore, Quetta and Peshawar at the ends and Lyallpur and Sargodha in the centre, each having a population of over 100,000. Their inter-censal growth (1951-61) is given in the following table:

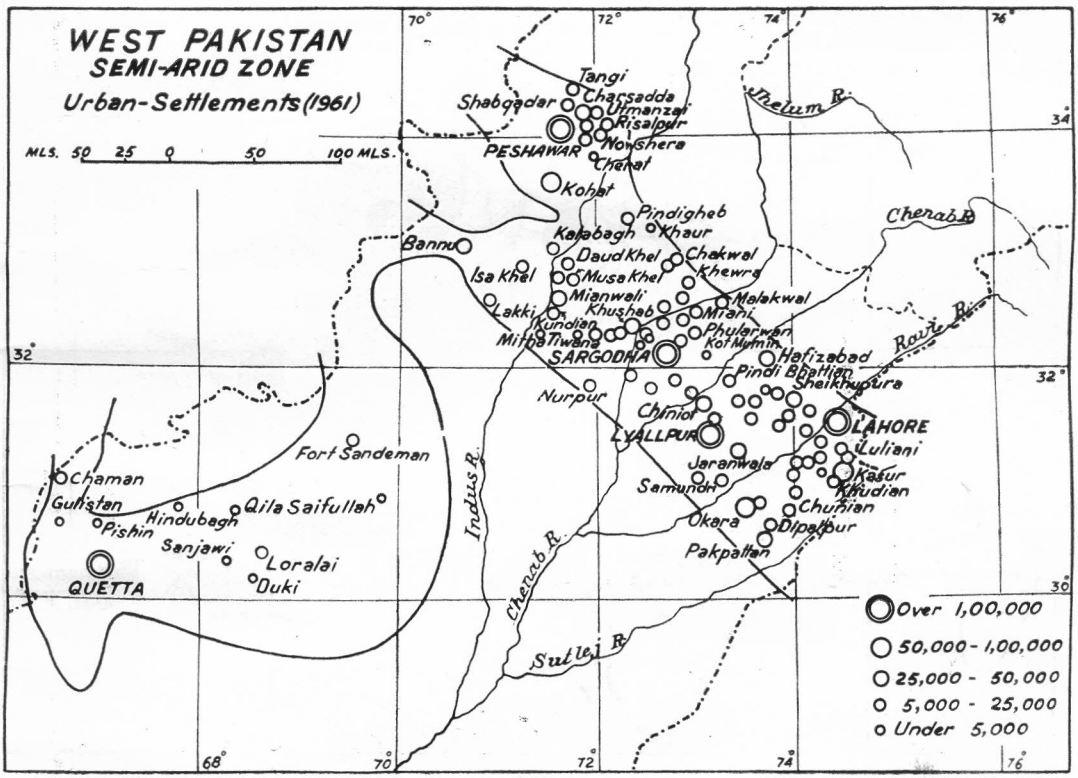
City	Population 1951	Population 1961	Increase	Percent
Peshawar	1,51,176	1,66,273	66,915	44
Sargodha	78,463	1,29,291	50,862	65
Lyallpur	1,79,144	4,25,248	2,46,104	137
Lahore	8,49,476	12,96,477	4,47,001	53
Quetta	1,05,633	84,343	22,290	26

All these have greatly developed industrially and each one of them has satellite residential colonies.

The distribution of urban settlements, is shown in Map 4. These settlements diminish in size and number west of Jhelum-Chenab line. The villages also become more scattered towards the west. In the mountainous west the settlements are almost confined to river valleys and intermont plains, where water is available, as also to the mining areas.

2. *Horticulture*

This category includes all intensive cultivation of small fruits and vegetables. Horticulture is practised almost around all urban centres and on a small scale throughout the rural side. But it occupies too small an area to be shown separately and has therefore been included in crop lands.



Map 4.

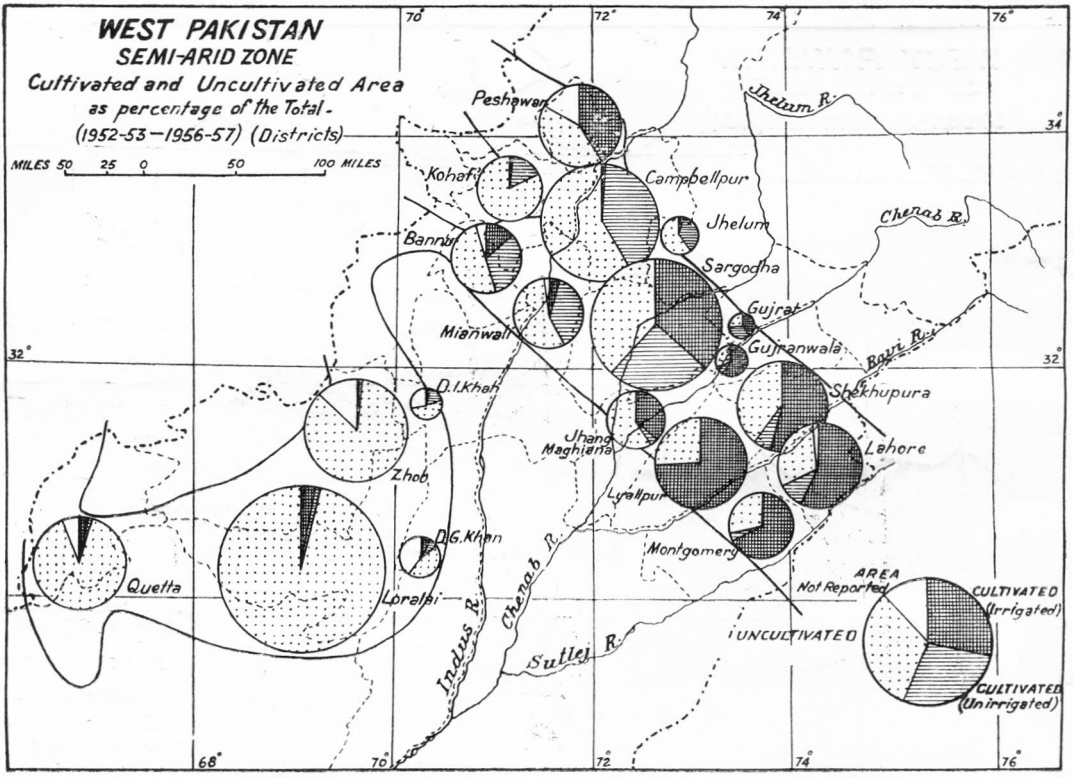
3. *Tree and other perennial crops*

This includes orchards mainly of deciduous and citrus fruits and groves of date-palms and mango trees. They constitute predominant land use in some areas but in the total extent in most of the districts is too small to be shown separately.

4. *Crop-land*

Arable farming is the most important land use in the plains and its pattern has been mainly determined by water-supply and the sources of irrigation. In the canal-irrigated

lands the use of land and the crop grown generally depend upon the amount of water available from season to season. As there are no reservoirs, water is supplied to the land by diversion barrages and weirs and water supply, is, therefore, dependent on the seasonal behaviour of rivers and is not constant. Owing to the enormous difference between flood and low water, there are two types of canals (*i*) Perennial which run throughout the year, and (*ii*) seasonal which operate in the flood season only and include (*a*) non-perennial and (*b*) flood canals. The use of land for any particular crop and the intensity of cultivation mainly depend upon the position of the land in relation to these canals and the period and amount of water available from them.



Map 5.

(*i*) Cultivation under perennial irrigation is the predominant use of land in the scalloped interfluves of the three Punjab doabs and the basin plains of Peshawar and Bannu. (Map-5) High cropping intensities and characteristic cropping programmes distinguish these areas in land use from those having other types of water-supply. In Punjab the intensity is seldom less than 100 per cent while in the Peshawar Vale it is as high as 150 per cent.

There is a predominance of winter crops, wheat being the most important. Paradoxically the season of maximum cropping coincides with the period of deficient flow in rivers.

It may be explained by the fact that canal capacities are adjusted more closely to winter river flow than to summer and thus carry not much more water in summer than in winter. And in summer on account of higher evaporation and transpiration the water-supply is about one half as effective as winter supply and cannot mature as large acreage of crops. Another important characteristic land use in these lands is that assured year-round water-supply permits greater variety in food, fodder and cash crops than is possible in other lands. This advantage in addition to high crop intensities makes these perennially irrigated lands as the most prosperous in West Pakistan. Cotton is the major Kharif crop of these areas in Punjab and millets are extensively grown for fodder.

(*ii*) The seasonally irrigated tracts by non-perennial or flood canals are generally distributed over meander or cover flood plains. They can be given copious summer waterings for raising Kharif crops with high water requirements like rice. Cotton and millets are other chief crops. These canals operate throughout the entire growing season of Kharif crops. The Rabi crops in this area including wheat are matured with the help of rains or wells or both. Intensities of cropping on land irrigated by canals and wells combined may be almost as great as those under perennial irrigation.

Seasonal supply of water is given to lands which are rough, saline or otherwise inferior. Crops which require particularly assured supply of water over long periods, such as sugar-cane, are not widely grown.

(*iii*) Seasonally irrigated canal lands which have no supplementary water-supply from wells are devoted to rice in Kharif and drought tolerant gram and oilseeds as well as some wheat.

(*iv*) Cultivation based on river flooding is the sole or predominant use of ribbon like belts along the major rivers and in patches along the minor rivers, interspersed with small patches or extensive tracts of scrub unused land .

While wheat is the only crop grown on the active flood plains of the Ravi, Chenab and Jhelum in Rabi, summer or Kharif cropping is often extensive with millets, pulses and oil-seed as the chief crops.

(*v*) Torrent watered cropland is dependent on sporadic flood waters tapped from torrent beds by irrigation cuts and trained into the embanked fields. These lands are of special significance in the piedmont plain of Dera Ghazi Khan and Dera Ismail Khan. The water must be used as it comes. Cultivation is precarious and only a limited number of crops can be grown. Crop intensities are generally low, the highest to be found along the torrents. Millets are the only crops grown in Kharif while grain and oil-seeds are the main crops of the restricted winter cropped fields.

Such lands also occur in the Peshawar vale and Bannu basin. But here the winter crops are more important as the winter rains are more siginificant. These rains are also useful for fruits.

(*vi*) Well Irrigated Crop-land. Land of this category is irrigated with groundwater raised by various methods, the commonest being the Persian wheel. Secure from the vagaries of rainfall and involving much labour and expense these lands are very intensively cultivated. Well irrigation though widely distributed is found in concentration in some parts, *e.g.* the Swabi, tehsil in Peshawar vale, where water is used in specialised commerical tobacco production. In well irrigated lands the intensity of cultivation is at places as high as 200 per cent. Wells and canals are found together within many areas. They supplement the canal supplies to maintain high cropping intensities. Well irrigation is also practised in active flood plains, sufficiently high to escape damage from normal floods.

In well-irrigated lands the spring harvest is almost always much larger than the autmn harvest because the intense summer heat lowers the efficiency of the draught animals and increases the rate of water loss through evoporation. Wheat is the most widely grown of the winter crops. But with an assured and regulated water-supply there is a wide range of crops grown.

(*vii*) Dry Cropped Land. Land of this category is cultivated with the help of rainfall only, without irrigation from any sources. Crops are, therefore, precarious. Various practices for the conservation and judicious use of water are adopted. These lands are common both outside and inside the area commanded by canals. In the latter case dry cropping is restricted to those lands which are too high or too rough to be watered by any sources. In Potwar the terrain is intricately gullied and the rivers are deeply incised below the general land level. In Peshawar and Bannu, the rolling sandy plains are mainly dry cropped. Here the monsoon rains are supplemented by winter rains from western disturbances. Thus both the Kharif and Rabi crops can be grown, millets and pulses in the former and wheat and gram in the latter season.

In parts where the soil is fine textured and the water tends to run off, the rainfall conserved in many fields is distributed over a few by the construction of embankments and diversion ditches. Blocks of fields are thus cultivated in rotation from year to year.

5. *Improved Perennial Pasture*

This land use category includes grazing lands which are managed or enclosed. Such lands do not exist in West Pakistan.

6. *Unimproved grazing land*

Lands of this category includes all natural grazing grounds. The vegetation consists of grasses, shrubs and scrubs. They are generally confined to lands which are unsuitable

for cultivation because of ruggedness of terrain, excessive salinity or waterlogging, inaccessibility to flow from canals or susceptibility to frequent, destructive river flooding. The landuse problems in these lands are similar to those found in arid grass lands in many other parts of the world. The life is hard and hazardous. The rainfall being low and erratic there is ever present the risk of starvation for flocks and their owners. Grazing is abundant only during the rainy season and for the rest of the year the animals subsist on dry grasses and shrubs. Grasslands are commonly found on riverine belts which are subject to annual inundations and on waterlogged soils, where there is plentiful soil mositure to counteract aridity.

Practically in every village there is an area called culturable waste which serves as pasture for village cattle. Village commons or *Shamilat* is a part of it. The stony slope at the foot of the mountains in north-east Baluchistan are scrub and or semi-desert and are useful only for grazing.

7. *Wood-land*

These semi-arid lands are deficient in forest resources for want of water. There are a few small areas of government reserved or protected forests in different parts.

8. *Swamp and Marsh*

This category includes fresh or salt water areas used for fishing, hunting or grazing. These are too small to be demarcated. Most of them are confined to depressions and abandoned river channels in the meander flood plain or to a smaller extent in the cover flood plain. The moist ground at the edges supports plant growth for grazing.

