PAKISTAN GEOGRAPHICAL REVIEW

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1. The Pakistan Geographical Review serves as a medium of publication and dissemination of knowledge mainly on the geography of Pakistan. Only such papers are published as have been written on a specific aspect of the geography of the country and carry original contribution in that field. Regional studies with special reference to Pakistan may also be published.

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(*See inside of the back cover.*)

Pakistan Geographical Review

Volume 18 JULY, 1963 Number 2

PHYSIOGRAPHY OF CHAGAI-KHARAN REGION, WEST PAKISTAN

M. ABU BAKR,

Geological Survey of Pakistan.

Location and Boundaries

The two adjacent districts of Chagai and Kharan are situated in the western and northern regions of Quetta and Kalat Divisions respectively, and lie between the parallels 27°10′ and 29°53′ N and the meridians 60°53′ to 66°16′ E covering an area of about 37,937 sq. miles. Afghanistan borders on the north, Iran on the west, Kalat District on the east and Makran District on the south.

GENERAL GEOLOGY

Stratigraphy

Chagai-Kharan region is formed of a complex of intrusive rocks of several types and ages and a sequence of sedimentary rocks containing in many places extrusive volcanic material. The Cretaceous-Eocene sedimentary sequence has been divided into three age groups—Chapar Group (late Cretaceous to Paleocene), Barankoh Group (Paleocene) and flysch deposits with intercalated basic and acid lava flows (early to middle Eocene). The rocks are cut by several types of intrusives ranging from peridotite and gabbro to syenite and aplite.

Stream deposited alluvium in channels, terraces and alluvial fans overlie the bedrock around the base of the hill-ranges. The alluvium in channels is composed of unconsolidated sand and gravel; in terraces, it consists of unconsolidated silt, sand and gravel forming surfaces a few feet above the present stream beds. The fans are composed of gravel and sand. The alluvium in the terraces is older than that in the channels and fans.

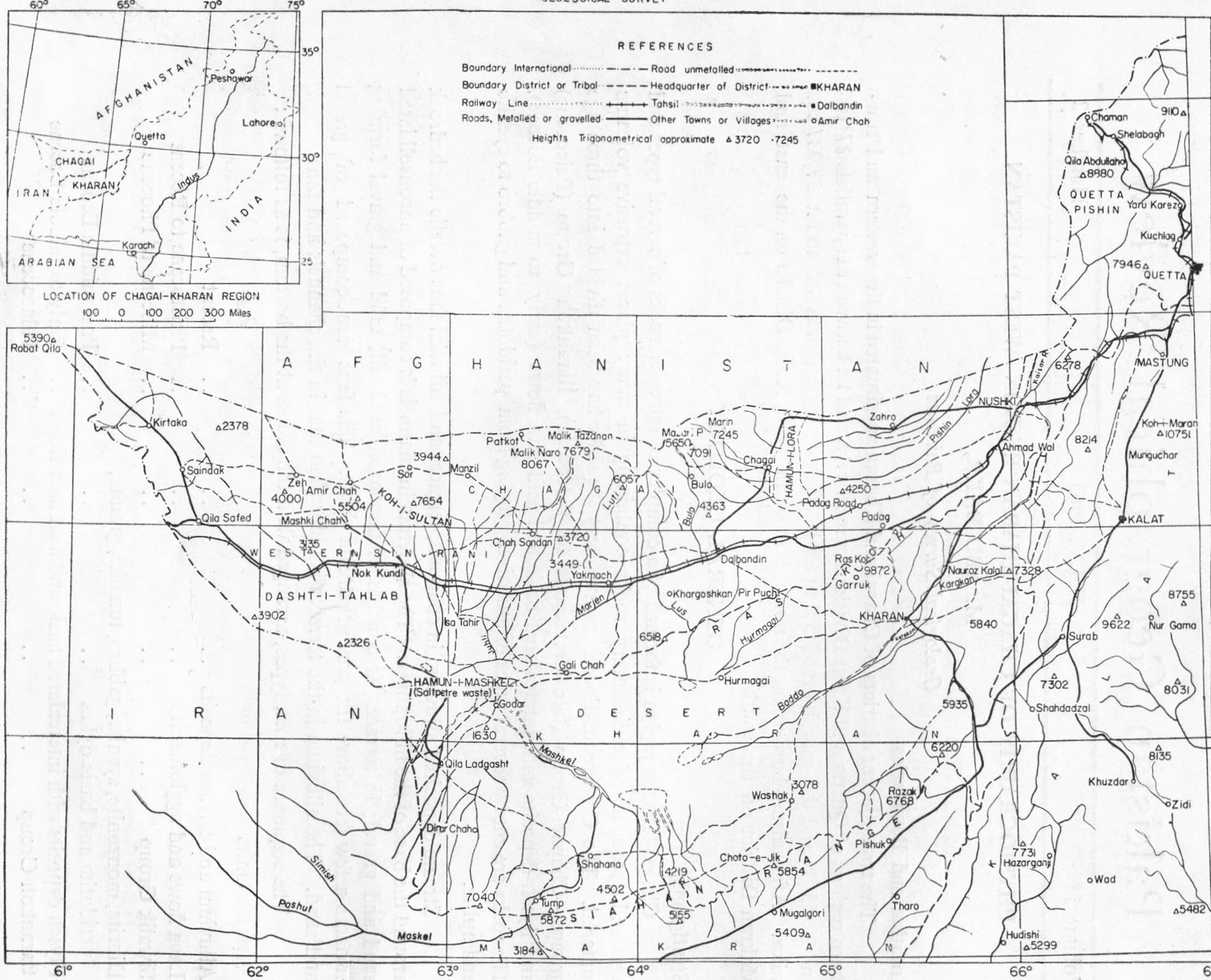
The sequence of rock types, arranged with the oldest at the bottom, is as follows :

Units	Age
Alluvium and terrace deposits	Recent
Lava flows and agglomerate	Pleistocene to Recent
Siwalik Group	Miocene to Pliocene
Diorite, monzonite, syenite, gabbro, tonalite, granite, peridotite and basic dykes	Post middle Ecoene
Flysch deposits with intercalated basic and acid lava flows ..	Early to middle Eocene
Barankoh Group	Palaeocene

GOVERNMENT OF PAKISTAN
MINISTRY OF INDUSTRIES AND NATURAL RESOURCES

GEOLOGICAL SURVEY

PLATE I



Base from Survey of Pakistan 1:1 million Sheet

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MAP OF CHAGAI—KHARAN REGION, WEST PAKISTAN

Chapar Group	Late Cretaceous to Paleocene
Tonalite and quartz diorite	Age not known

Distribution, age relations and characteristics of lithological units.

Early intrusive rocks

Tonalite and quartz diorite, the oldest rock types, are present in the Ras Koh Range mostly as inliers surrounded by basalt. Fragments and boulders of tonalite and quartz diorite are seen as xenoliths in basalt and tuff. These rocks are leucocratic, coarse grained and consist mostly of plagioclase felspar, quartz, hornblende, pyroxene, biotite, and chlorite.

Cretaceous-Eocene sedimentary and extrusive rocks

In the Chagai Hills, the sedimentary sequence is divided (Ahmed, 1958) into the Chapar Group (late Cretaceous to Paleocene) and Barankoh Group (Palaeocene). The Chapar Group is sub-divided into the upper Chapar Formation (consisting of shale and sandstone) Chapar Limestone and Chapar Shale. The Barankoh Group includes the lower Barankoh Formation (red or pink shale, conglomerate, agglomeratic conglomerate, and tuff), Barankoh Shale (olive-gray shale with calcareous sandstone), middle Barankoh Formation (grit, sandstone, sandy shale) and Barankoh Limestone (gray shaly limestone, and calcareous sandstone).

In the Ras Koh Range, the flysch deposits consist of interbedded shale, sandstone, limestone, shaly limestone, quartzite and porcellanite ranging in age from early to middle Eocene. The shale is mostly gray or olive, in places grading to sandy shale or sandstone. The sandstone is gray or grayish green, fine grained, and calcareous. The limestone and shaly limestone are gray, light green, and blue. The shale forms continuous beds whereas sandstone and limestone are in lenses.

From the point of view of distribution and relation with basaltic and pyroclastic rocks, the sequence of rocks can be divided into two parts—a lower part, composed of interbedded shale, sandstone, limestone, and shaly limestone and an upper part consisting of sandstone, shale, porcellanite, quartzite, tuffaceous sandstone, and limestone intercalated with basalt and pyroclastic rocks (tuff and agglomerate) in the form of lenses and irregular bodies.

The agglomerate consists of either basalt or rhyolite fragments and boulders bound together with or without interstitial tuffaceous material. The basalt is composed essentially of phenocrysts of augite and/or hornblende, and plagioclase felspar in a fine-grained flow-oriented groundmass mostly of the same minerals. Rhyolitic lava flows and pyroclastics are intercalated with those of basalt and also with purple limestone and light green porcellanite. The rhyolite is mostly gray and deep green and consists of porphyritic crystals of quartz and plagioclase felspar set in a fine groundmass of quartz, felspar, chlorite, and calcite.

Later intrusive rocks

Basic dykes (quartz dolerite and dolerite) have intruded into tonalite, quartz diorite, rhyolite and, in places, into sandstone, quartzite, limestone, and shale.

Ultrabasic rocks (peridotite and pyroxenite) are present as sills in the Ras Koh Range. In the eastern Ras Koh Range, the peridotite contains workable deposits of chromite.

In the Ras Koh Range and Chagai Hills, batholiths, stocks, bosses and dykes of diorite (with associated monzonite and syenite) are intrusive into basalt, shale, and sandstone. The diorite is medium to fine grained and consists of plagioclase felspar, augite, hornblende, and biotite. Monzonite is porphyritic, coarse grained and consists of plagioclase and orthoclase felspars, augite, and hornblende. The syenite is generally medium grained, red or pink and contains orthoclase felspar, biotite, hornblende, and a little quartz.

In the western Ras Koh Range, norite and gabbro are intrusive into basalt. Norite consists of plagioclase felspar, hypersthene, augite, and magnetite. The gabbro, in most places, is olivine-bearing and consists of augite, plagioclase felspar, olivine, iddingsite, and magnetite.

Granodiorite has been noted in the Kundi area, north of Dalbandin. It is coarse grained having granitic texture and forms the peripheral part of masses of microgranite which is intrusive into basalt, quartz dolerite and diorite.

Siwalik Group

Elongated ENE, the Siwalik rocks are present in a narrow strip along the base of the Chagai Hills. They are composed of conglomerate, sandstone (gray, red), shale (red, purple), clay (gray, orange) and grit.

Pleistocene—Recent lava flows and agglomerate

In the Koh-i-Sultan area, an alternating series of lava flows, agglomerates, and ash beds is found which, in certain regions, overlie the late Cretaceous Hippuritic Limestone.

The lava flows and agglomerates are composed chiefly of andesite and basalt which have been decomposed in places due to solfataric activity.

STRUCTURE

Complete information on the structure of Chagai-Kharan region is not available as the geological examination of this area is still in progress. The most important structural features are :

(*a*) A major fault (probably a boundary fault) extends from near Chaman through Nushki toward Makran and has brought the Chagai-Kharan suite of rocks against the Kojak Formation which borders the calcareous zone of Baluchistan. Movement along this fault has taken place in recent time as the alluvium and terrace deposits have also been affected by it. This fault, at Chaman and Nushki, is known respectively as Chaman fault and Nushki fault.

(*b*) An arcuate orientation of the hill-ranges and of the strike of the rocks: the strike of the hill-ranges at Nushki is NE, in the Ras Koh Range ENE, while

in the Saindak-Qila Safed area it is NW. Roughly, the ranges form parts of arcs of a semi-circle.

In the Western Ras Koh Range and also in parts of the eastern Ras Koh Range, the structure can be summarized as follows :

The Cretaceous-Eocene sedimentary and extrusive rocks are highly folded, the axes of folds are almost parallel, the orientation being mostly ENE but locally NE. The fold axes are very closely spaced and the amplitude of the folds appears to be small. The most prominent folds are the Charian—Sehchang anticline and a syncline which extends from Pishi River to Lagan Nala. In this area the presence of parallel disposition of folds with roughly straight axes might have resulted from pressure directed from NNW, or NW, or a couple acting at approximately 45 degrees to the present trend of the orogenic axes.

There are two major sets of faults affecting the Cretaceous—Eocene sedimentary rocks, the pyroclastics and ultrabasic bodies—(*a*) faults striking NE or locally NNE and (*b*) faults striking NW or locally NNW or WNW. In places, these two sets are disposed roughly at an angle of 45 degrees, with respect to the fold axes. Most of the fault planes are vertical or inclined at steep angles. The faults can be divided into the following types—strike faults, transverse faults, and en echelon faults.

The shale, sandy shale, sandstone and, in some places, limestone and tuff are highly cleaved. The cleavage planes always have the same attitude as the fold axes, *i.e.*, they either dip at steep angles (65—80 degrees) toward NNW or are vertical.

A set of vertical or nearly vertical NNW striking joint is present in the Cretaceous—Ecoene sedimentary rocks, associated basaltic lava, and pyroclastic rocks. Joints are well developed in diorite and monzonite. The most prominant joint set is oriented ENE either vertically disposed or inclined at steep angles (70—85 degrees) toward SSE. Perpendicular to the above is a joint set which is nearly horizontal or inclined at low angles (5—15 degrees) toward NNW. In some places, a vertically disposed joint set is present oriented NNW.

In the Chagai Hills, north of Dalbandin, the most important fault is the great Chapar fault (Ahmed, 1958). It is probable that horizontal movement has taken place along this and other minor faults which are noticed in this area.

Age of deformation

The Cretaceous—middle Eocene sedimentary rocks were deposited in a comparatively quiet period as we notice little evidence of erosion or unconformity in them. The folding of the Chagai-Kharan region, which brought in the formation of the hill-ranges, is later than the deposition of Cretaceous—middle Ecoene sedimentary rocks and the extrusion of rhyolite and basalt, and intrusion of peridotite and pyroxenite as all these rocks have been affected by folding. It appears that the upheaval of the ranges had not commenced before

late Eocene. "On the other hand, the last chapter in the history of the upheaval, as illustrated by the Siwalik strata, had ended before the end of the Pliocene. Therefore, the folding of this large area, the upheaval of all the ranges, the metamorphism of shales into slates, the intrusion of great igneous masses, the conversion of the sea into a land area, the denudation which furnished the materials for the Siwaliks, and finally the uplift of the latter ranges, must have all taken place within a relatively short period of earth's history. The upheaval, may have commenced before the end of the Eocene, it attained its maxiumum during the Miocene period and came to an end with the Pliocene" (Vredenburg, 1901, p. 207).

OROGRAPHY AND DRAINAGE

Orography

In the Chagai-Kharan region, there are three hill-ranges, separated from each other by wide desert plains. Fig. 1 is a photograph of desert south of Dalbandin Chagai District. The hill-ranges in the north are the Chagai Hills, Koh-i-Sultan and Saindak-Qila Safed hills; in the central part, Ras Koh Range extending from south of Nushki to east of Galichah, and in the south, Siahan Range which forms the boundary

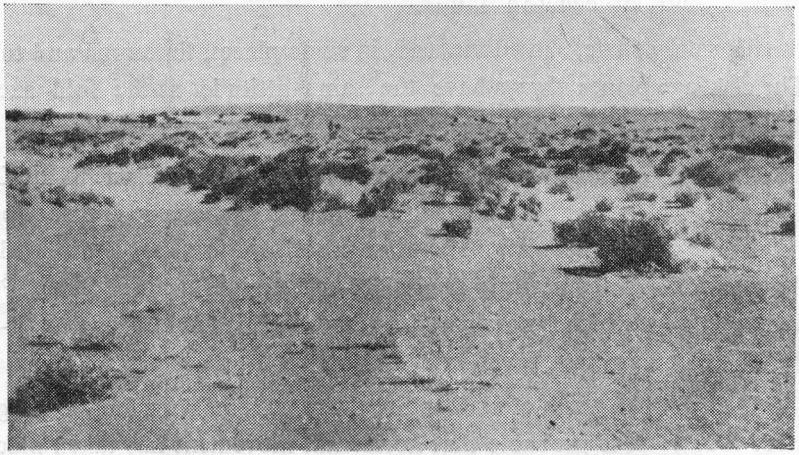

Fig. 1.
Desert South of Dalbandin Chagai District.

between Kharan and Makran Districts. Chagai Hills lie between lat. 29°00′ and 29°30′N and long. 63°18′ and 64°50′ E and form the watershed between the Helmand area in the north and Hamun-i-Mashkel in the south. Oriented in a E-W direction, Chagai Hills extend for about 90 miles in length and about 32 miles in width. Important peaks in these hills are Marin—7245 feet, Malik Teznan—7682 feet and Malik Naru—8079 feet above sea level.

To the west of the Chagai Hills and separated by a sandy plain about 25 miles long is Koh-i- Sultan Range. It is about 17 miles long, 10 miles wide and strikes roughly WNW. Three greatly denuded craters of an ancient volcano, now extinct, occur in this area. The highest peak Koh-i-Sultan is 7654 feet above sea level. A little west of Koh-i-Sultan and south of Amir Chah are the Damodin hills consisting of a small range of extinct volcanoes.

The Saindak-Qila Safed area consists of a series of low hills, oriented NW and extends for a distance of about 60 miles, the average width being 12 miles.

The Ras Koh Range, oriented ENE, lies between lat. 28°25′ and 29°13′N and long. 63°57′ and 66°E and is about 140 miles in length and from 20 to 30 miles in width. The highest peak, Ras Koh is 9872 feet above sea level.

The Siahan Range, elongated ENE, forms the divide between the Kharan District and the nothern part of Makran District. The important peaks are Razak—6768 feet, Mughal Pabb—5935 feet, and Choto-e-Jik—5854 feet.

The place having the lowest elavation (1630 feet above sea level) is situated near the centre of the Hamun-i-Mashkel. The towns of Nushki, Dalbandin and Kharan are at heights of 3271 feet, 2785 feet, and 2317 feet, respectively.

At and near the border of Chagai District and Afghanistan are the deserts of Siah Reg, Sor, Hamun-i-Lora, and Zahro; in between the Ras Koh Range and Chagai Hills is the desert of Khargoshkan and Padag Road; between the Ras Koh and Siahan Ranges is the Kharan desert. Westward, the two last mentioned deserts widen and coalesce to form the great deserts of Hamun-i-Mashkel and Dasht-i-Tahlab, both of them lying at the border of Pakistan and Iran.

The gravel fans and pediments lying around the hill-ranges merge into the deserts. The deserts, in places, have pebbles spread over them on account of occasional floods of former times which brought them from the hill-slopes. The stony deserts are locally called 'dasht'. Sand dunes of the 'barchan' type are very common in the desert. The dunes are the result of wind blown sand—the wind blowing mostly from ENE during summer and WSW during winter. In places, plains of fine alluvium (locally called 'pat') are present between the sand dunes.

DRAINAGE

Hydrography

Chagai-Kharan region lies outside the monsoon area, the annual rainfall ranging from 2 to 5 inches. It is an area of closed drainage, and there are no perennial streams except the Kaisar River near Nushki. Innumerable dry channels, in places roughly parallel

to each other, emanate from the mountain slopes and merge into the desert. They contain a little water during the rare event of rain.

The important rivers are Mashkel, Morjen, and Juhli which drains into Hamun-i-Mashkel (locally, Hamun means dry lake basin); Baddo, Korakan, Hurmagai draining into Kharan desert; Pishin Lora (Dhor), Chandan Khan and the streams from the Chagai Hills which merge into Hamun-i-Lora; Lus, Pishi, Kanian, Mughlan, Sehchang and Bulo which drains into Khargoshkan—Padag Road desert; and Kaisar River, which drains the Shorarud and Kishingi vallyes.

Establishment of drainage in its historical retrospect

On a study of the alluvial and desert areas in Chagai-Kharan region, two things stand out prominently—the accummulation of enormous amounts of talus skirting the hill-ranges, and the distribution of pebbles over the major part of deserts. The present annual rainfall is hardly any agent of transportation. But, in former times, it appears that the area had an abundant rainfall which aided in the development of fan talus and the distribution of pebbles over the desert belt. The presence of remmants of dams built for irrigational purposes in olden days, on mountain streams in Kharan, now an almost uninhabited desert, leads to the assumption that this part of Kalat Division had greater rainfall in the past.

Drainage types and patterns

The Chagai-Kharan region is an area of closed drainage. The 'hamuns' or dry lakes form the lowest part of the hydrographic basins. Actually very few streams reach the 'hamuns' as they merge into desert after coming out of the hill-ranges. The rivers are mostly transverse and the drainage, as a whole, is subsequent. The drainage pattern is typical of arid zones.

Lakes and springs

The dry lake basins which are, in places, playas range in size from about one to 16 square miles, the largest being Hamun-i-Mashkel.

Springs in the Chagai-Kharan region are few and far between. In the Ras Koh Range, a number of springs are seen around Ras Koh peak, Charian and Sote Jungle area. Most of the springs have insignificant discharge.

Ground water

The rainfall being meagre and the drainage of the area closed, ground water where available at moderate depth is generally saline as noticed in Khargoshkan, Gwalishtap and Tozghi-NokKundi area. Potable water is available in certain parts of Yokmach, north of Dalbandin, in the northern slopes of the Ras Koh Range, and in Kharan. Water from

Karezes (horizontal wells dug on 'daman' or fan-talus slopes) are used for irrigational and drinking purposes in parts of Nushki and Chagai *tahsils*.

Dr. E. R. Gee, a former Director, Geological Survey of Pakistan made a study of ground water conditions of the Yakmach—Gat-Nok Kundi area. He observed that the drainage east of Isa Tahir was mainly from the Chagai Hills, the strata of which were probably less saline and opined that water of better quality could be expected from the alluvium of that area.

GEOMORPHIC PROCESSES AND RESULTS

The topography of the Chagai-Kharan region shows the rudimentary and unfinished work of weathering processes. Here, the principal agents of erosion are wind, strong summer heat, and occasional cloud bursts resulting in hill torrents ('sheet floods' of McGee). As described before, the dessication of this region is of recent origin.

"Plant growth being very scanty, the desert vegetation affords the surface little or no protection; there is little chemical weathering, but rock-breaking by physical weathering predominates; and the streams are intermittent, at least at the upper and lower ends" (Davis, 1905).

Spheroidal weathering is, in places, conspicuous in diorite, tonalite and basalt. The tonalite and diorite of Sorghar in the Ras Koh Range have been cut into rectangular blocks due to the presence of two sets of joints, one perpendicular to the other. Spheroidal weathering on a marked degree is noticed on these blocks. Fig. 2.

The dessication of the area has greatly enhanced the development of wind-blown sand. The sand dunes are mostly of 'barchan' type. Fig. 3.

The gravel terraces at the margin of deserts are in concentric belts showing step like escarpments. These probably depict ancient shore lines of great lakes, now reduced to 'Hamuns,' dessication having taken place in stages.

Physiographic divisions and sub-divisions

The region can be divided into three physiographic divisions:—

(*a*) The highland areas.

(*b*) The gravel fans (locally called 'daman').

(*c*) The desert.

The highland areas, which consist of three arcuate hill-ranges have been described under orography. They are characterised by closely spaced, generally parallel, dissected but resistant hills, with elevations ranging from 2317 to 9872 feet above sea level.

The gravel fans are formed of boulders and pebbles of rocks composing the hills, silt, sand, and clay. They are a conspicuous scenery of the area and some of them are upto a few square miles in size. In such waterless territory, these fans form store-houses of water draining down the hill-slopes.

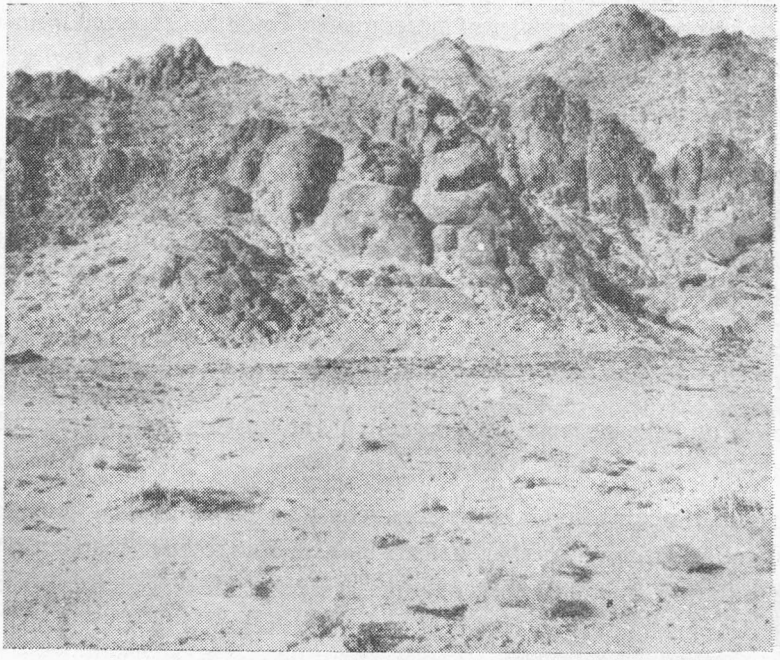

Fig. 2.

Jointing and spheriodal weathering in monzonite, Garrok Hill, Western Raskoh Range, Chagai District.

The deserts which are situated in between the hill-ranges and form wide plains covered with sand and pebbles.

Human geography in relation to physiographic setting

Total population of Chagai-Kharan region is 83,746 of which Chagai District contains 41,263 persons, and Kharan District has 42,483 persons. Density of population per square mile is 2 in both Chagai and Kharan Districts.

Availability of water being limited, there are only a few permanent settlements in this region. Most of the population comprises of nomadic shepherds, moving from one water source to another. Each party consists of one or two families.

There is another group of people who are seminomadic and live by both agriculture and pasture. Agriculture absorbs only a small part of the population as noticed in the vicinity of Nushki, Kharan, and south of Dalbandin. In the latter two places, agriculture is completely dependant on rains ('Kush kaba' cultivation). Less than 3 % of the area is under cultivation.

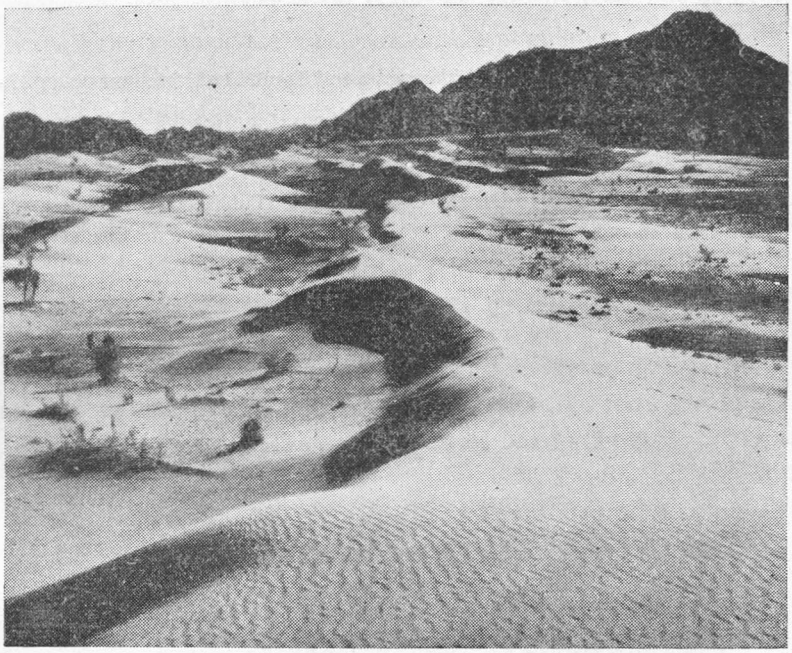

Fig. 3.