9. *Unused land*

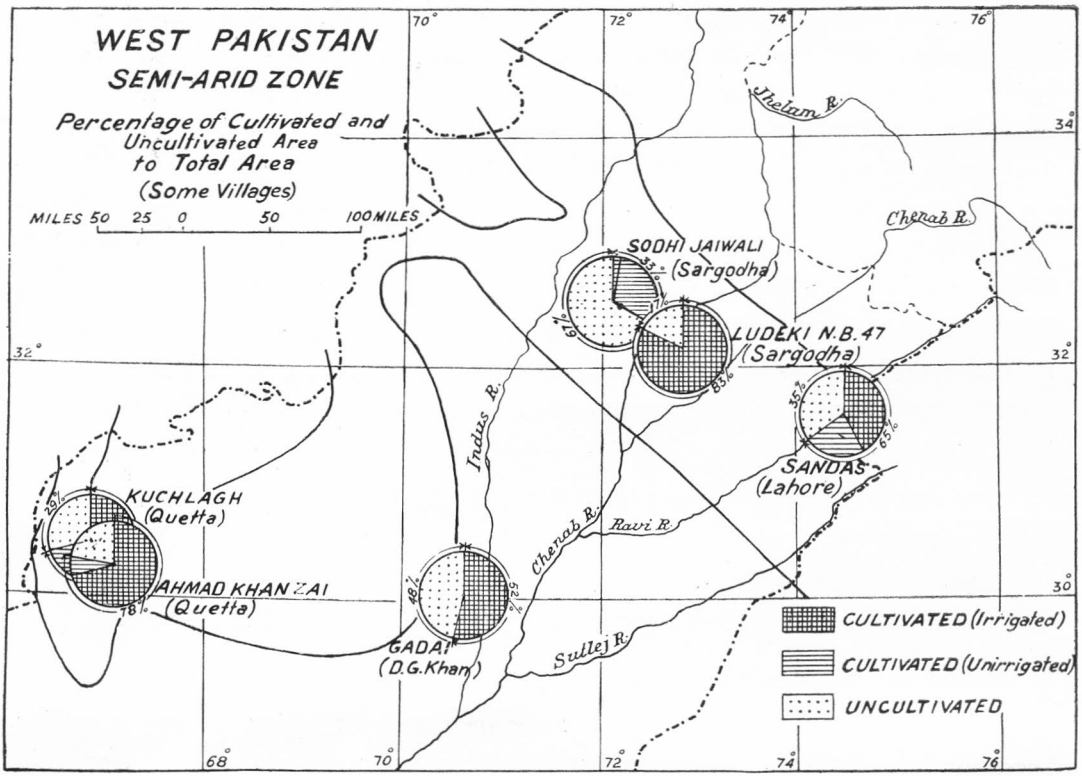
This land use category includes land which is at present unproductive *i.e.*, the land which does not fall in any of the categories mentioned above.

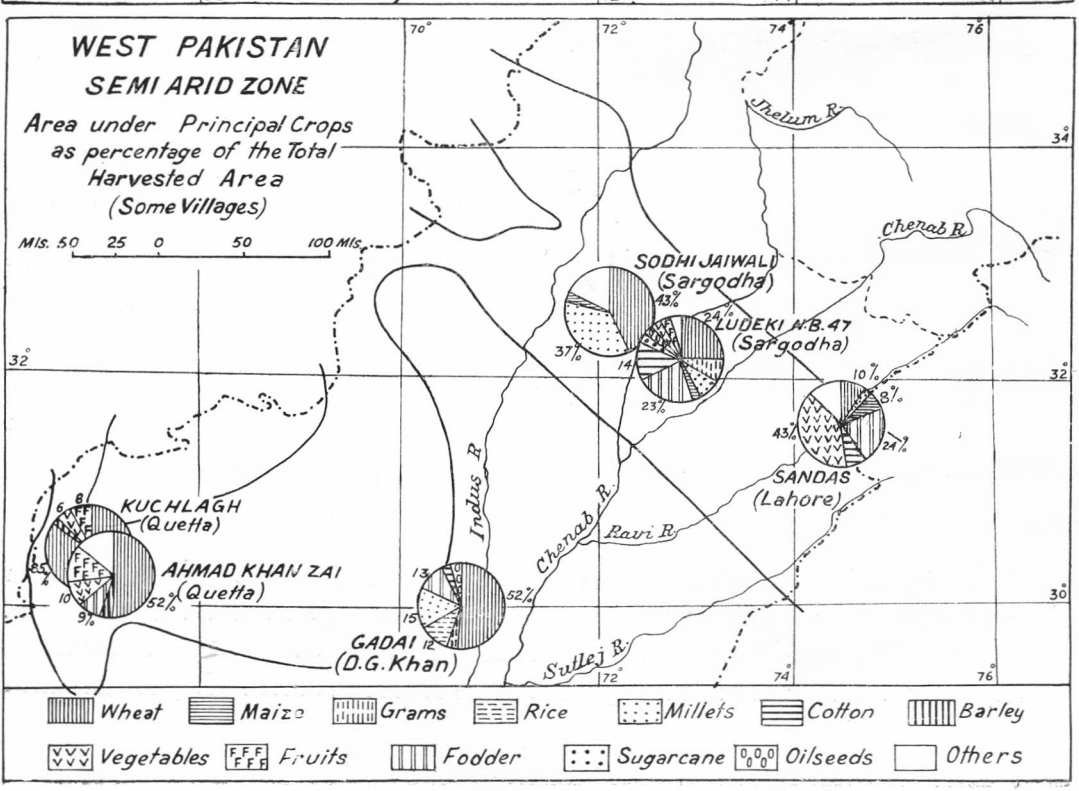
Although such lands are scattered over the whole region under study, they are found in large extent in piedmont plains, Potwar uplands and the hilly area of N.E. Baluchistan. They could not be used for a variety of reasons in different parts *e.g.* extreme aridity, unproductive soil, too stiff, saline, alkaline or waterlogged. Some of these land should be cultivated with the extension of irrigation.

Sub-regional and village studies (Maps 6 & 7)

Bari Doab.—This region is highly irrigated, predominantly seasonally in its eastern part, constituting the Nili bar and perennially in the western part, known as Ganji bar. There is considerable well irrigation to supplement the seasonal canal irrigation and the soil is very fertile with the result that the agricultural use of land and the intensity of cultivation

Map 6. and 7.


WEST PAKISTAN
SEMI-ARID ZONE
Percentage of Cultivated and Uncultivated Area to Total Area
(Some Villages)
MILES 50 25 0 50 100 MILES
SODHI JAIWALI (Sargodha)
LUDEKI N.B.47 (Sargodha)
SANDAS (Lahore)
KUCHLAGH (Quetta)
AHMAD KHAN ZAI (Quetta)
GADAI (D.G.Khan)
Jhelum R.
Chenab R.
Indus R.
Ravi R.
Sutlej R.
CULTIVATED (Irrigated)
CULTIVATED (Unirrigated)
UNCULTIVATED


WEST PAKISTAN
SEMI ARID ZONE
Area under Principal Crops as percentage of the Total Harvested Area
(Some Villages)
MIS. 50 25 0 50 100 MIS.
SODHI JAIWALI (Sargodha)
LUDEKI N.B.47 (Sargodha)
SANDAS (Lahore)
KUCHLAGH (Quetta)
AHMAD KHAN ZAI (Quetta)
GADAI (D.G.Khan)
Jhelum R.
Chenab R.
Indus R.
Ravi R.
Sutlej R.
Wheat
Maize
Grams
Rice
Millets
Cotton
Barley
Vegetables
Fruits
Fodder
Sugarcane
Oilseeds
Others

is very high. It is almost completely free from waterlogging and salinity. Deficiency of water supply in winter is the main problem. Cotton and millets are tle principal crops. Wheat is the chief rabi crop while oil-seeds are also grown in its western parts. This is a part of the area which will be most affected by the loss of the waters of the three eastern rivers to India.

Sanda Kalan and Khurd (*Dist. Lahore*). —The twin village is located in the active flood plain of the river Ravi, 2 miles south west of Lahore. The rainfall is under 20 inches. It is irrigated by canals, wells and city drainage. Sixty five per cent of the area is cultivated of which 56·6 per cent is double cropped. The very high percentage of uncultivated area in a village so near Lahore is due to the fact that a large area is subjected to too much soil moisture. Sixty eight per cent of the cultivated area is irrigated out of which city drainage irrigates about 45·7 per cent. The rest (31·7 per cent) is seasonally flooded (*Sailaba*) by Ravi. Dry cropped (*Barani*) area is negligible. On account of the vicinity of Lahore cash crops occupy 75 per cent of the cultivated area. There are several harvests of vegetables, and fodder is necessary for the maintenance of cattle to supply milk. Wheat and maize are the chief grains (Map 5). The holdings are small but are quite economic on account of the intensity of cultivation.

Rechna Doab.—The greater part of the Doab in the semi-arid zone consists of meander or cover flood plains which are greatly waterlogged and are highly saline. Large areas of cultivated land, once highly productive have fallen into disuse. The scalloped interfluve is however free from these menaces and is perennially irrigated with as high cropping intensities as 130 per cent. Soils, though complex in pattern, are productive. Wells are widely scattered to help the winter crops. Wheat, maize and fodder are grown in winter and cotton and sugarcane in summer. Rice is the principal crop of the seasonally irrigated land and of the depressed areas, occupying the foremost position in its cultivation in West Pakistan.

Dry cropping is practised in the sandy lands which are too high to be reached by flow from canals. The moisture from the summer rains is conserved for winter grains, wheat or gram or their mixture. The active flood plains are used for flood cultivation (*Sailaba*) and grazing. Grazing is the main use of land on the waterlogged parts where water-loving grasses and shrubs grow profusely in areas which are unsuitable for cultivation.

Chaj Doab.—Meander flood plain and scalloped interfluve are the two land forms which cover the bulk of the area, the latter being a part of the Kirana bar. There is no cover flood plain. The perennially irrigated bar uplands constitute one of the most prosperous agricultural lands with wheat as the chief winter and cotton as the summer crop. A part of the meander flood plain which is also irrigated has lower crop intensities. The cropping intensities are higher under perennial irrigation than under non-perennial, and these intensities are also found to be higher towards the head of a canal rather

than to the tail end. Cotton is also the most important crop in seasonally irrigated lands. Rice is grown in the fine-textured soils of the riverain lands.

Dry cropping is done on the sandy soils of the high river banks and central parts of the meander plain. The active flood plains are used for flood cultivation and grazing. Some areas are waterlogged and saline but to a much less extent than in Rechna Doab. Unused lands include some rocky wastes and belts of shifting sand.

Village Ludeke (*Dist. Sargodha*).—The village is located 1½ miles north west of Sargodha to which it owes its prosperity. The cultivated area is very high (83 per cent) and practically the whole of it is irrigated by canals. The water-table is too low for well irrigation. Cash crops occupy 55 per cent, much less than in the case of Sandas of Lahore, an obvious commentary on the difference of the influence of the nearby urban centres. Food crops cover 45 per cent of the area. Rabi has 56 per cent and Kharif 44 per cent of the crops. Wheat and cotton are the main crops. Though fodder occupies about the same position, the acreage under wheat is higher and under vegetables much lower than in the Lahore villages. Only 20 per cent of the area is double cropped.

Northern Thal (*Sind-Sagar Doab*).—It is a rolling sand plain. Unlike other doabs it lacks alluvium and consists mainly of wind-blown sand. Sand-storms, excessive permeability and rough land are the main problems of land use in this area. These lands provide a living example of a large scale transformation of a semi-desert area with a pastoral economy into a prosperous canal colony. The land use in this area is also notably affected by the integrated socio-economic development in distinction from other plain area. There is a long strip of perennially irrigated land in the south of the Salt Range with wheat, gram and fodder as the main crops. The summer crops include sugarcane and cotton. The rest of the area is dry cropped with gram as the main crop. Waterlogging is developing fast.

In the Salt Range Piedmont area the alluvial fans are grazed but not cultivated. Further south are found the torrent watered and dry cropped land. The most secured lands lie near the nalas and are reserved for winter crops.

The Suleiman Piedmont.—These lands lie to the west of the Indus and consist of a plain, sloping gradually down from the mountain foot to the river. Numerous torrents have cut deep beds for themselves and the entire sub-montane belt is dissected into strips or blocks. It is an area marked by a great contrast in water-supply, plenty to scarcity. The rainfall within the region is no index of its hydrological resources. Its water-supply depends not so much on its own rainfall as that of the bare hills to the west.

The deposits show an orderly sequence in texture from gravel fans and sandy outwash near the mountain to medium and moderately fine materials at the far end. The whole region is monotonously uniform both in physical appearance and land use.

The torrents being the main source of water-supply, agriculture depends upon the size of the catchment basin and rainfall it receives. Torrent-watered crop land lies in strips along the mountain base and alongside the large streams. The divides between the torrents are generally waste.

In the northern part where the rainfall is heavier and more evenly distributed dry cropping is also practised. In the south, dry cropping is not practicable and torrent-watered cultivation is confined to the summer season. The Rabi harvest, wheat and gram, is normally greater in the northern part and Kharif, mainly millets, in the southern. About one-third land in the Dera Ghazi Khan plain is used for grazing. On account of great radiation of heat from the mountains, villages are rarely found in the immediate nieghbourhood of hills. The deposits against the protective embankments of villages raise the fields higher.

Village Gadai.—The village is two miles south of Dera Ghazi Khan, a little outside the semi-arid area. It has two distinct zones, (*i*) an alluvial plain in the south and east and (*ii*) hill torrent area in the north and west, built of coarser material brought by seasonal torrents. Fifty five per cent of the area is cultivated, entirely by irrigation. Sixteen per cent of this irrigation is provided by hill torrents and the rest by flood canal and wells. Cash crops are unimportant on account of irregular water-supply. Hill-torrent area produces only millets mainly jowar. Wheat, fodder and rice are important in the canal irrigated land.

Bannu Plain.– It is a large alluvial basin drained by river Kurram and its tributaries and practically isolated by a ring of mountains. It possesses a productive central core, aligned along the course of the river Kurram and a surrounding belt of less productive, rolling sand plains and torrent seamed piedmont plains. It exhibits the normal depositional sequence, coarse textured deposits at the foot of mountain, moderately fine or fine textured at the centre.

The land use varies in different areas. In the central plain of the Kurram-Gambila doab, with perennial irrigation, are grown a large number of crops—wheat, foders and vegetables in winter and maize, sugarcane, rice and fodders in summer. As the rainfall is fairly well distributed throughout the year both Rabi and Kharif crops are almost equally important.

Torrent watered crop-land is restricted to narrow lands along the major *nalas* while the intervening tracts are devoid of cultivation and vegetation. Cultivation is devoted to raising such crops as wheat, gram and millets.

The rolling sand plains in the east and south are precariously dry cropped. Winter crops are more important than summer crops, the former being grown with the help of monsoon rains and matured by winter showers. Desert scrub and waste land are found in some places.