Sand dunes, east of Sorap Wells, Western Raskoh Range, Chagai District, View looking east.

Townships are located at Nushki, Dalbandin and Kharan. The huts built by settled people are made of mud, while those of nomads of branches of trees and reeds. The sheperds buy wheat and cloth in exchange for wool and, if necessary, sheep. Although a few motorable roads are present in the main valleys, camels are the only certain means of transport into the interior.

The people are all Baluchi Muslims and are divided into two main tribes—Sanjarani and Nausherwani. The former generally reside in the northern part and the latter in the southern part of the region.

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MANCHAR LAKE : A STUDY OF ITS FISH INDUSTRY

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The overwhelming majority of meat consuming population is practically depleting Pakistan's live-stock wealth, thereby causing an acute shortage of animal protein. Prospects for large scale expansion of live-stock raising do not appear very bright, for almost all the agriculturally suitable land is allocated to cash and food crops to meet the existing food shortage in the country. Arid and semi-arid areas which are less favoured with regard to water-supply do not hold much promise in the immediate future for any considerable increase in the yield of fodder crops. The only possible less expensive alternative protein, other than dairy products is fish, the consumption of which is showing an upward trend. Independence confronted Pakistan with a completely new set of population-resource ratio particularly with respect to fisheries. The rapid expansion of modern fishing over the past fourteen years has been induced by necessity, for the country's food supply is short on protein. Pakistan's annual per capita consumption of fish is about 5 pounds only[1]. It is indeed very low when compared to U.S.A. 12 pounds, U.K. 35 pounds, Norway 42 pounds and Japan 92 pounds per annum. The present paper is an attempt to study the Manchar Lake fish industry; to know its problems and finally to present some modest proposals for their solution.

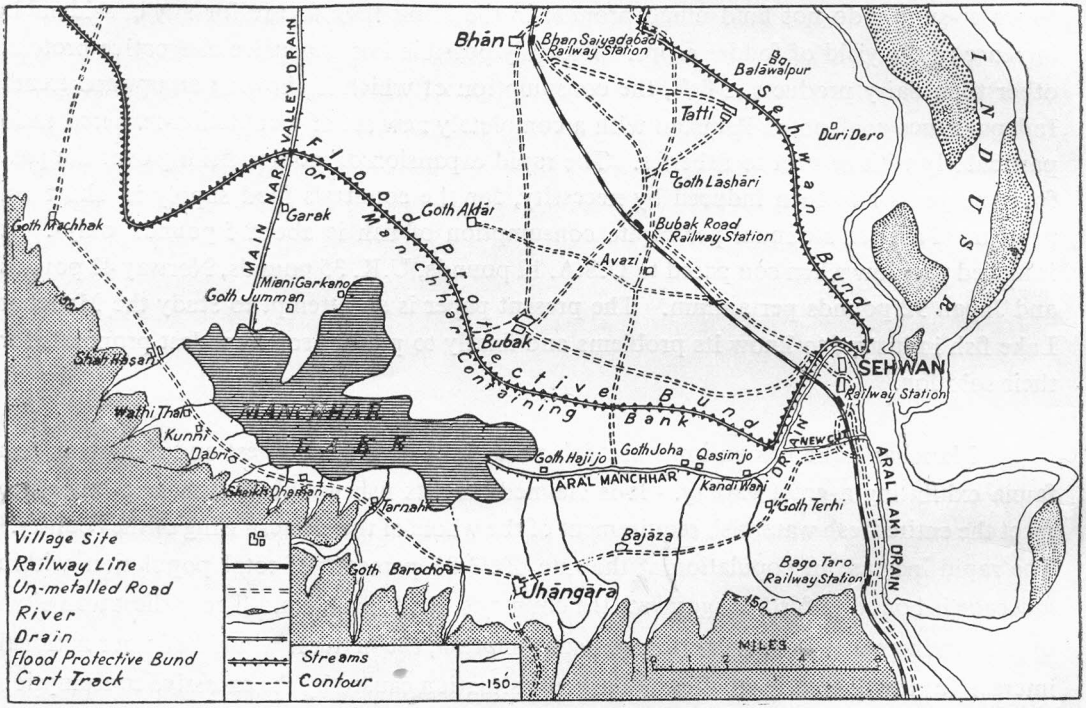
Manchar Lake has an immense fish potential. It is the biggest and richest in fish fauna exhibiting a great variety. It is claimed that its fish wealth is sufficient enough to meet the entire fresh water fish requirement of the whole of the western wing of the country.[2] The rapid increase in population at the rate of 23·85 percent* of total population within a decade is bound to further aggravate the country's food problem. The earliest we switch over to an increased fish production and consumption, the better it would be in our national interest, for it will greatly ameliorate the acute situation caused by the excessive consumption of animal protein.

Location, Water Supply and Drainage : Manchar is a flood plain lake situated in the middle of western valley section of the lower Indus plain between longitude 67°-34′ and 67°-43′ east, and latitude 26°-23′ and 26°-28′ north. It occupies the extreme southern portion of the depressed area formed by the dipping of the Kirthar rocks near the flanks of

*Figures arrived at by comparing 1951 and 1961, censuses of the Government of Pakistan.

the mountains, and the high bed of the Indus (Map 1). When the lake is full to capacity, it covers an area of 100 square miles, but prior to the construction of the Flood Protective Bund (Manchar Containing Bank) it is reported to have occupied an area of 200 square miles[3]. During the off season, (dry season) it shrinks to 30 square miles (area covered at the minimum level). The level of water in the lake is 10 to 12 feet when the spread is at its maximum and 3·5 to 4 ft. when it is at its minimum.

The lake is fed by the numerous hill torrents or 'Nais' that descend down the Kirthar ranges on its west, and south during the rainy season, and the water of the mighty Indus that reaches it through the Main Nara Valley drain and the Aral drain. The Main Nara Valley drain is now canalised, previously it was called Western Nara—a branch of the river Indus. The course of the Aral has now been straightened by excavating a new channel, called "New Cut". The portion of the Aral between the New Cut and the Manchar is known as



Map. 1

the Aral-Manchar drain while that between the New Cut and its junction with the Indus is known as Aral-Laki drain. It is rather interesting to find that the Aral serves the dual purpose of feeding as well as draining the lake. There are two regulators to control the inflow and outflow of water, known as the Aral Head and Tail Regulators. The former is located on the Aral loop, west of Sehwan town, while the latter on the New Cut to the south of Sehwan Railway Station. During floods (August and September) the level of the water

in the Indus rises and stands at 117 R.L. while the bed of the lake is 100 R.L.* The Indus water, therefore, passes through the Aral to feed the lake via the Head Regulator. On subsidence of inundation the lake's water level stands higher than in the parent stream. The water, therefore, drains back into the Indus via the Tail Regulator.

Fish Fauna : The highly pulsating expanse of the lake, with area ranging between 30 and 100 square miles, depth from 4 to 12 ft. and shallow marginal areas subject to beneficial effects of sun rays are some of the chief factors responsible for an abundant supply of fish food in the form of Phyto and Zooplanktons. The lake, therefore, abounds in fish wealth. Till 1957, 40 species of fish were recorded by Dr. A. J. Farooqi and his co-workers. Parctically all the fish found in the lake belong to the following families : Ciprinidae, Percidae, Notopteridae, Belonidae, Anabantidae, Gobiidae, Mastacembelidae, and Ophicephalidae, but the lake best represents the first two families.[4] Labeo rohita or 'Dhambro' is of far greater importance to the fishermen than any other variety from the point of sale, and is thus one of the most highly prized fish of the lake. Other important fish from the sale's point of view are: Cirrhina mirgala or 'Morakha' or 'Mori,' Catla catla or 'Theila', Wallago attu or 'Jarko' or 'Mullee, Mystus aor or 'Singhari,' Notopterus chitala or 'Gandan', Ohpicephalus straitus or 'Kara shakar' or 'Saul', Ophicephalus punctatus or 'Gahro shakur', Barbus sarana or 'popri'. Apart from these fish the lake also abounds in carp minnows, which are not netted since there is no demand. Hilsa ilisha or 'palla', family Clupeidae was previously caught as recorded by Dr. Beni Prashad.[5] It used to enter the lake via the Aral, but not a single Palla has so far been netted during the course of past three years.* This may probably be due to the obstruction caused by Ghulam Mohammad Barrage in their ascent upstream as also by the Aral Head Regulator.

Craft and Gear Types : Practically all the boats operating on the lake belong to the fishermen. They are non-mechanised and admirably suit the local conditions. They are of the same design but vary in size; are flat bottomed, built of plank and the bow and beam are rectangular in shape with sliding gunwale from the beam. The boats have an elevated platform in the aft, a hold in the middle, which is invariably covered with mat-roof to protect from above, and a small deck behind. All the boats are steered by bamboos on account of the shallowness of water and obstruction caused by acquatic vegetation. The speed of these boats is about 1 to 1·5 miles per hour, which is indeed very slow. Fishermen themselves are good boat makers and about five to ten families are engaged in this craft.

*Information supplied by the Executive Engineer, Southern Dadu Division, Irrigation Branch, P.W.D.

*Information supplied by Mr. Zahid Hussain, Assistant Director of Fisheries, Southern Zone, Hyderabad.

In 1961, a total of 678 boats of various types were plying on the lake. Of these 503 were Beri, 113 Batela, 10 Kotwar and 52 Hora. As to their utility 54 were exclusively used for living purposes, 3 for fish storing and 12 for collecting fish by dealers, 11 boat shops, 258 fishing boats, 323 for fishing and living purposes, and 17 for transporting goods and passengers. The maximum carrying capacity of different boat types is given in Table-I.

TABLE 1*

MAXIMUM CARRYING CAPACITY OF DIFFERENT BOATS

Type of Boat	Fish (Mds)	Passengers	Total lifting capacity (Mds.)
Horo ..	10	2	17
Biggest Batela ..	25	20	55
Biggest Beri ..	60	50	135

*Data supplied by Mr. Ghulam Mohammad Khan, F.D.O. Manchar Lake, Bubak.

In Manchar various types of nets are used which broadly fall under three heads: (*i*) Hand nets—to this class belongs a cone like fishing gear called 'Kurri'. It consists of 5 to 6 bamboo sticks about 3·5 ft. in length tied at equal distances apart to a woodern ring 6 to 8 inches in diameter. The upper ends of these sticks are tied together while the lower ends are so tied that they are equal distances apart from one another forming a ring like structure, having a diameter of about 4 feet, which may be taken as the base of the cone. A conical net with its open base-end is tied to the ring of the conical frame, while its close apex-end is tied to the top end of the frame. When a fish is located the 'Kurri' is immediately placed over it, and the upper end of the net is immediately untied, the fish struggles to escape and is ultimately trapped in the apex-end of the net, which is then taken out by hand. (*ii*) Gill nets — to this class apart from others belongs 'Patti' which is from 150 to 300 feet in length, and 8 to 10 feet in breadth. The cotton yarn used in it is of counts 10-s, and between $2\frac{1}{2}$ to $3\frac{1}{2}$ seers in weight. The mesh is 1 to $1\frac{1}{2}$ inches and its total cost is Rs. 12 to 16 per net. Some fishermen have now started using nylon gill nets which are more durable and give a better catch. The net hangs in water, it has no floats but weights of burnt clay k ep it fixed to the bottom of the lake. (*iii*) Casting nets or Jaro—it is generally operated from the boat, cotton yarn used is counts 20-s; yarn required $1\frac{1}{2}$ seers; mesh 1 to 2 inches and total cost from Rs. 8 to Rs. 10 per net.

Fishing Operations : A very novel way of catching fish is with the help of a fixed net, called 'Bhan'. In catching fish with Bhan three types of nets are used: 'Adao', 'Khandi', (collectively called Bhan) and 'Varjhar'. A complete Bhan net requires $\frac{1}{2}$ to $2\frac{1}{2}$ maunds of yarn of counts 10-s, with a mesh from 1 to $2\frac{1}{2}$ inches. The total cost is Rs. 250 to 450. It is more than 80 feet in length and 12 to 13 feet in height. The Bhan net is fixed with long

bamboos forming an incomplete circle with a gap of about 8 to 10 feet. The ends of the net form a semi-circle within the big incomplete circle. The portion of Bhan net that stands in water is called Khandi while the one about 5 feet above water is called Adao, the lower end of which forms a kind of pocket or pouch, in which fish are trapped when they strike the net in an effort to jump over it. Another net Vanjhar, about 6 to 8 feet in height, 30 to 40 feet in length, is fixed with bamboos, to guide fish into the opening of Bhan as shown in the figures 1 and 2.

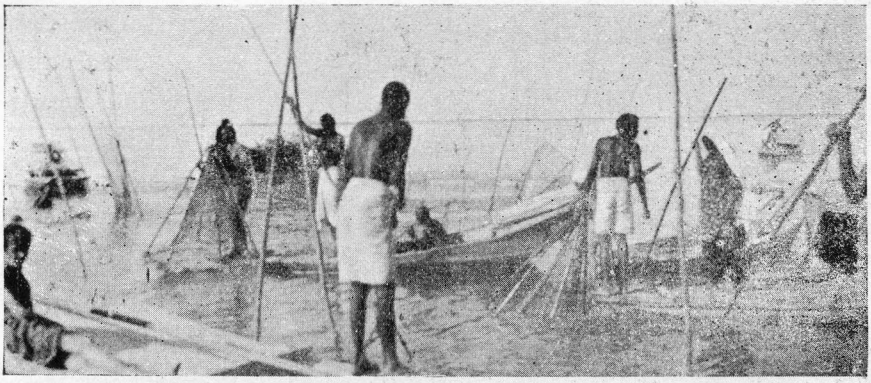


Fig. 1
Fishing with Bhan net note the characteristic hand net or Kurril.

A number of boats carrying fishermen stand in a semi-circle at some distance; move towards the net closing down the gap between them and making a terrific noise by beating utensils apparently to drive the fish ahead. The fish are ultimately trapped in the semi-circles formed by the two ends of the net marked 'A' and 'B', where they are caught by the fishermen's family by using hand operated Kurri nets. The deafening noise produced by beating utensils appears to be of no consequence as it cannot produce any effect on fish under water. It is quite likely that this action may result in setting up vibrations in water by the movements of boats which may be responsible for frightening the fish to run towards the trap.

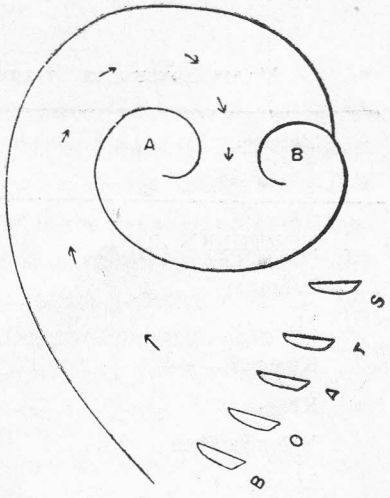


Fig. 2
Plan of Setting the Bhan-net.

The lake has a profuse growth of submerged, emergent and floating vegetation, (Fig 3.) *e.g.*, Potamogeton, Hydrilla, Utricullari, Ceratophyllum, Typha sp., Nymphia, sp., etc. The excessive growth of vegetation slackens the speed of boats and obstructs the spread of nets, resulting in a low fish catch. Further the deposition of decomposed vegetal matter together with silting, considerably makes the lake shallower every year.

Fishing is carried on the year round save on Fridays, Muslim festivals, rainy days, marriages and funerals. The average number of fishing days in a years is 275. Fishing starts early in the morning at about 5 a.m., and comes to a close at about 12 to 1 p.m. Hence the duration of fishing is between 7 to 8 hours per day. The catch is brought to the landing centers by fish collectors who are from amongst the fishing community or by the fishermen themselves. By 3.30 p.m. the stock is weighed by the staff of the Fisheries Department and sold to the dealers on the rates fixed by it. Fig 4. The rates vary depending upon the season, demand, variety and size of fish. Payment is made to fish collectors or fishermen in cash after deducting 1/5th as government share. The fish is packed by the dealers in gunny bags with crushed ice and sent to Bubak Road and Bhan Saidabad Railway Staions for onward despatch to different destinations. The quantity of fish despatched to six major consuming stations each in the Northern and Southern zones. (Table 2.)

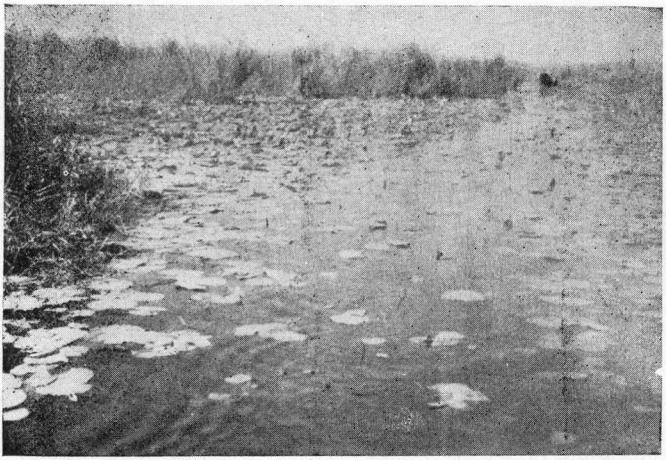


Fig 3.
The Lake vegetation. Note the characteristic emergent and floating vegetation.

TABLE 2*

MAJOR CONSUMING STATIONS OF MANCHER LAKE FISH (FROM JULY 1961 TO JUNE 1962)

Stations.	Quantity (in Maunds)	Stations	Quantity (in Maunds)
NORTHERN ZONE :		SOUTHERN ZONE :	
Lahore ..	1532	Quetta ..	2812
Multan ..	850	Rohri ..	1878
Khanpur ..	824	Sukkur ..	1678
Khanewal ..	800	Khairpur ..	1482
Rahimyarkhan ..	704	Shahdadkot ..	1388
Rpwalpindi ..	195	Badah ..	938

*Data supplied by Mr. Muhammad Yunus Khan, Fisheries Department, Southern Zone, Hyderabad.

Fish Production : The production curves for the different years show a marked disparity (see Fig 5). However, it becomes quite evident that fish catch is small during the six months from Apirl to September and considerable during the remaining six months from October to March. The low fish catch from April to September (hot season) is due to low up country demand and an enormous increase in the expanse of lake due to flooding by hill torrents and the Indus. The exceptionally small fish catch during the months of June, July and August in 1958, was due to high fish mortality. It was caused by a considerable drying up of the lake mainly due to the negligence of the authorities concerned, who did not maintain water covered area at the minimum planned level. The high fish catch from October to March (winter season) is due to reduced water surface and a very high upcountry demand.

Fig 4.
Fish weighing and recording by the staff of the Fisheries Department.

The total annual production was 21,922 maunds in 1954 (see Fig 6). It slightly increased to 23,578 maunds in 1957-1958 and dropped to 21,319 maunds in 1959. The production shows a significant increase to 30,404 maunds in 1960. In 1961 it almost doubled the 1954 figure by registering a total of 43,260 maunds. These figures show at a glance a rising trend onward of 1959. The explanation can be found in the fact that the lake almost dried up in the summer of 1958, resulting in a more or less complete destruction of fish. In 1959, only new stock was available, which since then is growing in size. This increase can also be attributed to the efforts of the Fisheries Department which took possession of the lake in February 1960, after the contractors lost the civil suit they had filed against the government. Some essential data of fish production is given in Tables 3 and 4.

As to the percentage of fish catch by species Dhambro ranks first (see Table 4). In 1960, it accounted for almost 3/4 (70 per cent) of the total fish catch and fairly above half (57.7 %) in 1961. The production of Mori increased to 1/4 (25·6 %) of the total catch in 1961, giving it a second place. The abnormally low catch of Dhambro (0·5 %) in 1958, was due

TABLE 3

MANCHER LAKE FISH PRODUCTION (1959, 1960 AND 1961)

Months.	1959		1960		1961		
	Mds.	Sr.	Mds.	Sr.	Mds.	Sr.	Ch.
January	1800	..	2788	..	3815	14	..
February	1538	6	2275	..	3058	24	..
March	1142	10	1626	..	3749	2	..
April	1076	20	2140	2	4820	16	4
May	1283	15	2517	11	4513	4	..
June	1064	..	1313	28	4279	38	..
July	1639	10	2820	18	3928	34	..
August	1217	20	2721	2	2642	5	..
September	1285	5	2200	39	1480	15	8
October	1931	14	2589	37	2608	29	..
November	3977	23	4131	3	4099	11	8
December	3364	21	3280	24	4265	1	..
Total :	21319	24	30404	4	43260	34	4

Source : Data supplied by Mr. Zahid Husain, Assistant Director of Fisheries Southern Zone, Hyderabad.

TABLE 4

PERCENTAGE OF DIFFERENT SPECIES OF FISH NETTED

	Dhambro	Thaila	Mullee	Mori	Others	Total
1958	0.5	88.0	10.0	0.5	1.0	100
1959	55.5	16.5	16.5	9.5	2.0	100
1960	70.0	16.0	10.0	2.0	2.0	100
1960	57.7	6.9	7.9	25.6	2.0	100

Source : Data suplied by Mr. Ghulam Mohammad Khan, F.D.O. Manchar Lake, Bubak.

TABLE 5

	Dhambro	Thaila	Shinghari	Mullee	Saul	Morig
*Size (in ft.) ..	2.8	2.8	3.8	3.6	3. 6	1.11
Weight (in lbs.) ..	9	10	13.5	18	15	5.5

*Source : Data supplied by Mr. Ghulam Mohammad Khan, F.D.O. Manchar Lake, Bubak.

to its high mortality on account of considerable drying up of the lake during that year. The size and weight of the biggest fish caught of some of the species in 1961-62 is given in Table 5.

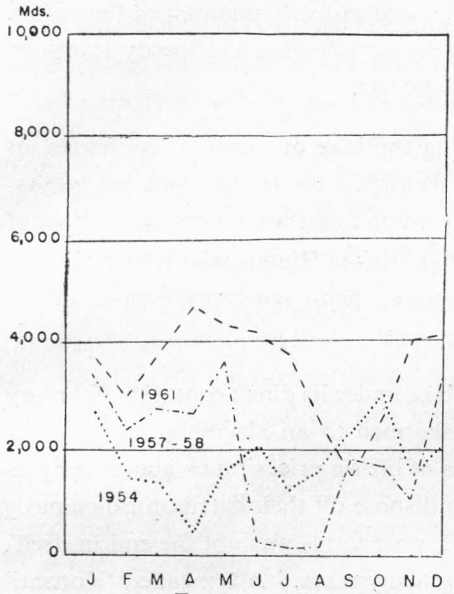


Fig. 5

The rising trend of annual production inevitably suggests that there are great possibilities of further increase provided suitable measures are adopted for the conservation and exploitation of the lake's fish resources. As previoulsy indicated the lake is pulsating in expanse. On the basis of four maunds per acre yield of fish for permanently water covered area (19,000 acres) and 1 maund per acre for seasonally covered area (44,000 acres), the lake can reasonably be expected to yield 1,20,000 maunds of fish. Thus there are bright prospects for tripling the 1961, production of 43,260 maunds.

Means of Communication and Transport : As far as accessibility of the lake is concerned three unmetalled roads, one each from Sehwan, Bubak and Bhan Saidabad Railway Stations converge at Bubak town. A similar road links Bubak with the landing centre Miani Tar, on the northern bank of Danisterwah. Miani Tar is approximately six miles from Bubak Road Railway Station, 9 miles from Bhan Saidabad Railway Station, and 12 miles from Sehwan Railway Station. The conditions of these roads is awfully bad and beyond description. It also appears as if they had never been repaired since they were first laid. They are bumpy, rough and dusty, and therefore wholly unsuitable for safe and speedy transport. There are many instances of the overturning of vehicles resulting in injuries to their occupants. Of the motor vehicles only the four wheeled drive can ply with some safety and relative comfort to the passengers. The only possible means of transporting fish to rail-heads, till recently, were bullock carts. They used to take quite a long time to reach their respective

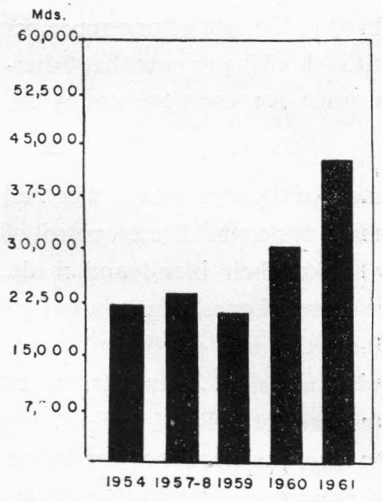


Fig. 6

destinations which inevitably resulted in causing fish deterioration and damage due to the stresses of a rough journey. It is only now that 3 motor trucks have been introduced by the fish dealers for a speedy transport of fish to the rail-heads. It is in the interest of Manchar Lake fisheries that the roads are metalled immediately, and properly maintained thereafter. If this is achieved it would go a long way in facilitating the introduction of a speedy transport in general and of refrigerated and insulated vans in particular.

Fishing Community : The fishermen inhabiting the lake are called 'Mohanas' or 'Mirbahars' (meaning sea lords or admirals). They lead their life in their floating habitations or in small settlements very near the lake. They are in fact the original inhabitants of the former Sind and have directly descended from the aboriginal Hindus who later embraced Islam.[7] They are athletic, laborious, pleasure-loving and happy-go-lucky people, but at the same time illiterate and very poor.

Before the Fisheries Department took over the lake under its direct control in February 1960, the contractors and middlemen fleeced the fishermen to an alarming extent. They used to advance them loans in the shape of necessities of life on prices much above the prevailing market rates. They were further compelled to dispose off their catch on ridiculously low prices in payment of the money so advanced. However, this was not the end in itself, money was further extracted from them by imposing many taxes. A tax called 'Kotwari' was charged which deprived them of 4 to 8 fish per Bhan net. This was 'Kotwars' share (personnel of watch and ward) who were engaged by the contractors. They also had to pay one anna per rupee ($6\frac{1}{4}$ %) as 'Jamadari' share to fish contractors which was a kind of tax towards the payment of lease instalments. The auctioner called 'Kami' charged 5 to 10 fish per lot as his share. A surcharge termed 'Resai' was realised at the rate of one rupee per family for entertaining contractors guests and dignitaries. It is shocking to note that fishermen had to pay Rs. 10 bi-annually to the contractors as a price for their consuming fish during that period.