Peshawar Vale.—Situated in the extreme north-west the Peshawar Vale is hemmed on three sides by arid mountain ranges. It opens towards the east into the Potwar Uplands. The central part of the Vale is a very fertile alluvial plain drained by the river Kabul and its northern tributaries of which the Swat is the most important. Fed by melting snows and rain fall both in summer and winter they carry plentiful supply of water all the year round. About half of the area is under perennial irrigation with cropping intensities as high as 150 per cent. With a good winter rain-fall the area under winter crop exceeds that of the summer crops. Wheat is the most widely raised winter crop followed by barley and fodders. Maize and sugarcane are the chief summer crops. Rice is important on the riverain lands. Cotton which is an important crop in the canal irrigated lands of the Punjab Plains is rarely grown.

Well irrigation is concentrated in Swabi where excellent tobacco is grown.

Dry cropping is confined to a narrow belt along the mountains and Sar-i-Maira tract in the south-east. Here the soils are sandy which are favourable to dry (barani) cultivation. Mostly Rabi crops are grown on such lands. The bordering ranges are clothed with scrub and grass and provide extensive suitable grazing grounds.

Potwar Uplands and the Salt Range.—The Potwar Uplands and the Salt Range bordering it in the south are made up mainly of land-forms, not encountered in other parts of the Indus Plains. The lithology and attitude of bed rock and its depth below the surface together with erosion are the main features determining land-forms.

The soil consist of alluvial, loessal and residual materials of varibale texture.

The summit of the Salt Range is a broad plateau, occupied by a series of shallow basins with several salt lakes. Most of the land is unused, with patches of dry cropped or torrent irrigated lands. Coal and salt and some other minerals are mined in various parts.

The Potwar upland is greatly affected by gully and sheet erosion. About half the area is unused and most of the rest is devoted to dry farming. The pressure of human and livestock population on the land is very great. Scarcely a cultivable acre is left untilled and cultivation takes place on the most unlikely spots, such as high, uneroded pinnacles of alluvium, flanks of gullies and pockets of alluvial soil in the bare rock plains. Cattle, sheep and goats are put out to graze, wherever the vegetation grows, in gullies along stream courses and hill-slopes. Grazing of these lands make them even more susceptible to erosion.

In all parts the winter crops are greater than the summer even though the summer rainfall is every where greater than that of winter. Wheat is the pred minant crop. Rabi crops are grown only on the coarser soils and Kharif crops on the finer textured soils. Millets are grown in summer.

Village Sodhi Jai Wali (*Dist. Sargodha*).—The village is situated in Soan Sakesar valley in the Salt Range. The rainfall is about 15 inches. Summer half is rainier than winter

half. Only one-third of the total area is cultivated of which only 7·1 per cent is irrigated by the waters of the Jai Wali stream and three wells. The small percentage of the cultivated acreage is due to the rough topography and lack of water-supply. Water-table is very low. The existing wells lie on the banks of the Jai Wali. Food crops occupy 87 per cent of the harvested area. Of these wheat is the most important occupying 43 per cent of the total harvested area and 50 per cent of the food crops. Bajra (millet) occupies 34 per cent of the harvested area. Cash crops occupy only thirteen per cent of the total harvested area and include oil-seeds and tobacco and some fodder for local consumption. Sixty per cent of the total area is used for grazing sheep and goats. It lies along the hill slopes. Holdings are small, only one quarter of the holdings are larger than 8 acres.

Located far in the interior the economy of the village is primarily based on subsistence farming.

Quetta-Zhob hilly region.—This region lying in north-east Baluchistan is different from other regions dealt with so far in the pattern of land-use. The two dominant factors are the presence of mountainous tracts incapable of cultivation and the absolute necessity of perennial irrigation to ensure harvest. More than 90 per cent of the area is unused or unproductive. The cultivated area, only 2½ per cent, is confined to the river valleys irrigated by flood water or to the intermont plains irrigated by Karezes. For dry crop cultivation the fields are embanked and are filled with rain or flood water in winter and summer.

Wheat is the predominant crop in Rabi and fruits in Kharif. Grapes and apples are the chief fruits. Rabi crops are rain fed but almost all the Kharif crop depend upon irrigation. Forest occupy only about 1½ per cent of the area.

Unimproved grazing lands are found in the valleys and the plains and the lower slop s.

Villages Ahmad Khanzai and Kuchlagh (Dist. Quetta).—Ahmed Khanzai is located 3½ miles south-west of Quetta and Kuchlagh 14½ miles north-west of the city. Both the villages have a high ratio of cultivated area amounting to 78 and 71 per cent respectively out of which 91 and 65 per cent is irrigated. The high percentage of cultivated land in an otherwise semi-arid and unproductive land is due to the availability of water from Karezes and springs and due to proximity of these village to the urban centre of Quetta.

Cash crops occupy 46 per cent in Ahmad Khanzai and 14 per cent in Kuchlagh. The difference is due to their relative distance from Quetta. Of the cash crops, fodder, vegetable and fruit are important in the nearby Ahmad Khanzai. In Kuchlagh only apple orchards and fodder are the chief cash crops. Wheat is the predominant food crop, accounting as much as 86 per cent in the farther Kuchlagh and 52 per cent in near by Ahmad Khanzai. Crop failures are a common feature, much more so in Kuchlagh with a smaller irrigated area. They are as high as 25 per cent in some years. The failure of crops

is generally due to heavy spring frost when the trees are fruiting or due to heavy winter rains which spoils the wheat crops. The double cropped area is negligible.

Land Use in Prospect

On account of the heavy pressure of population, shortage of food, extension of irrigation and water power, implementation of land reforms and the growth of industry, the land use is likely to undergo an appreciable change in the years to come. More and more culturable wastes are being brought into cultivation through mechanised cultivation and tube-well irrigation, which has been made possible by the development of hydro-electric power and the electrification of the rural area. Co-operative farming is being encouraged on governmet lands commanded by the new barrages.

According to the Land Reforms Commission a ceiling has been fixed for agricultural holdings at 500 acres of irrigated land or 1,000 acres of unirrigated land. The land over and above the above limit has been resumed and the tenants cultivating the resumed areas have been given the option to buy them on instalments spreading over 25 years.

Fragmentation of holdings below the subsistance or economic limit has been restricted. A subsistance holding comprises an area of 12½ to 16 acres and an economic holding 40 to 60 acres depending upon its cultivation. These measures are bound to affect land use pattern in various areas.

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ROCK SALT RESOURCES OF PAKISTAN

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Rock salt is the commercial name of the mineral halite, a chloride of sodium (NaCl). It is one of the most important members of the evaporite series of minerals produced as a result of the concentration and precipitation of ocean water in enclosed or cut-off water-bodies. In arid environments, the evaporation of isolated bodies of sea water that were cut off from circulating ocean currents by reefs, sandbars, or other means, produced extensive and thick-bedded deposits of salt during different geologic times. Rock salt, so formed, is generally associated with gypsum and anhydrite and the salts of potassium and magnesium in minor quantities; it is often interbedded with red marl and clays.

In West Pakistan, rock salt deposits are found in the Kohat District and throughout the Salt Range (Fig. 1). In the Kohat region, the salt lies below the Eocene limestone, whereas in the Salt Range it is at the base of rocks of Cambrian age and extends for several miles beneath the Potwar plateau to the north. In a deep test hole at Dhariala, north of Khewra, salt beds 7,000 feet thick were encountered.

The existence of rock salt deposits in the hills of Kohat and the Salt Range has been known since time immemorial. Localities and workings in the Salt Range were mentioned by Alexander the Great as early as 372 B.C. The salt mines of the Punjab (Salt Range) are mentioned in *Ain-e-Akbari*, a chronicle written during the days of the Moghal Emperor Akbar. After the decline of the Moghal empire during the 18th Century, the salt deposits passed into the hands of Sikh rulers who worked some without any system or planing. In 1849, the British took over management of salt mining in the country and systematic investigtion and mining of salt deposits has since remained the responsibility of the government departments.

Salt Range Deposits

The Salt Range extends from the Jhelum River in the east to the Indus River on the west, a distance of about 150 miles. In the major portion of the range, from Jutana to

Mari Indus, salt outcrops at many localities over a distance of about 80 miles. The salt is generally found at the base of the escarpment-forming part of the Panjab Saline Series. The base of the Punjab Saline Series is nowhere exposed. The salt-bearing strata are composed of gypsum, anhydrite, dolomite, red marl, and salt. The salt beds are interbedded with impure salt marl, locally known as "*khallar*", and bands of marl with impure potash salts.

The salt beds of the range have been affected by a series of tectonic movements, resulting in shallow and elongated anticlinal domes due to the plasticity of the salt and marl under intense tectonic pressures.

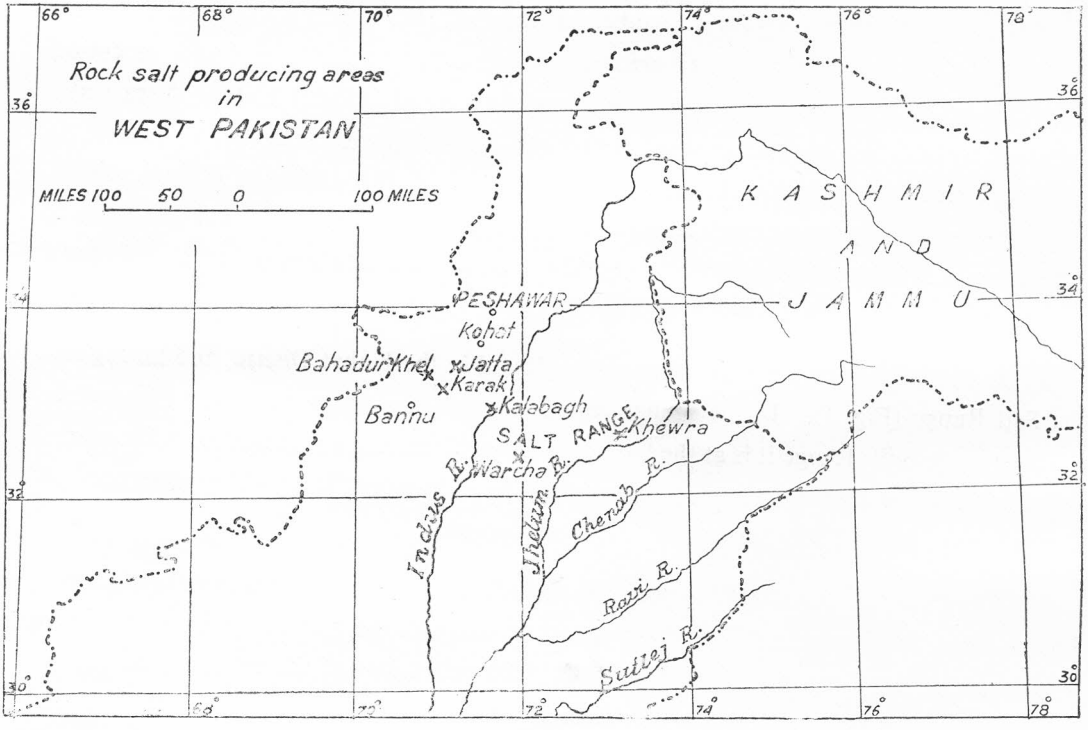

Fig 1.

Although salt outcrops are at a number of places in the Salt Range, mining is confined to Khewra, Warcha, and Kalabagh (Fig. 1).

Khewra deposit

The oldest and by far the largest production of rock salt in the Indo-Pakistan subcontinent is at Khewra, a small mining and industrial town in the Pind Dadan Khan subdivision of Jhelum District. Khewra is the terminus of the Malakwal-Khewra branch line of the Pakistan Western Railway and is about 15 miles northwest of the Malakwal town,

which lies on one of the main lines of the Pakistan Western Railways; it is 783 miles from Karachi. The Khewra salt mine is situated just east of the Khewra gorge, about half a mile north of the Khewra railway station.

Salt is mined by the chamber and pillar method. The chambers are 50 feet wide in most of the mine, a few are 35 feet wide in the western part, and are horizontally and vertically in series across the strike of the beds. To date, the mine has 65 chambers from west to east.

Structurally, the mine can be divided into western, central, and eastern zones. In the western zone, the beds dip 60-80 degrees to the north and northwest. In the central zone, the beds flatten out and dip northeast; in the eastern zone the beds swing east-west and dip south and southwest.

Geology

The Punjab Saline Series, the salt-bearing formation, is exposed along the southern edge of the scarp slope of the Salt Range and also along the cores of transverse anticlines traversing the escarpment. The Khewra area is an irregular dome which has been cut by the Khewra Kas (stream) exposing one of the important stratigraphic type sections of the Salt Range. In the southern one and a half mile of the Khewra gorge, a complete sequence of the Punjab Saline Series is exposed.

Following is the sequence of rocks of the Punjab Saline Series exposed in the Khewra dome area :

	Thickness
Upper gypsum dolomite	0-50 feet
Upper Saline Marl } Bright red marl band, minor salt seams	250 ,,
Upper Saline Marl } Dull red marl band, 15 feet gypsum at top	150 ,,
Middle gypsum	150 ,,
Lower or main Saline Marl	2,000 ,,
Lower Gypsum Dolomite	Hundreds of feet, base not exposed.

All salt seams being worked in the Khewra salt mine form part of the Lower Saline Marl beds of the Punjab Saline Series.

Structurally, the salt-bearing strata of the Khewra salt mine form the northeastern quadrant of an irregular dome, the southern half of which has been faulted. It is also affected by a number of faults and collapse structures along its periphery. A fault running north-south along the Khewra gorge limits the westward working of the Khewra salt mine.

The Main saline marl contains a complex of thick seams of pure and impure salt which together form a large lenticular body, the central part of which lies in the western zone of the mine and in the eastern zone lies the thinner edge of the saline lens. The other half of the lens probably lies across the Khewra gorge on its western side.

The saline marl is comprised of a number of seams of salt with intervening khallar and marl bands of varying thickness. The salt seams fall into two major groups separated

by a thick zone of thin seams of salt, marl, and khallar about 100 feet thick. The two complexes with their component seams are given below :

North Buggy	Buggy complex seams
Buggy	
Sujjowal	

Thin seams of salt, marl, and khallar

Upper Pharwala	Pharwala complex of seams
Middle Pharwala	
South Pharwala ..	
New Low Level Tunnel Seam	

Of all the seams mined in the Khewra salt mine, the Buggy complex contains the thickest and the best quality salt.

North Buggy Seam : This seam, about 25 to 50 feet thick, lies above the main Buggy seam in the northern workings of the western zone of the mine. A khallar band about 10 feet thick separates it from the Buggy seam.

Buggy Seam : At the western end of the present mine workings, the Buggy and Sujjowal seams are one combined seam over 270 feet thick. The intervening Buggy-Sujjowal khallar band appears near Chamber 8 and the two seams separate. The Buggy seam is about 150 feet thick, including a few minor khallar bands in this part of the mine. Toward the east, the seam decreases in thickness and gradually reduces to 70 feet around Chambers 35 and 38. The seam dips north and northwest at a fairly steep angle of 60-80 degrees in the western part of the mine. The dip is reduced to 30 to 45 degrees around Chambers 35 to 39.

In the central zone of the mine between Chambers 40 and 50, the northerly dip is maintained on the higher levels to Chamber 42. Here the easterly plunging anticlinal and synclinal structures change the direction of the Buggy and Sujjowal seams. As a result, the seams dip east and south in the centarl and eastern zones, respectively. In the central zone of the mine, the Buggy seam is about 60 to 65 feet thick with a number of minor khallar bands. As a result of very low easterly dips in this area, some of these khallar bands appear to occupy wider areas and cause difficulties in the workings.

In the eastern zone between Chambers 46—65, the beds strike east-west and have a moderate southerly dip of 25—30 degrees. In this zone, the Buggy seam is 65—70 feet thick with a tendency for attenuation towards the east and along the dip. On the 6th Level, its thickness is reduced to about 60 feet.

A significant khallar band appears in the Buggy seam on the 3rd Level which becomes 15 feet thick on the 4th Level. It divides the seam into two parts of 20 and 40 feet, respectively.

The southerly dip of the seams in the eastern zone continues upto the 4th Level (100 feet below the Pharwala Development Level Ground Level), below which the dips flatten

and a broad synclinal structure is formed. As a result, the seam becomes nearly horizontal on about the 7th Level.

Beyond Chamber 60 in the eastern zone, the east-west strike changes to northeast, apparently forming the nose of easterly plunging anticline.

Sujjowal Seam : Sujjowal seam is probably the oldest known and worked salt bed of the area; most pre-British workings are in this seam. The seam crops out near the old Khewra village in the Billianwala area. It lies below the Buggy seam and is similar in structure.

In the western part of the mine, the Sujjowal Seam is about 60 to 70 feet thick of red and white banded salt. Its thickness gradually decreases towards the east and is reduced to about 40 feet in Chamber 38. In the eastern zone, it is considerably reduced in thickness. Between Chamber 47 and 75 it is less than 15 feet thick and is left unworked.

Pharwala Seams : The Pharwala complex of seams are below the Buggy complex, separated by a barren zone of thin seams of salt, marl, and khallar of about 100 feet thickness. These seams crop out on the Pharwala Development Level, south of the Pharwala Development Tunnel between Chambers 1 and 30. The complex is comprised of the following seams :

Upper Pharwala	(Upper Middle Pharwala)
Middle Pharwala	
South Pharwala	(Lower Middle Pharwala)
New Low Level Tunnel Seam	

The Upper Pharwala seam starts from Chamber 8 and extends to Chamber 30 in nearly an east-west direction, from where it turns south east. The seam dips north and is 35 to 50 feet thick. It is irregularly divided into two parts by a thick band of khallar and marl. It includes potash salt near the bottom of the seam. Form Chambers 22 to 30 the lower half of the seam is useless as a source of good salt, due to impurities.

The Upper Pharwala seam is separated from the Middle Pharwala seam by a thick band of thin seams of salt, marl, and potash; potash salts forming a small part. The thickness of this band increases from 15 feet in Chamber 13 to about 70 feet between Chambers 27 and 30. From Chamber 22 eastward, it changes dip from north to northeast and flattens out to cover a much wider area in the vicinity of Chamber 30, where its strike swings south and the dip becomes easterly following the general trend prevailing in the central zone.

The Middle Pharwala, South Pharwala, and the New Low Level Tunnel seams start as one seam from Chamber 7 and remain one to Chamber 15. The average thickness of this compound seam in these Chambers is about 75 feet. East of Chamber 15, a khallar band, 3 feet thick, appears and divides the seam into the Middle and South Pharwala seams.

This split seam continues to Chamber 21 after which the South Pharwala seam develops potash impurities and the New Low Level Tunnel seam appears as the lower part of the South Pharwala seam. The South Pharwala seam is 35 feet thick in Chamber 16 on Pharwala Development Level (ground level) and increases to 40 feet on the 4th Level in Chamber 30 (of 26 Incline area). The New Low Level Tunnel seam continues its easterly strike up to Chamber 29, where it changes its direction to the southwest with an easterly dip. The separating khallar band between the South-Pharwala and the New Low Level Tunnel seam appears from Chamber 21. The New Low Level Tunnel seam is about 60 feet thick between Chambers 22 and 29.

The Middle Pharwala seam is about 60 feet thick upto Chamber 22, beyond which a khallar band two to three feet thick divides the seam in two upto Chamber 26. On the lower levels, this dividing khallar band thickens to seven feet and the two parts of the Middle Pharwala seam become 50 feet thick each.

Below the New Low Level Tunnel seam is a 1,000 feet thick series of thin seams of salt, potash, khallar, and marl. Some of the thin seams of salt are about five to eight feet thick of good quality salt.

The general trend of the Pharwala seams is east-west to Chamber 17 and from Chamber 18 to 30 the seams swing south, with the easterly dip. Continuing the easterly dip, the Pharwala seams go below the Buggy and Sujjowal seams of the central zone of Chambers 44 and 45. The Pharwala seams reappear below the Buggy seam in the eastern zone on the 6th Level in the core of the anticline in Chambers 46 to 61.

Reserves and production

The Khewra Salt mine has been worked on a planned basis since 1872, but earlier work was not guided by geological considerations. Immense amounts of salt have been left both above and below the present workings. Workings seem to have stopped on reaching the human haulage limit, or with the chance encounter of a subsidiary khallar or marl band which appeared to mark the end of the seam. After detailed geological mapping and study of the mine, an attempt is made to asses the reserves of salt lying above and below the old and present workings. Fresh reserves have come to light as a result of structural interpretations, proved by workings and boreholes. Recent estimates of the reserves of salt in the Khewra mine are over 35 million tons proved and over 47 million tons remaining in pillars.

Salt outcrops, forming part of the western extension of the Khewra saline lens, exist on the western side of the Khewra gorge. They are likely to contain good reserves of salt for future exploitation.

Yearly production has ranged between less than 20 lakh maunds prior to 1890 to 34 lakh maunds in 1960-61, but was as high as 57 lakh maunds in 1945.

Conditions of working

The system of employment of labour for the extraction of salt is peculiar to this area; miners have an "hereditary right" of employment and only registered miners have the right of work in the mine. They have guaranteed employment. Six hundred and eighty-seven miners are regularly employed, regardless of the volume of work required. The total production required each month is divided equally among the registered miners and each is allocated a space for working. The miners are paid minimum wage and the management is obliged to provide that much work, This system lacks proper control over the miners and results in inefficiency and low production.

Warcha deposit

Warcha is the second largest producer of rock salt from the southern slope of the Salt Range. The mine lies in Warcha Mandi (Rukhla), a village about two miles northwest of Warcha. Warcha Mandi is in Sargodha Division, about 9 miles north-northeast of Gunjiyal railway station on the Khushab-Kundian line of Pakistan Western Railway.

Geology

The mine is on the western slope of Warcha gorge, about half a mile north of the exit of the gorge. Here, the salt-bearing marl of the Punjab Saline Series is dierctly overlain, as a result of thrust faulting, by the Lavender Clays of Upper Carboniferous age. On the western side, the salt-bearing marl of the mine is thrust faulted against Mesozoic formations and the Productus Limestone directly overlies the salt marl with only a small thickness of Lavender Clays intervening. On the eastern side of the gorge, the salt marl is repeated several times with the Purple Sandstone, a result of a number of strike faults.

There are five seams of salt in the Warcha mine separated by bands of khallar. Unlike the Khewra salt seams, the Warcha seams are thin and have a maximum thickness of about 50 feet. The intervening khallar and marl bands are not more than 20 feet thick, compared to as much as 200 feet at Khewra.

The sequence of rocks in the mine, as noted by Gee (1938, 1946), is given below :

Upper Carboniferous	Lavender Clays
	———(fault)———
Punjab Saline Series	Gypsum, dolomite, etc.
	Red marl, khallar, and thin seams of rock salt, alternating
	Rock salt, ranges from 8 to 16 feet
	Marl, usually only six inches to one foot thick
	Rock salt, ranges from 5 to 16 feet
	Marl, two to six feet
	Rock salt, ranges up to about 12 feet
	Marl, 15 to 22 feet
	Rock salt (the Main seam of the northeastern part of the mine) up to 50 feet thick
	Marl, 25 to 30 feet
	Rock salt, 20 to 30 feet thick in the southwestern workings
	Marl and khallar, with thin seams of salt
	———(Base not exposed)———

The beds in the mine area generally dip toward N 30° W at an angle of 30 degrees. The pillars and chambers in the mine are aligned parallel to this westerly dip. The seams thin at depth and from east to west. The thickness of the top seams is reduced to one half at Chamber 24, on the west. To the west, the salt marl is cut by faults that bring in the purple and gray Lavender Clays in the northwestern workings. A fault also appears to cut the strata to the south of the present mine.

Mining development

Salt mining at Warcha dates back to the Sikh days (18th Century) and the present workings are grouped around the older, irregularly shaped, "Sikh" mine. When British control begain, scientific mining was adopted. The mine has been developed on four levels, one above the other. The seams are worked by the chamber and pillar method; 40 feet wide chambers are worked out and pillars of 30 feet width are left for support.

A new, low level tunnel leading directly from the southern workings has been constructed for hauling salt, considerably reducing the distance over wihch the salt has to be conveyed to the depot.

Reserves and production

Reserves of salt in the Warcha mine, as compared with the Khewra mine, are Recently, W.U. Siddiqui, Chief Mining Engineer and Director, Salts, W.P.I.D.C., calculated the reserves of salt at Warcha for the benefit of Salt Mines and Quarries Reorganization Committee (1961) as 125 lakh maunds proved, 338 lakh maunds probable and an additional 149 lakh maunds possible, for a total of 612. With the present rate of productions at about 10 lakh maunds per year, the reserves are likely to last for more than 60 years.

Besides the reserves available in the Warcha mine, other deposits of workable salt are found in the salt-bearing formations exposed in the vicinity of Warcha. A thick seam of good quality workable salt has been proved in the Jansukh gorge to the northeast of Warcha Mandi.

Yearly production has ranged from less than 1 lakh maunds proir to 1890 to 8 in 1960-61, with a high of slightly over 12 lakh maunds in 1945-1946.

Conditions of working

Salt in the Warcha mine is worked by "hereditary miners" as is the case in the Khewra salt mine. Here, 102 miners are on the rolls, and the mining organization is obliged to pay them a miniumum fixed pay regardless of the volume of work required at the mine. The total desired production for the month is equally divided and allocated to the miners. This results in inefficient working, low production, and lack of proper control by the management.

Kalabagh deposit

Kalabagh salt mines are relatively unimportant and produce only a small amount of salt to meet local demand and that of towns further down the Indus, down which it is transported in large country boats. It is the third producer of salt in the former province of the Punjab.

Geology

Kalabagh Hill, from which the salt is extracted, lies just north of the town of Kalabagh. It marks the southern end of the northeastern extremity of the Trans-Indus extension of the Salt Range and is near the apex of the Mianwali re-entrant. The Punjab Saline Series, the salt bearing formation, crops out at the foot of the slopes of the hill to the east, south (Indus river side), and southwest (Kalabagh town side).

Overlying the Saline Series with marked discordance is a complex of younger formations ranging in age from Upper Carboniferous "Speckled Sandstone" to the Pleistocene "Kalabagh Conglomerates". The older beds, including Trias, Jurassic, Cretaceous, Eocene and Lower Siwalik rocks, crop out in the western slopes north of Kalabagh. These beds have been acutely folded and faulted.

The Saline Series cropping out in the basal slopes of Kalabagh Hill includes rock salt, usually as steeply dipping seams, often contorted and lenticular. The Kalabagh Salt Mine is located on the eastern outcrops on the right bank of the Luni Wahan, the tributary which joins the Indus river opposite Mari Indus village. Apart from rock salt exposures in the mine area, good exposures are on the northern outskirts of Kalabagh town. Seams of salt as thick as 40 feet exist near the town along with other seams of possible workable value that have been proved in an exploratory drift in the western slope of Kalabagh Hill.

The Kalabagh Salt Mine area in the Luni Wahan is bounded on the east by the Luni Wahan (stream). Lateral erosion in this gorge and its tributary limit the workable deposits of rock salt to the north and south. A short distance west a thrust fault cuts off the salt marl and brings in the younger formations of the Kalabagh Hill. The workable area of the mine is therefore very confined, but, as the inclination of seams within the area is at steep angle in an approximately westerly direction, the deposit is likely to continue to considerable depth beneath the present workings. As a result, the workable extent of the present mine, according to Gee (1947), will depend on (*a*) depth to wich exploitation is economically practicable and (*b*) thickness of seams of good quality rock salt.

The seams of rock salt of Kalabagh are thinner and less regular than those of Khewra and Warcha. This is, to some extent, due to original conditions of deposition, but is also largely accounted for by the fact that the salt bearing strata themselves have been more compressed by recent tectonic forces than in the areas of the Warcha and Khewra mines to

the east. As a result, salt seams in the Kalabagh area are often contorted and lenticular and dips are usually steep, often vertical. At present, three seams are being worked in the Kalabagh mine. They are inclined at an angle of 65° west.

Mining development

As a result of the nature of the deposit, no systematic working of the mine could be carried out. The salt is worked in chambers which, in fact, are under-ground quarries. The chambers have no fixed dimensions. The salt may be thick at one place and suddenly thins out in the next chamber; good and bad quality salts are often found together. The mine is famous for yielding blocks of dainty cloured orange and lilac salt. Some is selected for cutting into attractive shapped articles, a small cottage industry.

Reserves and Production

Exact calculation of the reserves of salt available in the Kalabagh mine area is extremely difficult in view of the complex structural behaviour of salt seams. However, the figures of reserves supplied by W.U. Siddiqui, Chief Mining Engineer and Director, Salts, W.P.I.D.C., to the Salt Mines and Quarries Reorganization Committee (1961) exceed 251 lakh maunds.