The fishermen were freed from the age old dominance of the contrators who had reduced them to a state of mere serfdom when the lake passed under the direct control of the Fisheries Department. The middlemen who formerly sucked their blood and made their life miserable have now been eliminated, except for the essential ones, who now collect fish catch only to bring it to the sales centre. During 1960-61 the rate of all the species of fish was Rs. 18 per maund except mori Rs. 12 per maund. It was Rs. 24 and Rs. 16 per maund respectively in 1961-62.[8] As against it, fish rates ranged form Rs. 4 to Rs. 7 per maund[9] during the time of old fish contractors to whom the lake was auctioned for such a small amount as Rs. 25,000 per annum.[10] On account of present increased rates, fishermen now get a better return for their toil. In 1960 the lake provided the Government with a revenue income of Rs. 125,000, and Rs. 500,000 to the fishing community as a whole,[11]

It has been estimated that on an average a fisherman's family earned about Rs. 1,200 from fish during 1960-61. The average earning per head per day was Rs. 3 for an adult male, Rs. 2 for an adult female and Re. 1 for a child.

Conclusion : Among the many problems to be solved the most important is silting of the lake by hill torrents and the river Indus. It is further accentuated by the depositing of decomposed acquatic vegetation. It is unfortunate, that at present there are no records available to show the rate of silting. But whatever the rate of silting may be, as the lake is shallow, it becomes a problem of great significance. Dredging is the only solution but that would involve heavy expenditure which seems hardly feasible under the present economic conditions. However, something shall have to be done to prevent eventual disappearence of this largest single source of fresh water fish in West Pakistan.

Acquatic vegetation of the lake is so profuse that it adversely affects fish growth and hinders fishing operations. Their eradication is a problem. The weeds are of considerable economic significance to the fishing community for it provides them with food, fodder for animals and material for mat making, thatched walls and hut roofs. The four possible methods of weed eradication are: (*a*) use of weedicides, (*b*) elimination by mechanical weed cutters, (*c*) uprooting the weeds by manual labour and (*d*) burning of weeds on water receded areas. The last mentioned method is the cheapest, easiest and most suitable under the prevailing conditions.

Fishing methods presently employed are out dated, and the catch bears no relation to the amount of human effort involved. Use of nylon nets may be popularised for they are more durable and result in a better catch. Introduction of more gill-nets and long-lines would prove to be of great advantage.

The system of fish packing in gunny bags with crushed ice is very crude, unhygenic and unsatisfactory. Proper containers may be used so that fish reaches distant places in a better condition for human consumption. It is only recently that modern fish carriers have been introduced on an experimental basis by the Fisheries Department. The fish is kept in tin boxes with layers of powdered ice at the top and bottom of the box. The boxes are sealed and made air-tight when fish is to be despatched to distant stations. It is necessary that a small ice factory may be started at Bubak to provide cheaper ice. A refrigerated store house and a deep-freeze plant, if installed near the lake, would go a long way in the safe storage of fish and would prove to be of very great advantage particularly when the demand is low. Refrigerated trucks or vans which are so essential for the safe and speedy transport of fish to rail-heads can only be introduced when the roads are improved, preferably metalled.

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AGRICULTURAL LAND USE IN WEST PAKISTAN

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Land and water are the two most important natural resources of Pakistan. Proper use of arable land is of primary importance to the economy of the country, where two thirds of the working population is directly engaged in the agricultural industry, and about 57[1] % of the national income and 70[1] % of the export value is derived from the agricultural produce. The high rate of population increase (2·16% per annum compound rate) and the shrinking land-man ratio all the more stress the need for improvements in the existing use of arable land to meet the ever increasing demand on food supply and agricultural raw materials for the industries.

West Pakistan has 80·4% of the area and only 44·6% of the population of Pakistan, with an average density of 138 persons per square mile. The average density per cultivated square mile is, however, high, being 703 persons.

Table I. shows that on an average only 19·5% of the total area is cultivated, and 77·4% of the cultivated area is sown while the rest (22·6%) is left fallow. The ratio of current fallow to total sown area has varied over the period from 1947-48 to 1956-57 between 20·4% to 27·4%, varying inversely with the timely occurrence of rainfall and the availability of irrigation water. The inverse relationship between the extents of the fallow land and the amount and incidence of rainfall from year to year is more evident in the *barani* lands[2], which form about 31% of the total cultivated area in West Pakistan. Micro studies of land use in the *barani* areas have amply substantiated this view. In the entire Potwar plateau and other districts where the percentage of irrigated area is small, sown area fluctuates with the variations in the amount and incidence of rainfall. This is more true in case of winter crops, as, generally, summer crops in these areas are of minor importance and are grown mostly on irrigated land.

There appears to exist no direct relationship between the variations in the double-cropped and the net sown area. Double-cropped area primarily varies with fluctuations in the availability of irrigation water from year to year.

Table I. further shows that there has been an increase of 2,469,000 acres in the cultivated area of West Pakistan between 1947-48 and 1956-57, although the cultivated

1. Report of the Food and Agricultural Commission. Government of Pakistan, 1961.
2. Rain fed.

acreage has been slightly fluctuating over the period. This increase of 9·3% over the figures of 1947-48 is partly due to new areas being brought under cultivation as a result of the extension of irrigation facilities and partly due to reclamation of some waterlogged areas, which have gone out of cultivation.

Table 2. gives the classification of area in West Pakistan, by districts. A broad belt with more than 50% of the area as cultivated runs from the north-eastern corner of the Indus plain towards south west, narrowing down to the south west of Former Panjab, marking the encroachment of the Thar desert, to widen again in the former Sind province. As shown in Fig. 1, this belt comprises the old settled districts and the canal colonies in *Rechna* and *Chaj Doabs*[3] and the canal irrigated areas of Lower Indus Plain. Most of these destricts have a high percentage of irrigated acreage. The highest ratio of

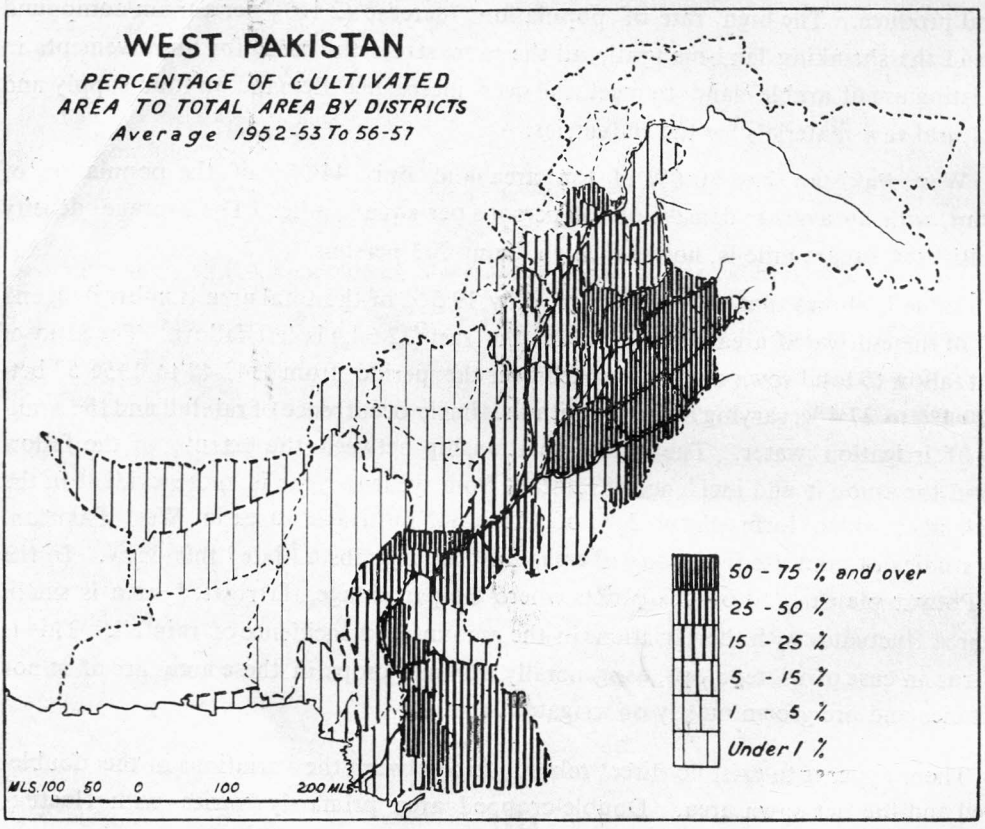


Fig 1.

cultivated area (78·7%) is in Lyallpur district where 100% of the cultivated area is irrigated. Montgomery and Mardan are the only two other districts where the ratio of cultivated area is above 70%. Baluchistan plateau and the western and northern hilly districts on the contrary show a very low percentage of cultivated area.

3. Interfluve between Ravi and Chenab and Chenab and Jhelum Rivers Respectively.

An interesting feature revealed by the figures in Table 2. is the great variation in the extent of double-cropped area in different parts of West Pakistan. Numerous factors affect the extent of double-cropping (which to some extent is an index to the intensity of land use), the principle being the extent of cropped area, facilities of water supply, density of population, size of holdings, and marketing facilities. In the D.G. Khan, Hazara, Kohat districts and the whole of Baluchistan plateau the extent of double-cropped area is very limited mainly on account of lack of water supply. In some districts, in spite of a high ratio of irrigated area and fairly high density of population, ratio of double-cropped acreage is relatively small. Lyallpur, Lahore, Sialkot, Multan and Montgomery are included in this category. The relatively small extent of double-cropped area in these districts can be partly accounted for by a relatively large number of livestock holdings, signifying a higher proportion of grazing land, providing an additional source of income and a resultant decreased interest in intensive agriculture.

In some districts the percentage of irrigated area is high but the quantity of water is not enough for large-scale cultivation of summer crops. This accounts for the low ratio of double-cropped area in Bahawalpur, Rahimyar Khan, Bahawalnagar, Sanghar and Thar Parkar districts.

As has been noted before, there has been an increase of 2,469,000 acres in the cultivated areas in West Pakistan from 1947-48 to 1956-57. But this increase has not kept pace with the growth of population, with the result that the land-man ratio has declined. In 1931, the per capita acreage of cultivated land was 1.4 which decreased to 1.12 in 1951, to decrease again to 0·91 in 1961. It is noteworthy that the rate of decrease has been faster in the last ten years (1951—61) than in the previous two decades (1931—1951). The decrease in the per capita cultivated area varies greatly in the districts of West Pakistan. The decline has been more marked in the case of canal colonies which attracted more immigrants. Table 3.

Districts in the Lower Indus Plain (former Sind Province) show a much higher land-man ratio (above 1 acre per head) than the old settled districts and canal colonies of the former Panjab (Fig. 2), excepting Mianwali and Sargodha districts, which show a higher land-man ratio on account of the recent extension of irrigation in the Thal area. In the more arid West, only Chagai, Sibi, D. I. Khan and D. G. Khan districts show a high land-man ratio as the population there is very sparse.

A comparison with some countries of the world shows that Pakistan has one of the lowest per capita cultivated acreage. Table 4. shows that amongst the South East Asian countries only Indonesia has a lower cultivated area per capita (0·65 acres) than West Pakistan. Japan, however, has a very low land-man ratio of 0·13 acres of cultivated area per capita. The low land-man ratio is not very alarming a fact in countries where the use of arable land is intensive and production per unit area high. In West Pakistan

low land-man ratio is combined with low per unit production. (Table 5.) Table 6. shows the yields of some important crops in few selected countries of the world. Wheat yield in West Pakistan is 8·5 maunds per acre, which is less than a quarter of U.K., and about one third of France and Japan. It is even less than in U.S.A., where cultivation is extensive. It is again less than one third of that in Egypt and only slightly higher than that in Iraq and India. Rice yeild is also low in West Pakistan, being only 8·9 maunds an acre less than half of that in Indonesia, about one third of Malaya and much lower than in all the other South East Asian countries.

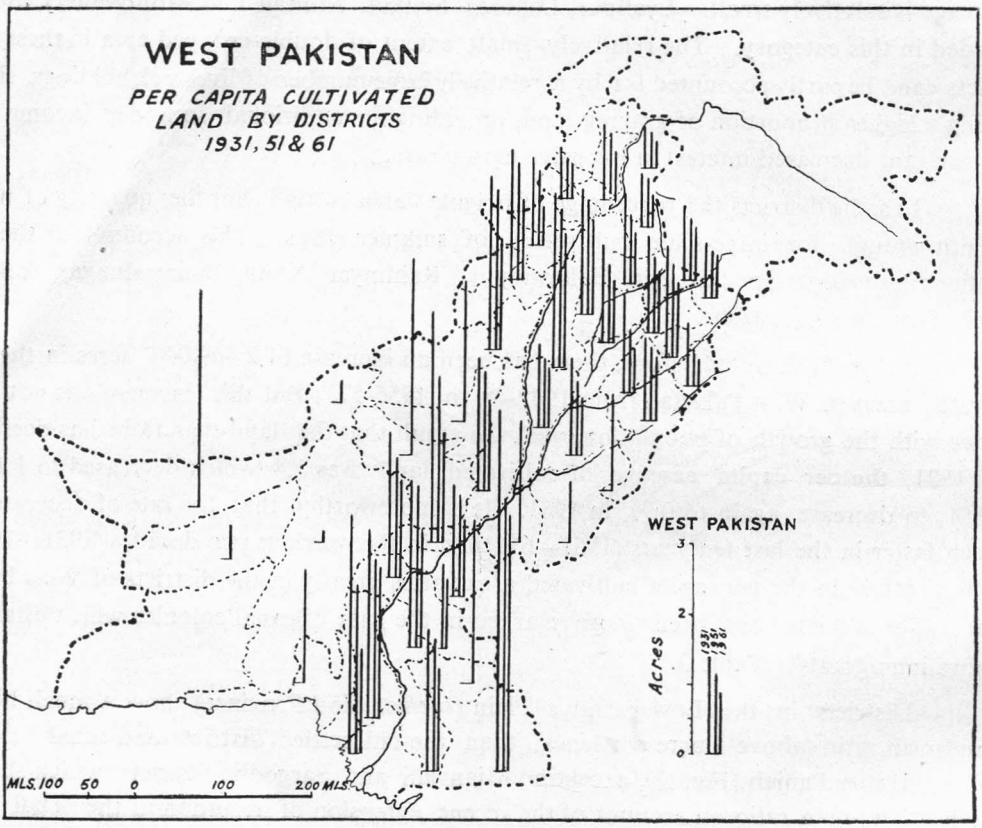


Fig 2.

Yields of cash crops in west Pakistan are also low. Cotton (Lint) yields 180·4 lbs. an acre, lower than the world average and less than half of that in Egypt and U.S.A. It is even lower than in some of the South East Asian countries. Sugarcane yield of West Pakistan is also one of the lowest in the world.

In West Pakistan, water supply is the most important factor for agricultural land use, and the land use pattern varies greatly with the quantity of irrigation water available. Much of the western and southern part of West Pakistan receives less than 10″ of annual rainfall and about two thirds of the total area receives less than 20″. This low rainfall

accompanied by fairly high summer temperatures ranging from 90°F to 110°F in most of the plain areas, places great demand on the irrigation water during *Kharif*[4]. *Rabi*[5] crops on the other hand require much less quantities of water.

Quite a high percentage of the sown area of West Pakistan is irrigated. Out of a total of about 31 million acres of sown area 21·6 million acres are irrigated. It forms 69·7% of the cultivated area. Most of the irrigated area is in the plains. Percentage of irrigated to total sown area increases from north east to south west, with increasing aridity. Canals irrigate the largest acreage, 81·5% of the total irrigated, while wells irrigate only 11·1%. In spite of the generally high ratio of irrigated acreage, the cultivation of cash crops is limited. Details of agricultural statistics show that on the average, 74·8% of the sown area is given over to the cultivation of food crops. This ratio has been varying between 71 to 75% over the period, 1947-48 to 1956-57. A slight rise in the percentage of sown area under cash crops has been recorded (from 17·3% to 18·5%). Ratio of area under cash crops varies in different parts of West Pakistan. It is generally high in the highly irrigated areas with plenty of water supply, and good market relations. In areas with little irrigation facilities, subsistence farming is the rule.

Details of tenancy and size of holdings by types show that in West Pakistan only 31.7% of the land is cultivated by owners. Only three districts of former Baluchistan (Sibi, Loralai and Zhob) and Rawalpindi show 50% or more of the area as owner cultivated. Low ratio between 8% to 15% of owner cultivated land exists in the canal irrigated areas of Lower Indus Plain, where the new settlers usually own large holdings, greater part of which had to be rented to tenant cultivators.

Average size of holidings is 6·8 acres in West Pakistan. It varies greatly from over 1·7 acres in the mountainous districts of Hazara to 17 acres in Thar Parkar in Lower Indus Plain. Size of holidings is generally affected by the extent of cultivated area, water supply and productivity of land. In the mountainous area of Hazara it is small on account of dearth of cultivated land (13·6%). In Rawalpindi district too, the average size is small as the north eastern part of the district is mountainous which has reduced the ratio of cultivated land.

Holdings are generally large sized (6·5 to above 10 acres) in the canal irrigated District of Sargodha, Mianwali, Lyallpur, Jhang, Multan, Montgomery, Bahawalpur, Bahawalnagar, Rahimyarkhan and all districts in the Lower Indus Plain. Irrigation facilities have brought large areas under cultivation. Holdings in the old settled districts of

4. Summer crop.
5. Winter crop.

Lahore, Gujranwala, Sheikhupura, Sialkot and Gujrat vary from 5 to 6·5 acres. In all these districts, although a high percentage of area is cultivated with ample facilities of water supply, holidings are only medium sized on account of relatively high productivity and high population densities per cultivated square mile.

On the whole West Pakistan is a country of small holdings with a larger proportion of land cultivated by tenants. This adversely effects the efficiency of agricultural production.

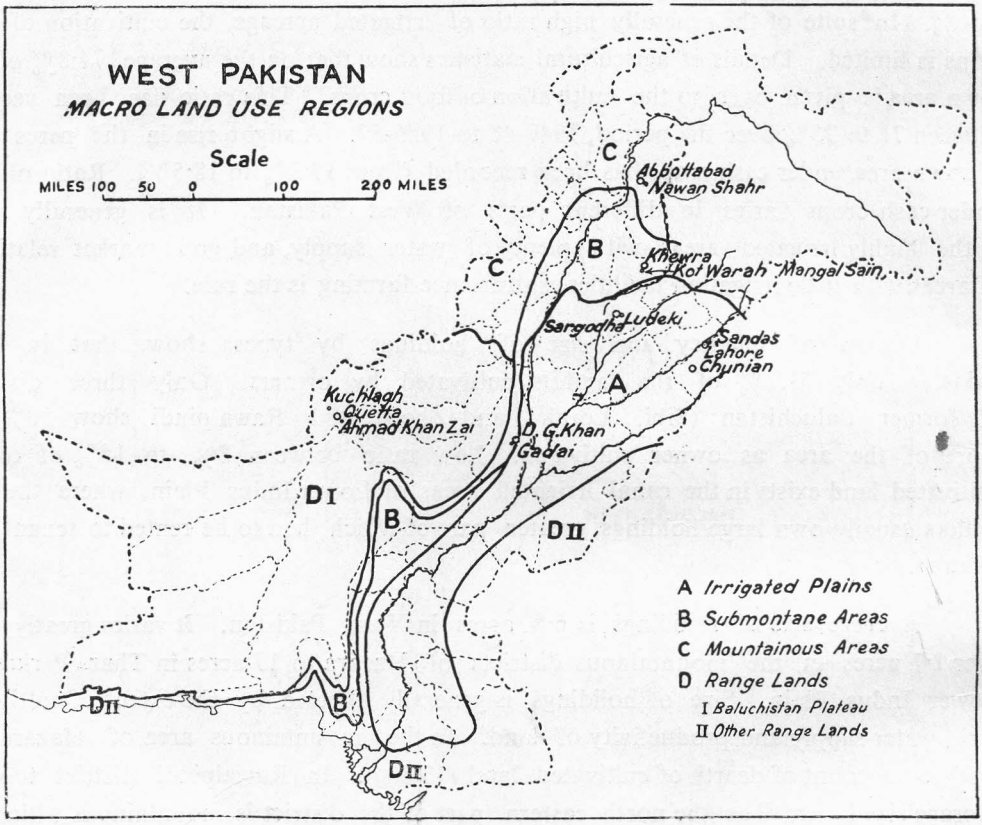


Fig 3.

Micro-land use surveys of specimen villages, representative of different regions of West Pakistan, with the exception of Lower Indus Basin, have been carried out. On the basis of general land use patterns, West Pakistan can be divided into the following regions as shown in Fig. 3.

A. Irrigated plains

Specimen villages :

(1) Ludeki Chak 47 NB, District Sargodha

(2) Chunian, District Lahore

(3) Sanda Kalan and Sanda Khurd, District Lahore

B. Submontane Areas

Specimen villages :

(1) Kot Warah and Mangal Sain, District Jhelum

(2) Gadai, District D.G. Khan

C. Mountainous Areas

Specimen villages :

(1) Nawan Shahr, District Hazara

D. Range Lands

DI. Baluchistan Plateau

Specimen villages :

(1) Ahmad Khan Zai, District Quetta

(2) Kuchlagh, District Quetta

DII. Other Range Lands

Specimen villages :

Nil.

A. LAND USE IN IRRIGATED PLAINS

Specimen land use survey of three villages (i) Ludeki Chak No. 47 NB district Sargodha, (ii) Chunian district Lahore and (iii) the twin villages of Sanda Kalan and Sanda Khurd, district Lahore, has been carried out. All these villages are representative of the irrigated tracts of the Upper Indus Plain. The villages between themselves show both similarities and dissimilarities of agricultural land use pattern. Similarities are the result of similar physical setting and the dissimilarities seem to result from varied human and economic factors.

Fig. 3 gives the location of these villages. The northern most of the three is Ludeki located about 2 miles south east of Sargodha. The village lies in the Bar Hethla of Chaj Doab[6]. It is a gently sloping plain built of alluvial deposits. Chunian on the other hand, located in the south western part of Lahore district, is partly comprised of Manjha Uplands[7] and partly of Hithar tract or the old bed of Beas. The dividing line

6. Lower portion of the interfluve Doab between Chenab and Jhelum.

7. Upper part of the doab between Ravi and Beas.

is a high bank which forms the nothern most extension of Beas, when it used to flow in a separate channel through Lahore district. Manjha Upland is built of thick deposits of alluvium whereas the Hithar tract, though almost flat in appearance, is intersected with dry *nullahs*[8] and shallow depressions which show traces of the old beds of Beas. It is built of old alluvium with widespread clay loams and sandy loams. Occasionally, small Kallarathi[9] patches are met with.

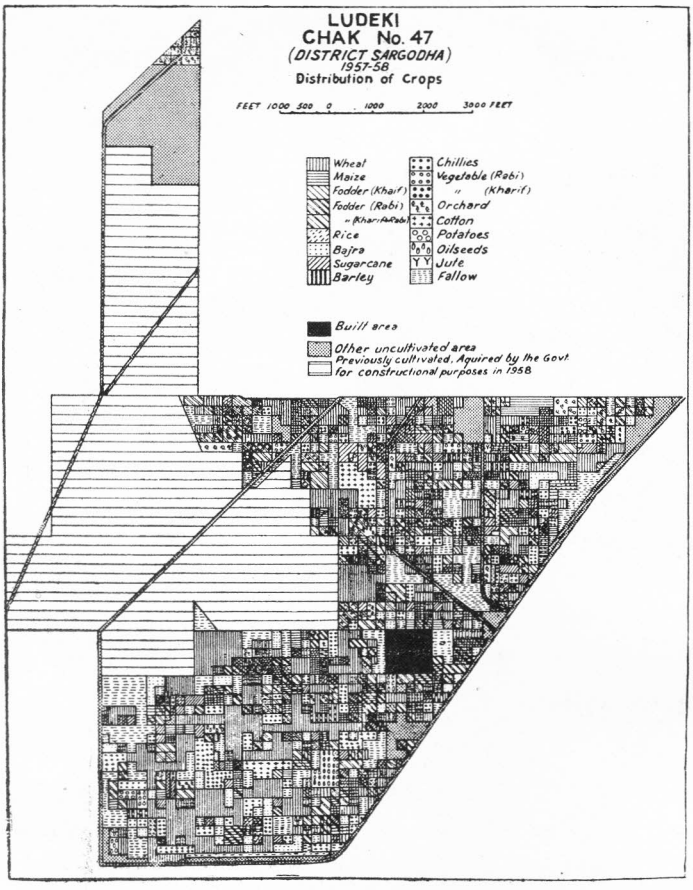


Fig 4.

The twin villages of Sanda Kalan and Sanda Khurd (together called Sandas in the following discussion), at a distance of about two miles south west of Lahore, lie in the flood plain of the river Ravi which is only a few furlongs from these villages. It is a level plain built of recent alluvium. Frequent floodings in the past have had a healthy effect on the soil, but the damage done to standing crops used to be great. A bund, about 18 feet high, has been constructed along the left bank of the river to protect the city of Lahore and the nearby settlements from Ravi floods. This bund has divided the village lands into two halves (see Fig. 6).

The climatic conditions in the villages under study are almost similar. Temperature in winter is nowhere so low as to prohibit the agricultural activity. The mean maximum during the summer months usually quite high, ranging between 90°—105° F from May to August.

8. Stream.
9. Saline.

Rainfall in three villages does not exceed 20". The following figures gives the seasonal distribution of rainfall:

	Sargodha (*Ludeki*)	*Chunian*	*Lahore* (*Sandas*)
Total rainfall	16·5"	14·0"	19·2"
July to September	9·1"	8·8"	14·4"
Oct. to Nov.	0·6"	0·5"	0·4"
Dec. to Feb.	3·4"	1·7"	2·5"
March to May	3·4"	3·0"	1·9"

The four summer months, June to September, receive more than half the total rainfall for the year. The three winter months, December to February, receive about 1·7" to 3·5" of rainfall whereas autumn is the driest period with under 1". Though the adequate provision of irrigation water has made these areas some what independent of the effect of the amount and variation of rainfall, still rainfall at the proper time has a beneficial effect on the crops.

A comparative study of the three villages from Table 8. shows that on an average fairly high per cent of the total area in each of the villages is cultivated, being 83·2% in Ludeki, 66% in Chunian and 65% in Sandas. In Ludeki the percentage of cultivated area had fallen to 49·4% in 1958-59, on account of a large acreage (1,130 acres) acquired by the government for non-agricultural functions. Excluding the area thus acquired by the Government, the ratio of cultivated land remains high being 86·4%.

In Sandas and Chunian the proportion of uncultivated area is higher than in Ludeki. In Chunian about 34% of the total area is uncultivated. Much of this area (19%) is comprised of the transitional land between Manjha Uplands and the Hithar tract where the abrupt change in the level is quite marked (see fig. 5). In Sandas 35·0% of the total area is uncultivated including 31·2% of area not available for cultivation. The latter is partly comprised of the land now occupied by the protective bund and partly by the spill area of the Ravi which is locally termed as Banjar Darya[10].

The cultivated area is further classified according to the means of water supply. Table 9. shows that in these villages *barani* area is very small in extent. In Ludeki 100% of the cultivated area is irrigated by canals and all land is classed as *nehri*[11]. There are two sub-classes *nehri I* and *nehri II* with slight differences in soil texture. In Chunian, 97·2% of the cultivated area is irrigated, 83·0% by

10. Unproductive on account of too much of subsoil moisture due to the proximity of the river.

11. Irrigated by canals.

canals and 14·3% by wells.T here has been a marked rise in the underground water-table in Ludeki and Chunian since the introduction of canal irrigation, but so far the menace of water-logging has not invaded much of the agricultural land in these villages. 5·6%, 4·0% and 3·8% of the cultivated land in Ludeki, Chunian and Sandas respectively suffer from *sem* (water-logging) or *thur* (salinity).