Yearly production exceeded 6 lakh maunds in 1945-1946, but was 4 lakh maunds in 1960-61.

Conditions of working

The mine is worked by 28 "hereditary miners". Loading and unloading is done by hand; haulage is done by mules. The mine is quite deep and the distance to the depot is about six furlongs, with the result that the transpor ation charges at Kalabagh are high. Here, it is 16·70 paisa per maund as compared to 3·78 and 3·53 paisa per maund at Warcha and Khewra respectively. Production of the mine is two to three wagons per day and has become uneconomic, but is continued on humanitarian grounds. Its supply could easily be met from the productions of Khewra or Warcha mines.

Kohat Salt Deposits

In Kohat District of Peshawar Division, huge quantities of rock salt exist near the surface. Salt is quarried at Jatta, Bahadur Khel, and Karak. Bahadur Khel is 50 miles southwest of Kohat on the Kohat-Bannu road; Jatta and Karak are connected with the Kohat-Bannu road by fair-weather motorable roads; Jatta is about 30 miles south-south-west of Kohat; Karak is about 25 miles southeast of Bahadur Khel.

Geology

The area between the Surghar Range in the south and Kohat in the north is characterized by exposures of rocks of Ecoene age. The Eocene belt of rocks is from 16 to 25 miles wide from north to south. The formations have been tightly folded, forming narrow anticlinal ridges. These ridges have a general eastwest alignment and the salt is exposed

in the vicinity of the axes of these anticlinal ridges. The sequence of rocks in the areas where rock salt is exposed is as follows (Rashid and Hussain, in press) :

	Siwalik Group and the Murree Formation.	.. Greenish-grey to purple sandstone with soft clay; conglomerate at base.
	——————————unconformity——————————	
Lower Eocene	Kohat Limestone	.. Cream to grey, finely crystalline, very fossiliferous (Foraminifera); lower part shaly, with Ostrea.
	Mamikhel clay ..	.. Red to dull red, soft, friable.
	Shekhan Formation or Salt Marl series ..	.. Gypsum; greyish-green, banded, massive, .. with green shale and gypseous shale. Rock salt, white, with black tinge.
	——————————base not exposed——————————	

The Shekhan Formation or the Salt Marl Series includes the top most zone of gypsum, olvie-green selenite shales, and some bituminous shale and dolomite. The lower part is comprised of grey salt, occasionally with bands of red clay. Gypsum at places has a thickness of about 140 feet; its minimum recorded thickness in about five feet.

The rock salt, where found, conformably underlies the massive gypsum over an area of about 2000 square miles in the Kohat region. Its exact thickness is not known as nowhere is its base exposed. However, a hole drilled on the core of an anticline near Shakarkara village passed through 2000 feet of salt (this may be due to a repeated sequence by overturn folding). In Bahadur Khel, its exposed thickness is about 350 feet, while in Jatta and Karak it is over100 feet. The salt is grey, translucent, compact and pure, in places with thin dark grey bituminous bands and inclusion of dark coloured bituminous salt. The grey salt includes lenticles of transparent salt crystals ranging up to several inches in diameter.

Reserves and production

No estimates for the reserves of salt in the Kohat region is available. No doubt it occurs in immense quantities and sufficient salt exists at the Jatta, Bahadur Khel, Karak, and other fairly accessable localities to meet the demand by quarrying only, for many years to come.

Yearly production from all quarries has ranged between less than five lakh maunds prior to 1870 to over 10 lakh maunds in 1960-61.

Quarrying

At all three localities mentioned, salt is worked in a number of small quarries and the number of workers at these quarries is fixed. There are 50 quarries at Jatta, 39 at Bahadur

Khel, and 10 at Karak; each quarry is allotted to one registered miner. Quarrying is done by hand and the quota of salt for each quarry is fixed from time to time according to the overall demand of salt from the region. The salt excavated by workers at these quarries is brought to shed by camels and donkeys. Here it is weighed and given to dealers to be transhiped on trucks or camels to the adjoining districts; some of it goes to Afghanistan.

In 1925, an attempt was made to mine the salt by driving a tunnel into the Jatta anticline. Seams of rock salt were encountered after passing through debris and marl. Due to the presence of bands of plastic clay and soft and intercalated between the salt seams, the workings became dangerous and the project was abandoned in 1933.

Quality

Rock salt produced from the mines of the Salt Range and the Kohat District contains very few impurities. The salt from the Salt Range, particularly from the Khewra, Warcha, and Kalabagh mines is white to light red in colour. It is compact and crystalline in texture. The Kohat salt is grey in colour, but is similar in texture to that of Salt Range deposits.

No complete analysis of salts from different areas are available. An analysis of the Khewra salt taken from Pitt's (1928) report shows contents of sodium chloride as 99·2 percent, calcium sulphate as 0·2 percent, and moisture and insolubles as 0·6 percent.

In additional to rock salt, other salts are associated with the saline deposits of the Salt Range and Kohat, but they have not been found in sufficient quantity to warrant economic exploitation. Thin seams and leases of magnesian and potassium salts are found associated with the salt marl and khallar beds of the mines. These salts include mixtures of kieserite, sylvite, langbeinite, kainite, and common salt.

Uses

Salt is essential in human diet. It is extensively used in industries conneted with the manufactures of caustic soda, glass, ceramics, leather, textiles, paper, soap, rayon, and other chemical industries. Rock salt is used for the manufacture of soda-ash by Khewra Soda Company at Khewra.

Rock Salt and Sea Salt Production in Pakistan

Pakistan is richly endowed with rock salt resources and also produces large quantities of sea salt from brine along its coast. Sea salt is also produced near Chittagong, East Pakistan, as a cottage industry. On an average, Pakistan produced 9·75 million maunds of sea and rock salt yearly during the five year period ending in 1956-57. Of this, rock salt amounted to 3·8 million maunds, constituting 39·5 percent of the total. During the same period, the country's annual comsumption was 9·22 million maunds, leaving a small surplus for export to Japan, Indonesia and Afghanistan.

Rock salt used to be exported in great quantities to Afghanistan from the mines of the Salt Range and Kohat but trade with Afghanistan has declined. India has also stopped importing rock salt from Pakistan due to political considerations.

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Stratigraphic terminology used in this paper is provisional and is subject to further review for adherence to the rules of the Stratigraphic Code of Pakistan.

THE HIMALAYAN FRONTIER*

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Of all the frontiers in the world none else was considered as solid and secure as the Himalayan Frontier that lay a hwart the subcontinent of once undivided India. But this frontier has unmasked a new face after October 21, 1962. When the disputed territory in the North Eastern Frontier Agency and inaccessible areas of Ladakh were systematically over-whelmed by Chinese forces. The brief Sino-Indian clash that sparked off in October 1962 can be considered important in-as-much-as it has drawn the world wide attention to the magnitude of the metamorphosis that the Himalayan frontier has already undergone. Long before, however, this massive and extensive wall of Tertiary mountains ceased to be of academic interest to the explorers only specially on account of the territorial reorganization of British India, the liberation of Tibet by Chinese and the coming of China and India on the International scene as rivals in Asia. The Himalayan wall has become, thus, in a very short time a causes belli between two big, proud and ambitious conuntries of Asia for the first time in history. This frontier is not only looming large in the national affairs of India but it has already started to influence the attitude and behaviour of neighbouring as well as distant countries of the world. In fact the Himalayan frontier has now acquired an unprecedented significance and it now ranks first among all the natural barriers, brick walls and iron curtain that divide the nations of the world to-day. With all these facts in view it is the aim of this paper to examine the role and implications of this frontier with special emphasis on its influence on the geo-political developments in South Asia.

The Nature of the Frontier

The bulwork of Himalayas represent the youngest fold mountains that abound in awe inspiring and sharp relief features. Between Indus and Brahamputra the giant ranges stretch in a series of arcs for over 1,800 miles. Within this stretch there are at least ninety two peaks more than 24,000 feet in height. The vast and lofty Himalayan system contains in between its parallel ranges many arid depressions at various elevations. By virtue of their altitude, layout, presence of huge quantities of ice and many stretches of forests the Himalayan region remained a broad no man's land that separated the sub-continent from the rest of Asia. All the major incursions in the ancient India were through the passes of

*This paper attempts to summarize the role and influence of the Himalayan frontier in the light of last years Sino-Indian clash as well as other recent developments.

North West. Other passes that provided passage across these ranges were really difficult and cumbersome to use but these passes are now of great strategic importance.

The sheer length of the Himalayan frontier has put an immense weight on South Asia and partiuclarly on the Indian Union. At present India has a coast line of 3,700 miles besides approximately 2,700 miles of boundary line that she has with the two wings of Pakistan. For all defence and practical purposes India always considered the Himalayan frontier as harmless no man's land that eventually faded into a quiet and peaceful Tibet—the realm of tranquility. Until Chinese advance into N.E.F.A. and Ladakh, India continued to focus her attention on non Himalayan boundaries sepecially those which separated India from Pakistan. It was under these cirmumstances that Chinese challenge to McMahon line added to India's already extensive boundary mileage, a length of approximately 2,000 miles for the purpose of constant vigilance and defence. Fortunately three

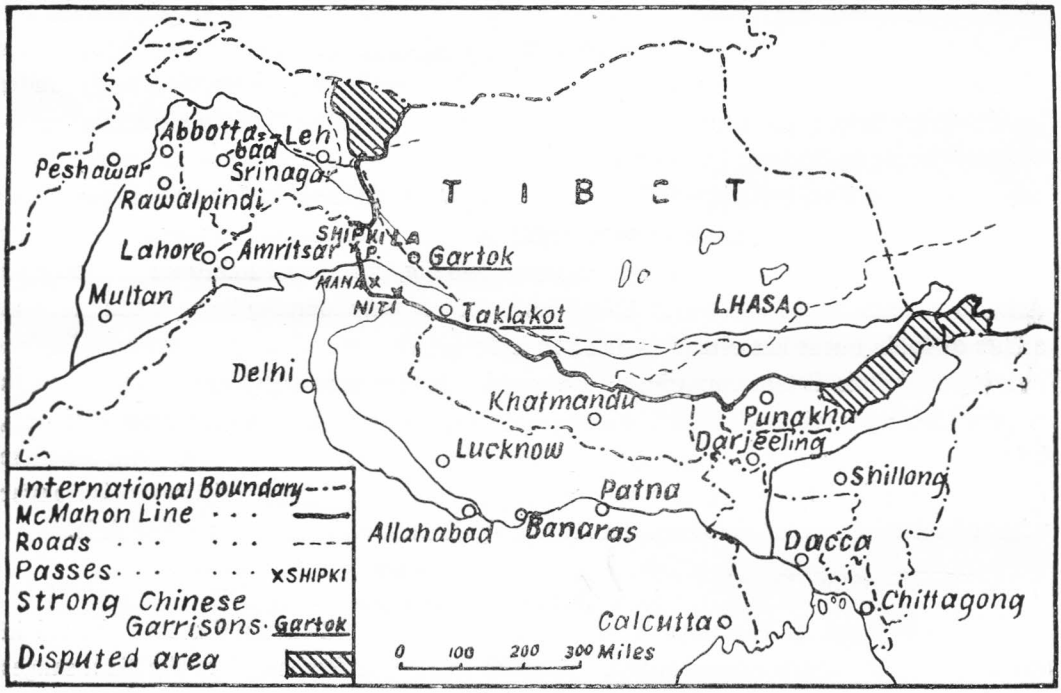

Fig 1.

McMahon line and its vicinity. Though the area between Taklakot and leh (including the area norh of Leh) is relatively quite yet controvercial Sino-Indian claims for place in indian sector are of a disturbing type:—Pak. Geog. Rev. July, 1962.

Himalayan states *viz.*, Nepal, Sikkim and Bhutan occur as narrow buffer zones preventing a direct contact of India with the northern areas in this sector at least at the present time. But N.E.F.A. area and Himalayan frontier between India and Tibet west of Nepal has become a problem of immediate concern to India on account of the revisionist claims of China that considers the disputed areas in these sections as terra irredenta.

All boundary lines, passes and places shown in various maps are approximate.

The ill-defined McMahon line passes through a difficult physical terrain on the two sides of which dwell hill tribes that display remarkable ethnic, linguistic and cultural links and similarities. For example Bhotias, Khas, Magars, Gurungs and Thakurs of Bhutan; Lepehas of Sikkim Nepalese and Gurkhas of Nepal and various less numerous peoples of Himalayan zone in Utter Pradesh and Punjab sector bear a greater affinity with the human elements of Tibet than with the people of India. According to McMahon line which India considers valid due to geographical contiguity and usage, the Indian territory in the Himalayan region extends upto the major passes situated on the water-shed. It remained unchallenged because the whole of Tibet remained a vast void in the past. In fact little or no attention was ever paid to the Himalayan frontiers as long as China was weak and unable to take any step about its backyard territory. In the context of the present circumstances it appears that the libertion of Tibet represents only one phase and that it is likely to be followed by at least two more major phases such as (*a*) the redemption of the disputed Himalyan territory by China and (*b*) the retrieving of the Himalayan states such as Nepal, Sikkim and Bhutan from Indian orbit.

It also appears that the basic characterstics of the frontier *viz.* its length, difficult topography, human elements of either Tibetan origin or Tibetan type and above all the problems of communication do not pose an easy question for India to resolve in view of the Chinese objectives. China has apparently completed all necessary preparations for taking expedient steps according to her own foreign policy in any area and at any time of her own chosing along the entire stretch of approximately 2,000 miles of Himalayan frontier. After using without success such easy approachas as Panch Shilla[1], recognition of China's liberation of Tibet and the support of China for a seat in U.N.O. India has only recently embarked upon serious short and long term preparations to check china's advance on her Himalayan frontiers. A couple of a million persons or a sizeable all purpose labour force can never be a big problem for China. By virtue of belonging to cooler latitudes, Chinese can also adapt themselves to Himalayan environment more quickly and conveniently than the Indian soldiers. But inspite of the emergency[2] in India which has given wide powers to the executive it is doubtful if the human resources can be utilized there in a similar fashion. By comparision the present infantry units of India have also limited capability for mountain fighting. It is this aspect of the Himalayan frontier which has obliged India to raise special mountain divisions. What will eventually happen to India's effort in this direction is difficult to fore-see in view of the reported espionage activities by China among the people of the Himalayan states. Furthermore the physical setting of the frontier is such that in future even if other things are equal, the advantage of the elevation for all tactical requirements shall always remain on the side of the Chinese.