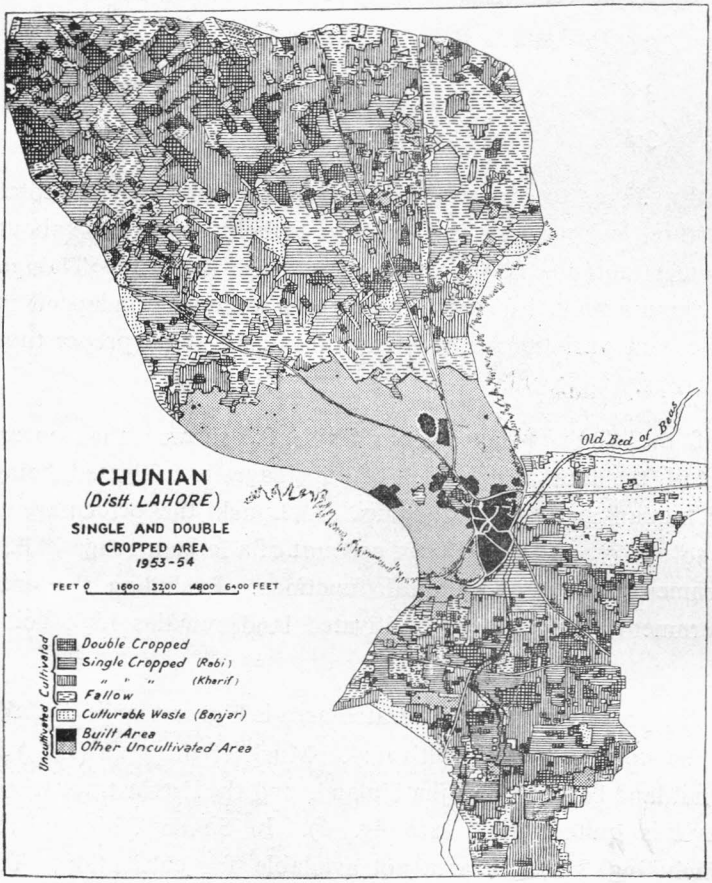


Fig 5.

In Sandas the area irrigated is the least of the three villages, being only 68·3%, the rest 31·7% (of the cultivated area) is classed as *sailaba*[12]. These twin villages have no irrigation by canals, the chief sources of water supply is the Mozang Nullah[13] and wells. Mozang Nullah irrigates 28·6% of the area termed as Abi. Wells irrigate 12·5% of the cultivated land. There is 28·2% of the cultivated area that draws water from more than one source.

There are generally two crops, *rabi* or the winter crop and *kharif* or the summer crop. The difference between the *rabi* and *kharif* acreages is much less marked in these villages than it is for West Pakistan. In Ludeki and Chunian winter crops respectively occupy 56·3% and 52·4% of the total harvested[13a]. (West Pakistan 63%). In Sandas 61·1% of the total harvested is under winter crops. This is not due to dearth of water supply for summer crops but results from the specialization in the production of winter vegetables.

12. Land containing enough subsoil moisture for the crops to grow without irrigation.
13. City drain.
13a Harvested area is equal to total sown minus the acreage of failures.

On the whole, as shown in Table 10. cash crops occupy an important place in the total harvested area. The difference is more marked in *kharif* when there is a keen competition between food and cash crops for water supply.

The following table gives the details of acreage under various food and cash crops in both seassons, expressed as percentage of total harvested.

Crops	Ludeki	Chunian	Sandas
Cash Crops			
Fodder	22.6%	28.6%	23.5%
Cotton	13.5%	20.5%	..
Oil seeds	4.5%	1.0%	..
Vegetables	4.5%	2.0%	43.0%
Fruits	4.0%	..	..
Sugarcane	4.0%	3.7%	3.9%
Others	2.0%	..	4.7%
Total	55.1%	56.1%	75.1%
Food Crops			
Wheat	24.8%	20.0%	10.0%
Grams	7.6%	5.5%	..
Bajra	8.9%	1.5%	1.8%
Rice	..	5.5%	..
Maize	3.6%	1.0%	8.1%
Barley	..	6.8%	..
Others	..	3.6%	5.0%
Total	44.9%	43.9%	24.9%

Sandas show a very high percentage of cropped area under cash crops which include 43%under vegetables and 23·5% under fodder crops. This is obviously due to the large urban centre of Lahore only two miles away, which places a high demand on such cash crops. These villages specialize in the production of cauliflowers. It is a very paying vegetable and is grown from August to April.

Cotton, Fodder and Sugarcane are the chief cash crops of Ludeki and Chunian. Fodder occupies the largest acreage in both the villages. In Ludeki, fodder is partly consumed in the village and partly marketed to the nearby town of Sargodha. In Chunian, it is chiefly grown for local consumption as the village has a large number of dairy cattle.

Among the food crops, wheat covers the largest acreage in all the three villages. Other minor food crops are *bajra,* (small grained millet) maize and rice. Maize attains greater importance in Sandas as it needs heavy soil and larger quantities of fertilizers for a good yield. Both the conditions are better fulfilled in the intensively cultiva-

ted land of Sandas. The distribution of crops in Ludeki does not show any particular pattern for the differences in soil and water-supply are very minor. In Chunian there is more intensity of agriculture in the Hithar tract, and maize or rice occupy larger acreage, on account of heavier soils and canal water having been supplemented by wells.

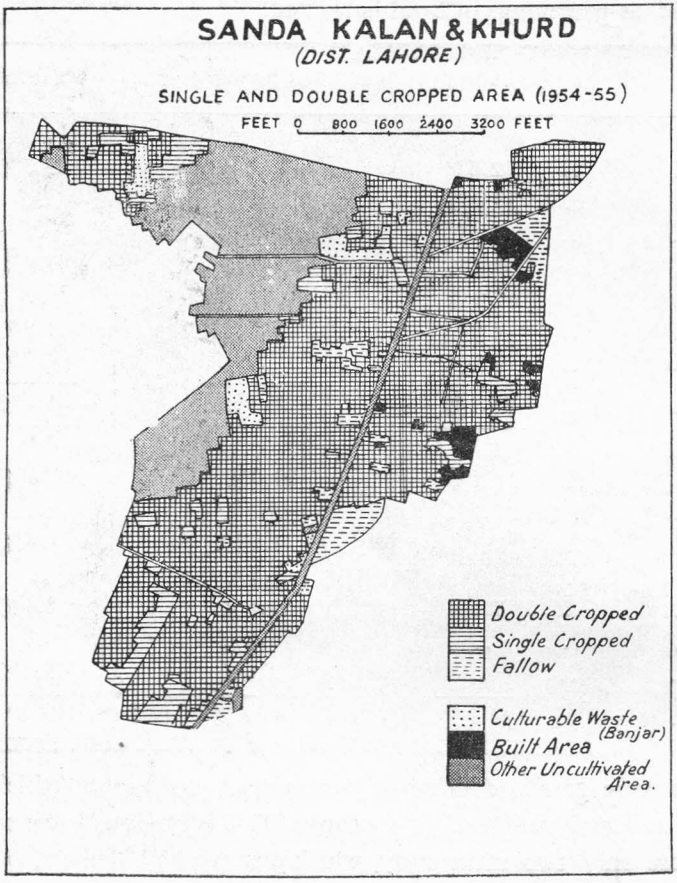


Fig 6.

In Sandas the area given over to the cultivation of vegetables is in the north-eastern part of the village near the settlements on the Lahore-Sanda road. It is because the soil near the settlements is more enriched by the village waste and quick transport is available.

Ratio of double-cropped area reflects the varying degree of intensity of the agricultural land use in these villages. The highest proportion of double cropprd area, as shown in Table 10. is in Sandas, where 56·6 of the total sown area is double-cropped. Out of a total of 902 acres of double-cropped area, there are 212 acres which yield more than two harvests during one season. Most of this area is under fodder and vegetables. In Chunian, about one third of the total sown area is double-cropped whereas in Ludeki it is only 20·0%. It can, therefore, be seen that the greater intensity of agriculture in the Sandas is not so much the outcome of watersupply which is plentiful in all the three villages, but results from the economic factor of the availability of market in Lahore near Sandas. The other contributory cause of this very high percentage of double-cropped area in Sandas is the small size of holdings. In Chunian too high a proportion of small holdings has invited the attention of the farmer towards more double-cropping. Ludeki on the other hand is a village of larger holdings and the cultivator has not felt the pressure of population on land which is one of the many factors leading to intensive agricultural practices.

Quantities of fertilizers used vary with the crops and intensity of agriculture. Both animal manure and chemical fertilizers are used. In Sandas in addition to these, the Mozang Nullah waste is a source of supply of manure. The water of the Mozang Nullah is filtered before use for irrigation. The filtered residue is a very cheap and useful manure which is applied to the fields according to the requirements. Vegetable fields are usually manured with this. In Ludeki cowdung along with the chemical manures (amonium sulphate) and night soil are used for cotton and sugarcane. For chemical manures water supply has to be plentiful and regular. In Chunain chemical fertilizers are not in common use. Sugarcane and cotton are usually given 40 to 100 maunds of animal manure per acre. Green manuring is also practiced in these villages on small scale.

The general four-year crop rotation in Ludeki and Chunian is follows: 1. Wheat, fallow, 2. Fodder, Cotton, 3. fallow, sugarcane, 4. fodder, maize. In Sandas most of the sown acreage is double cropped. The vegetable fields are not sown with any other crops. The heavily manured fields are reserved for vegetables during *rabi* as well as *kharif*.

Most of the sown area matures, only a small ratio of the sown area fails to yield any crop, Ludeki has the least percentage of failures, 1·3%. In Sandas it is 2%, in Chunain 7%. The high percentage in Chunian is accounted by for the large acreage under American cotton which is more senitive to fluctuations of water supply.

Conditions regarding the tenancy and holdings are quite different in these three villages. In Ludeki, 40% of the cropped area is owner cultivated, the rest is cultivated by tenants. Holdings are generally large, average size being 25 acres, only 7.5% of the holdings are under 12½ acres, which is fixed as the average size of economic holding by the Government. The large size of holdings in Ludeki is due to the village being originally a Ghoripal[14] settlement. The size of holding is now on the decrease due to law of inheritance. The size of holding is now on the decrease due to law of inheritance. Five cases of ownership were taken at random—Out of these only two cases showed conspicuous decline in the size of holdings due to Law of Inheritance. In both cases the total land owned by one person was divided equally against his sons. Generally fragments are not far off from each other which helps the farmer in utilizing his time more profitably. (Fig 7)

In Chunian the average size of holdings is 2.7 acres for owners and 3.3 acres for tenants. Relatively lower fertility and water supply have resulted in the larger size of holdings in the Manjha upland (7.4 acres); whereas relatively high fertility and better facilities of water supply have reflected in smaller holdings, in Hithar tract (only 2.3 acres). In Sandas the holdings are very small, generally under one acre. Apparently holdings in

14. Horse breeders were given 50 acres or two squares of land each in 1902. At that time the total area of the village was only 1,000 acres.

Chunian and Sandas appear to be very uneconomic but considering a large number of livestock holdings in Chunian and great intensity of agriulture in Sandas, living conditions are not poor. As is evident from the crop distribution and single and double cropped areas (figures 4, 5 and 6) Ludeki and Chunian show no distinct field pattern or even crod pattern. It is because of very minor differences of soil and plenty of water supply in almost all parts of these villages. In Sandas there is a definite concerntration of vegetables, in the north eastern part of the village land, reference to which has already been made.

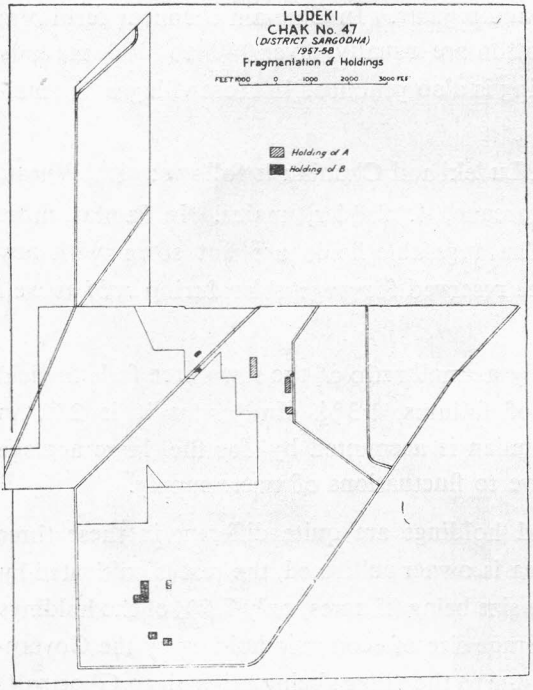


Fig 7.

All these villages are self-sufficient in food resources and have a large surplus of cash crops (fodder, cotton, and vegetables) for marketing in the nearby towns, Dairy products are a supplementary source of income in Ludeki and Chunian. About two thirds of the working population is wholly dependent on agriculture. In Ludeki and Sandas 10—15% of the population belongs to a class partly dependent on agriculture as Sargodha and Lahore provide them with some part-time work.

B. Land Use in Sub-montane Areas

Land use of two villages, in the sub-montane area of West Pakistan viz. 1. Kot Warah and Mangal Sain in the sub-montane area of salt range and 2. Gadai in the Trans-Indus sub-montane area of D.G. Khan, was carried out. These settlements, though lie in the sub-montane tract, exhibit great contrasts in the general agricultural conditions and are, therefore, treated separately.