1. This refers to five basic phillars (or principles) of peaceful co-existece formulated by India.

2. A State of Emergency resurrecting the Defence of India Act was proclaimed in India on October 26, 1962 in order to repulse as well as to meet the future threat of Chinese invansion. The national emergency has given wide powers to the government for mobilising national resources for defence purposes.

The Himalayan States

In the mountaineous region between India and Tibet there are nestled three states *viz.* Nepal, Sikkim and Bhutan. Though these states have never been a part of Indian empire, they have always remained in the Indian orbit.

The long narrow and landlocked state of Nepal, whose early owners were Bhotias, was conquered by Gurkhas in the 18th century. A Chinese army of 70,000 once marched upto Nayakot or within a distance of only 25 miles from Kathmandu the capital of Nepal. A treaty was signed by Nepal in 1792 in order to arrive at an agreement with the Chinese. By another treaty in 1816 the Nepalese gave up their clamis on the territories which are now

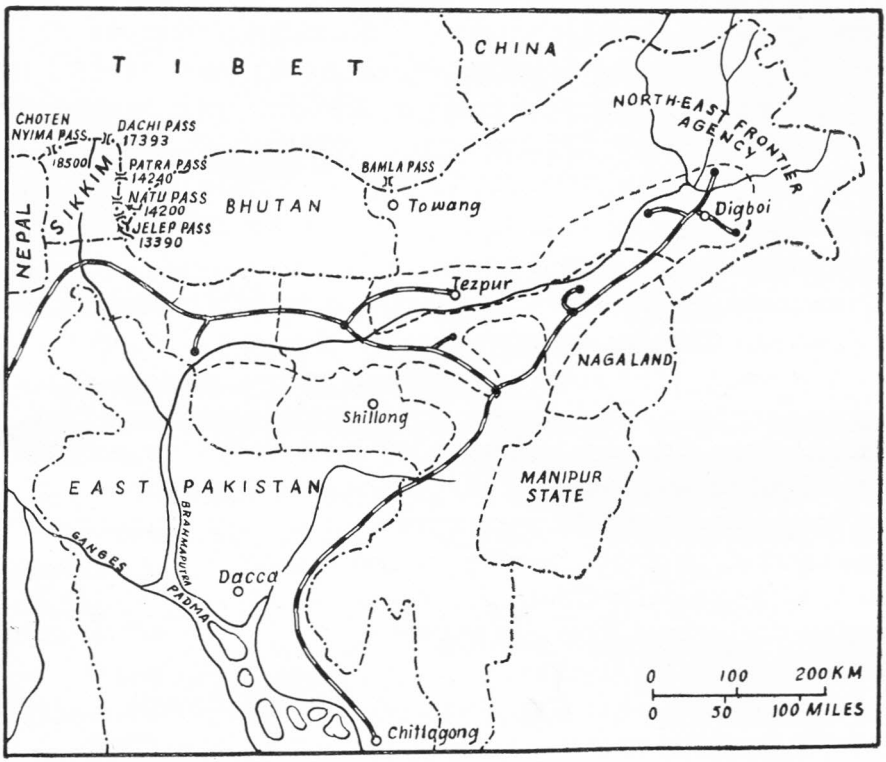

Fig 2.

occupied by the Indian towns of Almora and Dehradun. During the British regime the Gurkhas of Nepal served the British army and even now they are employed in British as well as Indian army units. Recently, however, the number of Gurkha troops in British army has been reduced while the China has offered to employ Gurkhas in Chinese army and also to pay them in hard currency. The country is at present receiving economic assistance from U.S.A., India, U.S.S.R. and China. China is also reported to be using all possible diplomatic means and methods for drawing Nepal in her own orbit. Mr. Nehru has on the other hand declared that India, true borders are the Himalayan mountains on the north of Nepal and that she would not tolerate any violation of that (Robert Sherwood; 5).

Sikkim that existed previously under British paramountcy is now a protectorate of India according to the treaty of December 5, 1950. Though it is an extremely small state (area: 2818 sq. miles) yet it is of considerable strategic significance for two reasons. First, it contains all the strategic roads and trade routes to Tibet. Second,it is close to East Pa' istan's north western margin and the narrow corridor that connects West Bengal with Assam. These facts assume extra ordinary significance in view of the strained Indo-Pakistan relations, persistent demands of Nagas for autonomy and their h stile attitude towards India at present and the rich oil reserves of the Assam valley. The total population of Sikkim is 161,000 which consists of Nepalese to the extent of 75 % of the total population. The small area as well as the small size of population makes this state extremely vulnerable

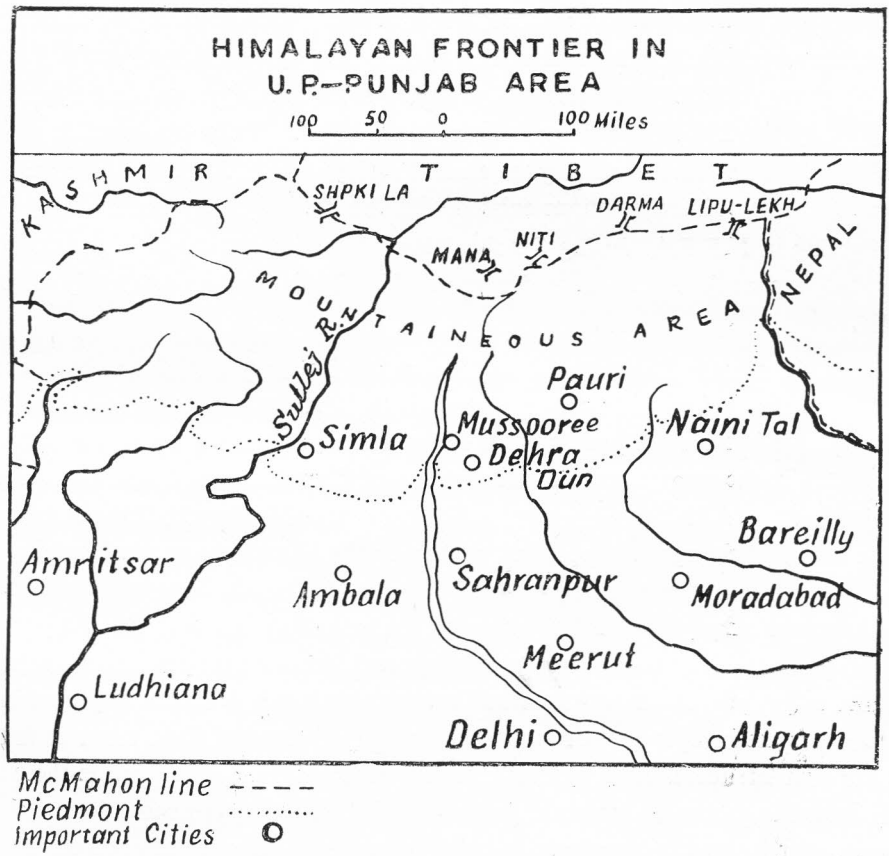

Fig 3.

to voluminous chinese infiltrations which can upset the defence of Assam unless any such situation is contained by India's full might. It is also suspected that various points inside Sikkim may be used for military manoeuvres by Chinese against India. Natu Pass situated in north eastern Sikkim at an elevation of 14,200 feet is considered to be "perhaps the easiest invasion route from China to India. In 1960 there had been an actual Chinese armed

incursion into Sikkim through Jelep Pass which is situated towards the east of Natu pass at an elevation of 14,390 feet above the sea level. Since then India is maintaining a strong garrison at this point (Desmond Doig, 1).

Bhutan's geographical location is of greater strategic significance as far as the security of Assam is concerned. Assam itself was conquered from Burmese in 1824 for Delhi. At present it is neither easily accessible nor is it a convenient adminstrative unit on account of the hostilities of Nagas. Bhotias of Bhutan frequently raided the Assam *duars* even after the introduction of English rule in India. A treaty was first signed between East India Company and Bhutan in 1774 in order to check the regular raids by Bohtias. Another treaty was signed in November, 1865 which granted an annual subsidy of Rs. 50,000 to Bhutan. This subsidy was further raised to Rs. 100,000 from 1910 when British government pledged non interference in Bhutans internal affairs and Bhutan agreed to accept the guidance of the British government in her external affairs. This subsidy was once again raised to Rs. 200,000 by the British government from April 1942. India arranged to retain this political agreement by further raising the annual susidy to Rs. 500,000 on the same conditions on which the political relations existed with the British government. The brief Sino-Indian fighting in N.E.F.A. during October/November 1962 has made it clear that loss of Bhutan shall expose Assam to grave dangers making its defence an extremely difficult task for India.

Since the armed clash with China, Indian has not only established or strentghened check posts in the eastern and western sectors of the Himalayan frontier as symbols of her sovereignity, she has also stepped up the improvement and or construction of roads and other facilities in the remote areas of the districts of Chamauli and Darjeeling. The states of Nepal, Sikkim and Bhutan do prevent a direct contact of India with Tibet but these states have also radically changed the political weather in the Himalayas so much so that competitions for influence in these areas between India and China has become keen and crucial. These states were simply quiet buffer zones till the turn of events in 1950. At present they have given a new twist to the inter-state dealings and indicate that poltical developments in these states might provoke an armed clash between India and China at any time in future. India considers the independent or semi-independent existence of these states as indispensible for her own territorial integrity. To the rest in the world a status quo in these states is the only available guarantee for peace in South Asia. The western conutries are, however, more, particular to have it come true in order to resist the advance of communism beyond Tibet in this part of Asia. China on the other hand hopes to gather greater strength from these states whose past history, tribes, linguistic and religious set up make the alliance of these states with Tibet appear more logical and justifiable. She has similar hopes in respect of other Himalayan territories also.[1] India faces an extremely difficult situation in this

1. 'Other Himalayan territories' means here N.E.F.A. and the areas south of the passes that occur between Nepal and Ladakh mainly in the U.P. and Punjab sector. It is also reported that China considers Ladakh, Nepal, Sikkim, Bhutan and N.E.F.A. as the five fingers of her Tibetan hand.

matter for two reasons. First, rapid developments inside Tibet at an impressive speed are likely to have a great impact on the popular opinion in these states. Second, the people of these states beside having ethnic, linguistic, religious and cultural ties with the people of Tibet are also extremely simple a great majority of whom is not literate also. They are, therefore, prone to ideological infiltrations from any quarter. In the past Budhism ws spread in these states and upto Tibet from India. In the light of the changed circumstances of the modern time, it appears that there is no force except the armed might of India that can offer resistance to the upsurge of communism in these states. At present India has already decided to provide free education and N.C.C.[1] (military) training to young men in N.E.F.A. with immediate effect in order to counter China's ideological campaigns in this area.

Recent Frontier Developments and Their Effects

The whole world, including perhaps India also, was left guessing when China opened a brief and brisk war on India in October 1962. Several answers have been produced to explain why China did it. More significant are, however, its implications and consequences. In the first place the Sino-Indian fighting in N.E.F.A. and Ladakh has produced the following immediate results :—

(*i*) It has unmasked the intentions, attitudes and degree of preparedness of China for a test of strength with Indian for securing the disputed Himalayan territory.

(*ii*) It has as a matter of fact rehabilitated U.S.A. (in a way) in India by throwing India off her pedestal of neutrality and into the folds of the western powers. In this process it has added another burden on U.S.A. beside Korea, Vietnam and Formosa.

(*iii*) It has caused a complete revision and reorientation of India's scheduled plans of development beside putting India's democracy under the control of emergency.

(*iv*) It has given a great psychological victory to China.

(*v*) It has paved the way for new geo-political developments in South Asia. As such it has opened a turning point in the history of not only Asia but in the history of the world as stated by Mr. Nehru himself. (Sherwood, 5).

The long term effects of the struggle between India and China are of greater significance than the immediate results which it has already produced. First, it has left India drenched in a patriotic fervor which has helped the Indian leadership in mobilising the countries enormous resources rather conveniently. The emergency has helped both New Delhi and Washingtion to cut short the otherwise lengthy, difficult and tortuous diplomatic procedures that would have normally controlled the despatch and reception of arms aid at the two ends. Second, the new defence preparations in India have a significant bearing for Pakistan also even though at present the tremendous military build up is apparently not directed

1. N.C.C. Stands for National Cadet Corps which functions as an Indian Territorial force under the Supe vision of ministry of defence.

against Pakistan. Third, within a very short period the Aid India Consortium has given India Rs. 12,000 crores in two terms. In addition to this has come the massive U.S. aid of Rs. 120 corores which is the single largest aid ever given to any country by U.S.A. In fact so much economic assistance has been heaped up under the compelling demands of national emergency that the essential commitments of the five year plan as well as the defence targets can be simultaneously fulfilled under the present circumstances india also enjoys complete freddom to divert any amount out of economic assistance funds for the defence sector on the plea of physical survival. Fourth, the national emergency has accelerated the improvements in the defence forces of India on an unprecedented scale with U.S.A.'s financial and technical assistance. In this conection the current military production in India's 21 Ordannce factories has been fully galvanized. A new plant is being set up in Madras in order to produce at least one hundred tanks annualy. A special mountain division and an additional armoured division are being raised baside several regular divisions which are being organized in order to raise the existing number of seventeen divisions to twenty three divisions. The western military mission has recommended to increase the total number of regular divisions to thirty. In addition to the huge size of the standing army which is in the process of being fully streamlined, manpower resources have been also systematically mobilized by raising different types of auxiliary forces and by introducing compulsory military training in all the Indian universities through the institution of N.C.C. In order to ensure a rapid turn overn of officers in the next few months the number of emergency commissions have also been increased. Similarly, considerable attention is now being focussed on the all round improvements in the Indian Air Force. Radar installations along the entire length of the Himalayan Frontier and full utilization of the possessions in the nuclear field represent other significant steps. In short, the emergency created by the Chinese advance into the disputed Himalayan territory has aroused a sense of crisis that has given India a unique opportunity to build her military might and economic strength on a grandiose scale. The military preparations by India has presently created new difficulties for the tax payer inside the country who has to bear the colossal defence expenditure and a vexing situation for the neighbouring countries specially Pakistan who has to regulate her dealings with India in the light of the day to day developments of that country.

The Influence of Frontier Developments on Pakistan

The new developments along the Himalayan frontiers have complicated the interstate dealings between Pakistan and India, in several ways. First, India has become interested, at least at the present time to have the partition of Kashmir confirmed along the present lines of effective control in order to disengage herself in this sector. Even this concern of India is suspected to be of a temporary nature since the immediate task before India is neither a soultion of Kashmir question nor a solution of the disputed territory in N.E.F.A. and Ladakh. India's main concern is, instead, the strengthening of her defence capacity to the maximum limits in order to resist China successful in the Himalayan areas. The present situation may, however; lead to a better understanding also between India and

Pakistan. Second, the developments after the Sino-Indian conflict have also disturbed the delicate equilibrium between Pakistan and India. This has happened mainly on account of the enormous U.S. aid that has been either given or promised to India during the last few months for checking the advance of communism in South Asia. The Sino-Pak. border agreement is, in fact, the product of these changed circumstances. Third, The Sino-Indian clash has produced an upsurge of nationalism of a vigorous type in India so that there is a rapid growth of a massive military apparatus. Such a mounting strength of India has become a matter of great concern for Pakistan.

Conclusion and Comments

The attitude of China and India towards their common frontiers in Himalaya is fraught with possibilities of serious nature. It appears certain now that with the opening of frontier dispute in Himalayas, India has been thrown in the folds of western powers for a long term because India cannot preserve her territorial integrity without a large scale economic and military assistance from the western powers. China, aims on the other hand, not only to redefine the McMahon line according to the results of her own topograhihcal surveys but it also appears to be her long term objective to wrest the Himalayan states from the sphere of India's influence. It is belived that in this conection the role of the two wings of Pakistan and the Indian provi:ce of Assam shall be of vital significance in the coming years. In the light of these facts it is also assesed that the nature of solution that might be reached between India and Pakistan in respect of Kashmir shall determine the nature of Indo-Pak. relationship in future. Thus there are two possibilities. First, Pakistan and India might continue to have strained relations much to the disadvantage of both if the Kashmir question is not amicably settled. Second, a mutually acceptable settlement in respect of Kashmir which might perhaps be achieved by partition whose possibilities are being explored, may release sufficient armed strength of India for using it elsewhere. It appears that the mutual understanding between Pakistan and India might eventually be easier to secure for India than to retain the control of Nepal, Sikkim and Bhutan. These states are of vital significance to India and at the same time extremely vulnerable to Chinese forces stationed inside Tibet. China's attempts to modify the McMahon line to her own satisfaction are likely to continue in several distinct phases. For example the first phase was the liberation of Tibet and consolidation of armed strength at strategic points inside Tibet. Development of highways, fortifications, concentration of troops and facilities along the entire Himalayan frontier upto Ladakh—all represent steps to achieve this end. This first phase succesfully paved the way for the second phase which consisted of opening a war in the remote areas of N.E.F.A. and Ladakh. The second phase has established that the McMahon line is not acceptable to China and that China is capable of revising it. The succesful execution of the second phase also accomplished an immense psychological victory for China in the whole of South and South East Asia at a time when the possible use of nuclear energy for war purposes and the techniques of cold and limited wars have given psychological warfare immeasurable advantages for deciding international issues. In fact the unilateral declaration of cease fire by China, after a brief

but brisk action without giving India an opportunity to retaliate, is without a parallel in the annals of modern military history. It has not only diverted India on an entirely new course but it has also impressed the world in general and South and South East Asia in particular that Chinese upsurge is irresistable. This impression is likely to remain till it is proved otherwise. And it is doubtful if the Chinese diplomacy shall ever give that opprtunity to India. The third phase shall largely consist of retrieving the Himalayan states primarily by means of ideological infiltrations that are likely to be organized systematically in the next few years. Here it would not be out of place to qoute Mao Tse Tung's favourite maxim also.

When the enemy advances we retreat
When he escapes we harass
When he retreats we pursue
When he is tired we attack

In the light of the above maxim it is perhaps safe to speculate that China would not attempt an armed incursion at any other point in the Himalayas just as she did in either N.E.F.A. or Ladakh unless an oportune moment in China's own estimate arrives for that purpose.

In the next few years, therefore, Sino-Indian friction shall possibly remain localised along the vague and disputed McMahon Line. While the internal subversion or ideological infiltrations inside the states of Nepal, Sikkim and Bhutan shall proceed without the use of arms, an armed conflict between India and China cannot be ruled out if the stress produced by the new and massive military manoeuvres by either side crosses the limits of tolerance set for themselves by each side. The fourth phase and perhaps the last of this series might involve the disputed areas south of the passes that occur in P.U. and Punjab sector.

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ELECTRIC POWER DEVELOPMENT IN WEST PAKISTAN

Eversince independence Pakistan is power hungry. There has been an acute shortage of power for irrigation industry, domestic and general consumption.

Prior to the partion of the sub-continet the power supply position throughout the province was extremely poor. But for the small quantity of power that the province of the Punjab was drawing from India and 20,000 Kilowatt hydro stations in the N.W.F.P., there was hardly a source of power anywhere. Small diesel sets scattered here and there were the order of the day.

By the year 1955 a fair amount of progress had been made, particularly in the former provinces of N. W. F. P. and the Punjab. In the frontier province a 20,000 Kw hydro-electric plant was put up at Dargai and two more machines were added at Malakand. In the Punjab a 22,000 Kw hydro-electric station was established at Rasul. The installation at the thermal power station at Shahdara near Lahore was improved enduring availability of 8,000 Kw from this station. In Sind and Quetta regions there were only a few small diesel generating units functioning in some of the towns which had been mostly abandoned by outgoing non-Muslim owners.

From 1955 to the 1959 the pace of development accelerated considerably. The PIDC started the construction of a 130,000 Kw power station at Multan which was to use natural gas from Sui as fuel. The construction of a hydro-electric Station of 160,000 Kw installed capacity was undertaken by the Central Government with financial aid from Canada under the Colombo plan.

The Punjab Government Electricity Department undertook and completed the construction of a steam generating station of 14,000 Kw installed capacity and a diesel station of 9,000 Kw at Lyallpur. A steam generating station at Montgomery of 8,500 Kw capacity and in the frontier, at Kurram Garhi a hydro-electric station of 4,000 Kw capacity were installed.

Nothing substantial had been done in the Sind and Baluchistan areas in the meantime. A scheme for setting up a thermal station at Hyderabad was envisaged by the old Sind Government and later planned by West Pakistan Electricity Department but its implementation could not be got under way. The PIDC was then required by Government to prepare a scheme for a central generating station at Hyderabad utilizing also the material that had by then been ordered through Director General Supply and Development. It was not till WAPDA took over the Electricity Department in 1959 that real headway was made on this scheme.

The period from 1959 onward has been one of tremendous activity in the field of power development. With the creation of WAPDA towards the end of 1958 a sound foundation had been laid for the promotion of co-ordinated planning throughout the province. Warsak on its completion in 1960 came under WAPDA'S charge. Multan power station which had already been transferred from PIDC to WAPDA while still under construction, was commissioned a little earlier than Warsak. Thus there was a sudden increase in the generating capacity of the province by nearly 300,000 Kw in 1960.

In order to utilize this power economically over the entire northern part of the province primary and Secondary Grids were planned and construction undertaken. Systematic planning of power development requires that a careful and thorough study be made of the trend of growth of power demand in the country. WAPDA initiated such a study almost from the day of its inception. This study has since been enlarged into a regular power market survey which is being carried out throughout the province. Visulizing the rapid growth of power demand a scheme for the extension of Multan power station by two more machines of 65,000 Kw was launched in 1960. This extension will be ready by the end of 1963 when the total generating capacity of Multan will go up to 260,000 Kw.

A thermal power station at 200,000 Kw capacity is to be set up in the neighbourhood of Lyallpur.

At Sukhar a power station of 25,000 Kw is under construction. At Hydrabad a power station of 30,000 Kw capacity has recently been commissioned. It is being planned to increase its capacity by another 23,000 Kw. In Quetta and Kalat region a Thermal power station of 15,000 Kw capacity is being set up at Quetta.

INDUS PLAIN GROUND WATER RESERVOIR

WAPDA has announced the discovery of the World's largest reservoir of underground water. For some time past American Engineers, U.S. Government experts and Pakistani Engineers were engaged on surveying ground water resources. Their estimates now reveal that this reservoir in the upper Indus Plain has about 1,900 million acre feet of usable ground water. This is equal to over 10 times the yearly average discharge of all rivers of the Indus Basin.

The perennial field of the reservoir has been estimated at 16 million acre feet of water annually more than the yearly flow of the colorado river and nearly two and a half times the annual flow of Ravi river. Quality of the water, however, varies in places. In several areas the water will have to be used after mixing with canal supplies.

The discovery is of great significance for West Pakistan which has only a limited number of sites for the construction of dams to exploit surface water. The discovery will also help in effectively checking the menace of waterlogging and salinity. The usefulness of the reservoir is closely connected with the existing irrigation system and can be developed only in co-ordination with the canals. It is, therefore, not an alternative to the development of surface supplies but a means of supplementing them—INDUS March 1962.

1962 FLOODS IN EAST PAKISTAN

East Pakistan is the world's biggest delatic region and most of the land in this province is hardly 55 ft. above sea level. It has a very high rainfall too. But what causes floods in this province every year is rather unusual drainage of rain water in the Ganges and the Brahmaputra valleys. The two rivers each about 2,000 miles long, carry down a lot of silt which chokes up outlets of flood water into the Bay of Bengal and this inundate large areas on both sides, of the banks of rivers and distributaries in the province. The 1962 flood, however, was unprecedented.

In the short span of two months in 1962 the floods visited the province twice, the first time in June and July and later again in mid-August. The first flood affected the districts of Chittagong Hill tracts, Chittagong, Sylhet, Mymensing, Dacca, Rangpur, Bogra and Pabna. The second one which was more devastating reaffected the districts of Mymensingh, Rangpur, Bogra, Pabna and Dacca and had for its new vicitims the districts of Faridpur, Rajshahi, Kushtia, Comilia, Jessore and Khulna. In all 14 out of the 17 districts of the province had to bear the fury of the floods and 6 of them had to face it twice.

A comprehensive survey of the extent of damages caused by these successive floods would take some time. The vastness of the area affected and the damages caused, not only to crops but also to other properties and cattle wealth, make the problem of assessment itself a difficult one. Nevertheless the figures so far collected from the areas affected will give an idea of the incidene of the floods

More than one fifth of he total area of the province actually went affecting about 1,3000,000 people. 177 person lost their lives. The damage to privated wellings and cattle has been put at 5,03,014 and 9,045 respectively.

The province's two major food crops, Aman and Aus, have been destroyed and its principal cash crop, jute has been very seriously affected. The loss to crops, as far as it could be estimated at the time is : Aman 21·9 lakh acres, Aus. 5.4 lakh acres Jute 1·3 lakh acres, others 1.36 lakh acres. The estimated money value of crops lost is Rs. 13,675·30 lakhs while loss on account of cattle and dwelling houses amounts to Rs. 18·09 lakh and Rs. 763·73 lakh respectively.

In a number of places, railway lines were breached and bridges and culverts washed away. Roads in the flooded areas, have been extensively demaged and public buildings, including educational institutions, have been very seriously affected.

I.G.U COLLOQUIUM ON CLASSIFICATION AND MAPPING OF GEOMORPHOLOGY AND LAND USE OF ARID AND SEMI ARID LANDS.

Under the auspices of the Arid Zone Commission set up by the International Geographical Union, a Colloquium on "Classification and Mapping of Geomorphology and Land Use of Arid and Semi-arid Lands" was held at Iraklion (Crete) from 19th September to 26th September, 1962. Delegates from the principal arid and semi-arid zones attended. Prof. Trol, President of the International Geographical Union and Prof. L.D. Stamp an ex-President were also present. Forty-seven papers were contributed—24 on land use and 23 on geomorphological mapping.

Dr. Kazi S. Ahmad of the University of the Panjab a member of the Commission also participated in the colloquium and read a paper on "Land Use in the Semi-arid Zone of West Pakistan."

I.G.U. REGIONAL CONFERENCE OF S.E. ASIAN GEOGRAPHERS KUALA LUMPUR

A Regional Conference of South East Asian Geographers was held in Kuala Lumpur at the University of Malaya from 2 April to 8 April, 1962. The conference was sponsored jointly by the I. G. U. and the University of Malaya.

Over 200 delegates from 25 nations participated in the conference and over 100 papers were presented. The I. G. U. Executive was represented by its President, Prof. C. Trol, and by two Vice-Presidents, Professors Cumberland and Tada.

Prof. Nafis Ahmad from East Pakistan and Miss M. K. Elahi from West Pakistan attended the Conference. Prof. Nafis Ahmad read two papers and also presided over the Section on Economic Geography. Miss M. K. Elahi contributed a paper in the Land Use Section on "Agricultural Land-Use in West Pakistan".

A notable feature of the Conference was an exhibition of the Maps of Malaya and South East Asia. Study tours to parts of Malaya and visits to places and institutions of interest around Kuala Lumpur were also arranged.

Three tours were organized which covered a study of most parts of Malaya.

BOOK REVIEWS

Germany its Geography and Growth by K.A. Sinnhuber, pp. 128, Jonh Murry, London 1961.

This book is designed as an introduction to Germany (Old Germany). The title provides precis description of the scope of this volume which is far more than a mere geographical account al hough the geographic technique has been mai ly applied. It is a very useful book for honours students of our country. It is written by a trained geographer with a considerable knowledge of Germany, obtained at first hand after a long residence in the country. It is well illustrated with maps, diagrams and photographs, majority of them show excellent examples of certain type of landforms and pattern of towns, depicting important cultural aspect of the area. In the begining it gives an idea that the author is mainly concerned with historical aspect but later on the whole subject is developed on the basic principles of geography. The book includes the study of the present W. Germany, E. Germany and the lost provinces, east of the oder-Neisse Line. It appeals alike to the man in the street, because of the technical and geological data further defined, and to the geographer in search of a good up to date back-ground. The emphasis throughout is upon the analysis of the historic and cultural landscape in its relation to geological, physical and political conditions at selected stages of the Germany. This emphasis is futher explained through the interesting local pictures.

Regions, as they are classified, have been discussed in general with more emphasis to the development of the cities and their related features. References are also made to the pattern of industries while discussing the features of landscape but the proper geographical analysis for their development is not given. Further the problem of agriculture have not been touched and these will probably disappoint some readers, specially the students of Geography.

M. I. SIDDIQI

John E. Trotter, *State Park System in Illinois*, Research paper No. 74. Department of Geography, University of Chicago, Chicago Illnois.

If Geography is defined as a study of spacial distribution of various phenomena, John E. Trotter's disser.ation is no doubt a detailed geographical study of the distribution of State Parks in Illinois. The study is resource based *i.e.*, locating the park where a place of natural beauty, historical interest or recreational value has been available. But the intere-

sting part of the study is that it shows that a very large number of state parks have been preserved or made on artificail lakes and by improving the original sites. Thus, though the state is deficient in areas of natural scenic beauty, and relatively better park areas are in the south and in the north; but a large number of state parks are along the river. This means that state has planned to locate parks in the neighbourhood of industrial and metropolotan areas.

The most interesting part of the study is the classification and rating system. There are federal, state and country managed parks of recreational, historical and scenic interests. Special attraction has been found in scenic, historical and recreational values and where more than one factor is found parks are better attended. The opportunities selected for rating are picknicking, camping, hiking, fishing, boating and swimming. Pickincking and camping are rated 3 each. The most highly rated parks have been rated as 12.

The book provides encyclopeadic information about Illinois State Parks. There are 17 tables and 9 maps. Cartographic techniques used are very good. However it is no problematic study.

K. F. YOUSF

Case Studies in World Geography—pp. 218. Edited by Richard M. Highsmith, Jr. (Prentice-Hall, Inc. 1961).

The volume has its origin in a series of articles (case studies) contributed by a large number of experts. In the subject matter and its treatment each of the studies is altogetger independent of others. However, taken collectively they embody an attempt to present a fairly comprehensive survey of various environmental settings and their influences on man's activities.

The value of the matters treated in this volume is evidencesed by such records as on.

The distinctive features of shifting cultivation, a stress on the term "bush fallowing" in the deltaic region of the river Niger, and the social organization of Ibo people; the identical state of affairs prevalently associated with any village of Indo(-Pakistan); an analytical study of the development of the legal mechanics of communal land tenure system (Ejido in Mexico) which replaces the old feudal system of the great heciendas; the technique of constructing a "kanat" in the arid regions of Iran; the technique of land reclamation at the bottom of the sea in the Netherlands and its simultaneous programmed compartment-wise

development (a manifestation of Man's physical victory over the refractory waters); the necessity and importance of aquaculture in Japan; the description in a narrative form of the life in the Lappland and a reference to the coming changes in nomadism; the oil findings in Kuwait and their impact on economy of that country; etc., etc.

To vindicate the factum in the concluding remarks at the end of each article the authors draw support from the incontestable details enunciated in an authoritative fashion. It is a good book.

TUFAIL

STATISTICAL SUPPLEMENT

LAND-UTILIZATION, SEASONAL AND ANNUAL IN THE NORTHERN ZONE OF WEST PAKISTAN

The present data was collected by the Bureau of Statistics, Planning and Development Department, Government of Pakiatan.

Seven out of twelve Divisions of West Pakistan constitute its Northern Zone; these seven Divisions contain two-third of the Province's cultivated area. Excluding the Tribal Areas and the non-arable land in the Bahawalpur Division, all land area in the Northern Zone is surveyed cadastrally. Every village has a topographical number, and every field in the village has an identification number called Khasra Number.

Records of Crop Inspections—twice a year, one for Kharif (Autumn harvesting) and other for Rabi (Spring harvesting) are maintained for each Khasra Number. This record is kept in Village Crop Inspection Registers which usually contain data for four to five years. The village called a 'Mauza' and the Revenue Official who maintains its records is called a 'Patwari'. He usually has charge of three to four Mauzas, into a 'Patwari Circle'.

There are two distinct cropping seasons in West Pakistan *viz* Kharif and Rabi. Kharif crops are sown in late spring or early summer and harvested in late summer or early autumn. The Rabi crops are sown during autumn and matured in the following spring.

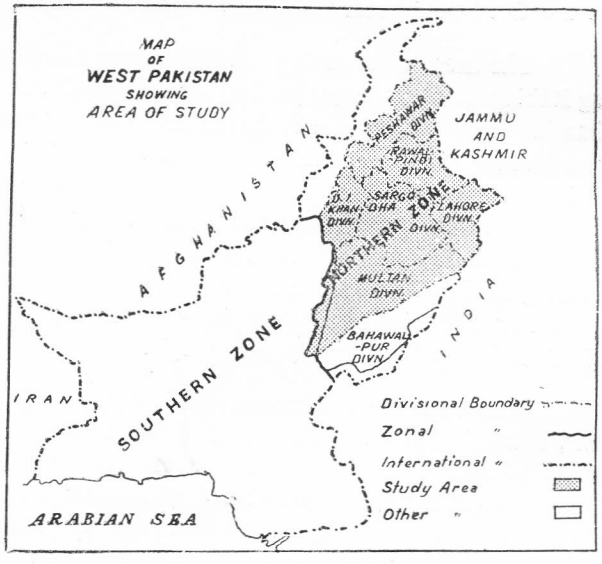

Fig. 1

Millets (Jowar and Bajra) are the most common Kharif cereals grown in dry cropped and torrent-watered lands. They are raised both for food and fodder. Maize is the leading Kharif cereal in Peshawar Division and prominent secondary crop in Lahore and Multan Divisions. Rice is the major Kharif Food crop in Gujrat District, Rawalpindi Division; the whole of Lahore Division; Montgomery and Dera Ghazi Khan Districts of Multan Division. Kharif Pulses (*Moth, Mung and Mash*) are sown over a much smaller area than Rabi Pulses. Cotton is the most valuable and the most widely grown Kharif Crop in Sargodha, Multan and Bahawalpur Divisions. Sugar-cane is the other important Kharif Cash Crop and is about evenly distributed in Peshawar, Sargodha, Lahore, Multan and Bahawalpur Divisions. The Kharif season also accounts for the bulk of Year's fodder production.

Wheat is the major Rabi Crop in Irrigated and Unirrigated lands throughout. Other Rabi cereals are Barley, Gram, Lentils and Peas. Rabi oilseeds include Rapeseed and Mustard, locally known as '*Sarsoon*', *Toria*, *Taramira* etc. Rabi fodder crop include Shaftal (Persian Clover) 'Berseem' (Egyptian Clover) Turnips etc. Clover is also grown on a small scale during this season. A third of Tobacco Crop in the Northern Zone is concentrated in well irrigated lands of Swabi, District Mardan, Peshawar Division and the remaining is evenly distributed in the Districts of Lahore and Multan Divisions.

Land-uses during Kharif seasons, Rabi seasons and for the agricultural years are presented in Table 1, 2, and 3 respectively. As is evident from the data, the extent of 'un-cultivated' and 'Cultivated' areas remained almost constant within any Division(s) over all the years under study and also in respective crop seasons. Two-third of the total area of Peshawar and Dera Ismail Khan Divisions one half in Rawalpindi Division, one third in Sargodha Division, one fourth in Lahore Division and two-fifth in Multan and Bahawalpur Divisions remained uncultivated throughout. The magnitude of Current fallows was small, being the least in Rawalpindi Division where it accounted for only about six per cent of the Cultivated area.

The area sown during Kharif seasons invariably remained less than the corresponing Rabi seasons. A larger portion of 'Cultivated area' was left Fallow during Kharif seasons than in Rabi season. In Peshawar and Dera Ismail Khan Divisions the ratio of sown area during Kharif to that Sown in Rabi was 1:2 except in 1957-58 when it was reduced to 1:3 in Rawalpindi Division this ratio was about 2:3 except in 1957-58; in Sargodha Division, the ratio was again about 1:2 during the last three years and in Lahore Division it was about 3:5. In Multan and Bahawalpur Divisions, however, the difference between the magnitudes of area sown during Kharif and Rabi seasons is small. But, at the same time, the extent of 'Current Fallow' in these latter two Divisions is much larger than other Divisions in the Northern Zone.

Table 4 shows the distribution of net 'Sown Area' by Area sown only once during the year, either in Kharif or Rabi and 'Area sown both in Kharif as well as in Rabi.' Sometimes the same area is sown more than once during a particular season as 'Extra Rabi' or 'Extra Kharif' as the case may be. But the extent of this latter practice is very small being less than one per cent of the total sown area. The magnitude of double cropping in the sense of the same land area having been sown both during Kharif and Rabi within the Agricultural year has varied from Division to Division. It is of the order of one-tenth, one seventh, one seventh, one-fifth and one-third of the Net Sown area in Rawalpindi Division, Peshawar and Dera Ismail Khan Divisions, Multan and Bahawalpur Divisions, Sargodha Division and Lahore Division respectively. It is least in Rawalpindi Division which is mostly unirrigated. Lahore Disvision has the greatest proportion of double-cropped area and it contains some of the most productive lands in West Pakistan. Lahore Division is all Canal irrigated except Sialkot District where well-irrigation is predominant. It also has a large share of Northern Zone's problem of lands in the highly saline and badly water-logged tracts in Gujranwala and Sheikhupura Districts, these two latter Districts are the foremost rice-growing areas in the Northern Zone.

TABLE 1

Land Utilizations in Kharif Seasons, Selected Years 1952-53 to 1957-58

Land-use	Percentage of total Area			
	1952-53	1955-56	1956-57	1957-58
PESHAWAR AND DERA ISMAIL KHAN DIVISIONS				
Uncultivated	65·4	65·2	65·2	66·3
Fallow	23·7	23·5	24·4	25·0
Sown	10·9	11·3	10·4	8·7
RAWALPINDI DIVISION				
Uncultivated	53·0	52·2	52·0	53·0
Fallow	28·1	29·4	29·0	32·4
Sown	18·9	18·4	19·0	14·6
SARGODHA DIVISION				
Uncultivated	36·1	35·0	34·6	36·6
Fallow	40·2	40·0	41·0	38·0
Sown	28·7	25·0	24·4	25·4
LAHORE DIVISION				
Uncultivated	26·4	26·2	22·7	27·5
Fallow	41·5	40·0	39·8	36·8
Sown	32·1	33·8	37·5	35·7
MULTAN AND BAHAWALPUR DIVISIONS				
Uncultivated	39·3	36·3	35·1	38·0
Fallow	35·3	37·6	37·1	36·1
Sown	25·4	26·1	26·8	25·9

TABLE 2

Land Utilization in Rabi Seasons, Selected Years 1952-53 to 1957-58

Land Use	Percentage of Total Area			
	1952-53	1955-56	1956-57	1957-58
PESHAWAR AND DERA ISMAIL KHAN				
Uncultivated	65·5	65·0	66·3	66·3
Fallow	12·2	10·3	10·1	8·0
Sown	22·3	24·7	23·6	25·7
RAWALPINDI DIVISION				
Uncultivated	52·9	52·0	52·1	52·1
Fallow	19·7	16·7	16·5	13·0
Sown	27·4	31·3	31·4	34·9
SARGODHA DIVISION				
Uncultivated	36·0	34·4	36·0	35·5
Fallow	26·4	20·6	18·0	19·4
Sown	37·6	45·0	46·0	45·1
LAHORE DIVISION				
Uncultivated	26·7	25·1	27·1	27·8
Fallow	31·8	20·9	20·8	22·1
Sown	41·5	54·0	52·1	50·1
MULTAN AND BAHAWALPUR DIVISION				
Uncultivated	42·2	35·1	37·2	38·7
Fallow	32·3	30·0	27·1	27·4
Sown	25·5	34·9	35·7	33·9

TABLE 3

Annual Land Utilization. Selected Years 1952-53 to 1957-58

Land-use	Percentage of Total Area			
	1952-53	1955-56	1956-57	1957-58
PESHAWAR AND DERA ISMAIL KHAN DIVISION				
Uncultivated	65·5	65·0	66·3	66·3
Cultivated	34·5	35·0	33·7	33·7
Current Fallow	5·7	3·7	1·7	3·6
Net Sown	28·8	31·3	32·0	30·1
RAWALPINDI DIVISION				
Uncultivated	52·9	52·0	52·0	52·1
Cultivated	47·1	48·0	48·0	47·9
Current Fallow	4·8	2·8	2·5	3·8
Net Sown	42·3	45·2	45·5	44·1
SARGODHA DIVISION				
Uncultivated	36·0	34·9	36·2	35·5
Cultivated	64·0	65·1	63·8	64·5
Current Fallow	10·8	7·7	6·0	6·0
Net Sown	53·2	57·4	57·8	58·5
LAHORE DIVISION				
Uncultivated	27·3	25·1	27·1	27·7
Cultivated	72·7	74·9	72·9	72·4
Current Fallow	11·2	5·9	5·0	5·6
Net Sown	61·5	69·0	67·9	66·7
MULTAN AND BAHAWALPUR DIVISIONS				
Uncultivated	42·2	34·8	37·2	38·7
Cultivated	57·8	65·2	62·8	61.3
Current Fallow	13·3	11·3	8·0	9·5
Net Sown	44·5	53·9	54·8	51·8

TABLE 4

Area Sown in either one or both Season during the Agriculture Year. Selected Years, 1952-53 to 1957-58

Land-use	Percent of Net Sown Area			
	1952-53	1955-56	1956-57	1957-58
PESHAWAR AND DERA ISMAIL KHAN DIVISIONS				
Sown both Kharif and Rabi ..	15·3	15·0	6·3	14·3
Sown either Kharif or Rabi ..	84·7	85·0	93·7	85·7
RAWALPINDI DIVISION				
Sown both Kharif and Rabi ..	9·4	10·0	10·8	12·2
Sown either Kharif or Rabi ..	90·6	90·0	89·2	87·8
SARGODHA DIVISION				
Sown both Kharif and Rabi ..	13·4	22·0	21·8	20·0
Sown either Kharif or Rabi ..	86·6	78·0	78·0	80·0
LAHORE DIVISION				
Sown both Kharif and Rabi ..	20·0	27·2	31·6	28·6
Sown either Kharif or Rabi ..	80·0	72·8	68·4	71·4
MULTAN AND BAHAWALPUR DIVISIONS				
Sown both Kharif and Rabi ..	14·4	13·2	14·0	15·5
Sown either Kharif or Rabi ..	85·6	86·8	86·0	84·5

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