Land Use in Kot Warah and Mangal Sain

The twin settlements of Warah and Mangal Sain are located within a distance of 1 mile from the well known salt mining centre of Khewra. The settlement originally one, is now split into two lying within half a mile from each other. Dearth of agricultural land has forced people to migrate a little north of the old settlement (Kot Warah) and settle nearer Khewra which offers employment to a great number of new settlers in Mangal Sain. Village lands, however, are documented under the twin names of Kot Warah and Mangal Sain.

The villages are located in the transitional zone where plains and mountains meet and are fairly representative of a broad class of this kind. The southern portion

of the village lands is comprised of river borne material brought down by the Jhelum (4 miles south) while the material brought by the hill torrents descending from the Salt-Range escarpment have covered the northern part of the village lands with coarse gravel and pebbles. These hill torrents, along with the rainwash, are also responsible for the spreading of salts on these lands. Therefore the village land has two distinct faces, entirely different from each other. The northern half, unproductive, dreary, bleak and strewn with gravel and pebbles coinciding with the fan like dispersal of mountain debris. The other half, south of 700′ contour line is productive corresponding with the northern most limit of the flood plains of the Jhelum (Fig. 8)

The land use pattern in this submontane area exhibits a strong contrast to that of the irrigated plains as the sources of water supply here are very limited. The rainfall received during the year is only 18″ on the average, and the underground water is usually brackish, due to the percolation of salts from the Salt Range. The watertable is at 20—25 feet in the southern half of the village and much deeper in the north. There are only three wells which supply some irrigation and drinking water.

The cultivated area almost entirely dependent on the scanty and variable rainfall, is limited to 39·4% of the total area, most of which lies in the southern half. The cultivated area covers 488 acres out of which 73 acres are usually left fallow. Only about 17 acres or 4% of the cultivated area is irrigated.

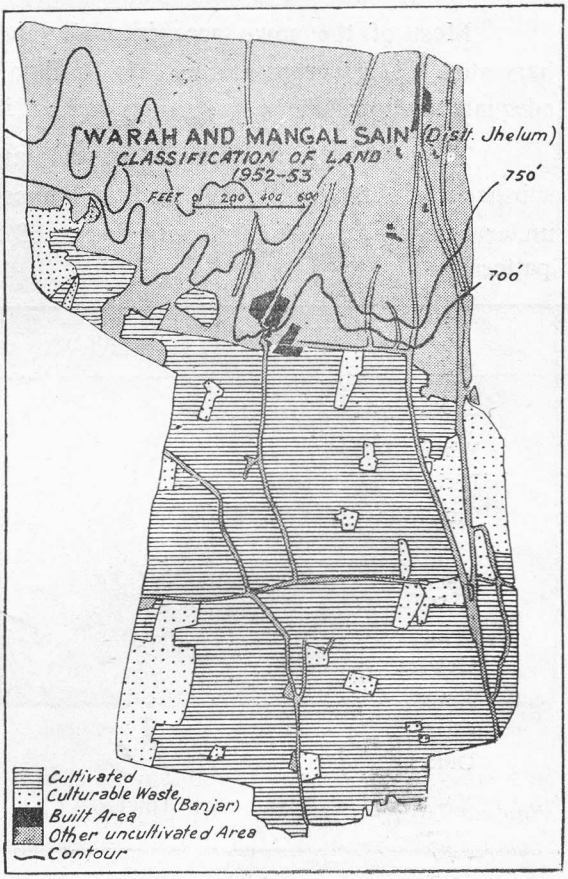


Fig 8.

The cultivated area is further classed as *hail, barani, maira and rakkar*. This classification is very unlike the one in the irrigated plains. *Hail* is the land near the settlement and is enriched by the village waste. *Barani* is flat low-lying land receiving plentiful rain water from the adjoining higher areas. *Maira* is the higher level land receiving direct rain water whereas *rakkar* is coarse textured land undulating in aspect. The distribution of these land types, is such that *maira* forms the central part

of the village lands on both sides of which lies *barani* land. *Rakkar* land which is coarse textured lies in the northern and western parts.

Since the sources of water supply, other than the rainfall are extremely limited, the extent of the sown area varies greatly from year to year. During the agricultural years, 1947-48, 1949-50 and 1950-51 the rainfall received was respectively 23·97″, 20·42″ and 18·34″ and the acreage sown was accordingly higher than the 5-yr. average, being 450, 430 and 425 respectively. On the contrary during the agricultural year 1952-53 the rainfall received was only 10″ and the area sown was, thus, reduced to 310 acres.

Most of the sown area is under *rabi* crops which occupy 75·3% of the total harvested. *Kharif* crops occupy only 24·7% of the cropped area, as summer rains are not adequate to allow large scale sowings without irrigation.

The crops grown also reflect the paucity of water supply. It is an area of subsistence farming with 95·8% of the harvested area under food crops and only 4·2% under cash crops. The following figures of the cropped area show the general crop pattern.

Crops	Percentage of the total harvested
Rabi crops	
Wheat	74.7
Barley	0.2
Tara Mira	0.5
Total	75.4
Kharif crops	
Bajra	16.4
Gowara	3.2
Jowar	2.6
Chari	1.6
Others	0.8
Total	24.6

Winter crops, which need much less quantities of water, predominate. About 74·4% of the harvested area is under wheat, while the acreage under other winter crops is extermely small. *Kharif* crops occupy only 24·6% of the harvested area. *Bajra* occupies about two third of the *kharif* acreage as it is more tolerant of aridity. *Gowara* is grown for fodder for local consumption. *Desi* cotton occupies one or two acres only.

Due to the scarcity of water, double-cropped area is highly limited. Only 17 acres, or 4% of the total sown, are double-cropped. It is the *chahi* or well-irrigated

area that bears two harvests a year. Figure 9, showing the distribution of single and double-cropped area in this village, relates to the conditions in 1952-53 which was a year of good and well distributed rains, therefore it gives an augmented picture of the double-cropped area.

Crop failures are quite high; about 12·5% of the cropped area fails to mature. The variations in the amount of annual rainfall have a great bearing on the extent of *kharaba*. In 1947-48, 1949-50 and 1951-52 when the rainfall was adequate and well distributed, being 23·97″, 20·42″ and 18·34″, the extent of *kharaba* was small being 0, 21 and 38 acre respectively.

Average size of holdings in the case of owner cultivator is 4·5 acres while the tenant holding is under ½ an acre. It is interesting to note that generally tenant holdings are larger in almost all districts of West Pakistan. The exceptionally small holdings of tenants in this village are accounted for by the fact that most of the tenants are part-time agriculturists. They work in the nearby salt mines and I.C.I. factory at Khewra, and also till a small piece of land.

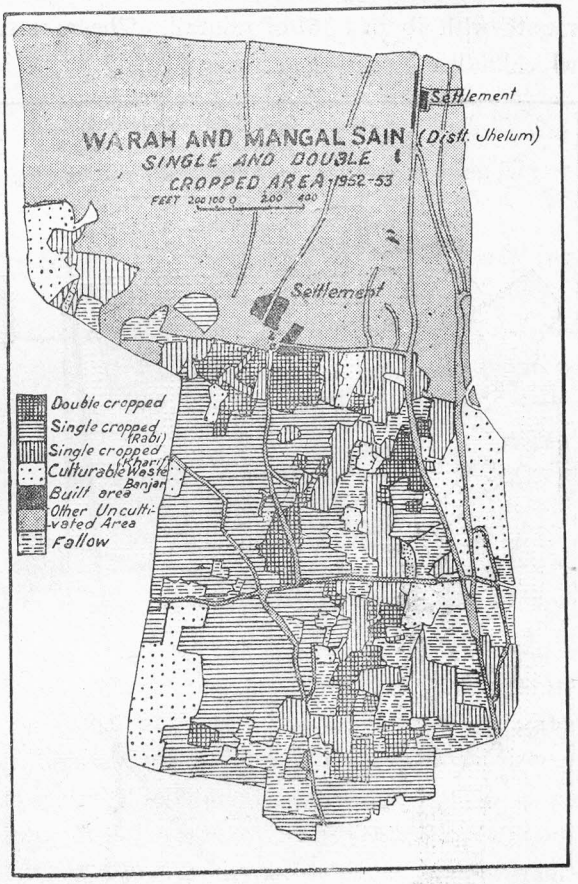


Fig. 9

Yields of crops are very low. Wheat yields 5-6 maunds an acre in good years and only 3-4 maunds in lean years. Similarly, yields of *bajra* are very low, only 4-5 maunds an acre. With great limitations of water supply, small holdings, and low yields, the farming conditions in the village are poor. It is the nearby mines and factory at Khewra that solve the problem of a supplementary source of income for the villagers.

Land use in Gadai (West), D.G. Khan District.

This village is located 2 miles south of D.G. Khan on the road to Fort Manro in the submontane area of Sulaiman mountains. The village land has two distinct zones, the southern zone is a gently sloping plain built of the alluvium of the Indus, whereas the northern and western zone is covered with relatively coarser material deposited by the seasonal hill torrents which come to life only during the summer rains.

The general climatic conditions are favourable for the agricultural activities to continue throughout the year provided there is plenty of water. This area is far more arid than Kot Warah and Mangal Sain as the annual rainfall is only about 6″, of which only 3·5″ falls during the summer months, from June to September. August is the rainiest month with about 1·36″ of rainfall. The area suffers from acute deficiency of rainfall, which makes irrigation necessary.

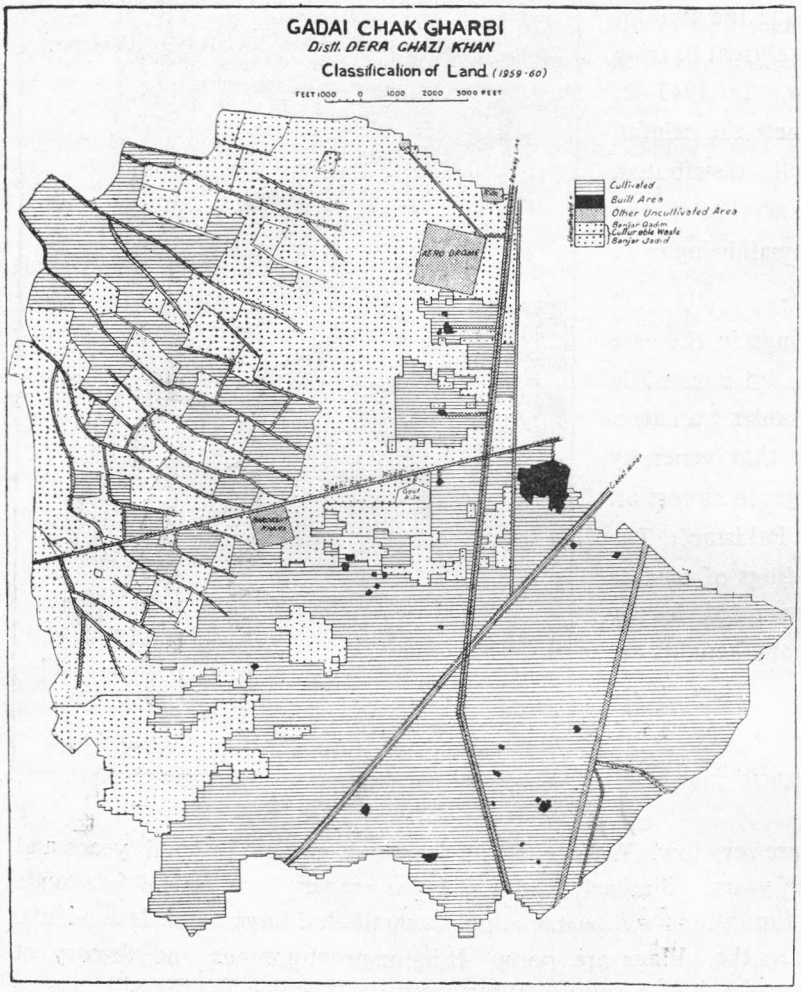


Fig 10.

Gadai (west) has a total area of 7,105 acres, out of whice 52·4% is cultivated. This relatively high ratio of cultivated area for such an arid region is due to irrigation facilities. About two thirds of the cultivated land is sown each year.

There is a high proportion of cultivable waste (44·2% of the tolal area). Most of it lies in the northern and western parts, where the seasonal hill torrents are the only means of water-supply (Fig. 10). Here the soil has a high content of salt on account of aridity. Such areas are reclaimable with intensive use of irrigation water which carries the salts down to the lower soil horizon.

The classification of cultivated land according to sources of water supply shows that all the cultivated area is irrigated. No area is wholly dependent on rainfall, which is very meagre. Inundation canals irrigate 37·9% of the cultivated area separately and

39·0% jointly with wells. Only 7% of the cultivated area is irrigated separately by wells. The area irrigated by both sources (wells and canals) has the surest supply of water and most of the double-cropped area lies in this southern and eastern part.

Hill torrents irrigate 16% of the cultivated area which is known as *rod kohi*. *Rod kohi* irrigation entirely depends on the water available in the hill torrents during the rainy season. Earthern embankments are constructed to divert the water and lead it to the distributing channels. There are three such embankments built at suitable places (Chabbri, Sochani and Phullar). Fields irrigated thus are also embanked in order to hold water. These torrents have a great tendency to change their course which often causes great damage to the crops.

Mechanical analysis of soil samples collected from various fields is given in the following:

Soil type	Percentage of sand	Percentage of silt	Percentage of Clay
Nahri	4.50	60.30	35.20
Nanri Chani	1.75	65.55	32.70
Chahi	13.50	67.80	19.15
Rod Kohi	3.0	58.65	38.35

Chahi soil has a fair proportion of sand, silt and clay, whereas in other types sand content is low. All these soils are fertile.

Inspite of 100% of the cultivated area being irrigated winter crops are more important, occupying 61·5% of the harvested acreage. The undependable water supply from the inundation canals affects summer crops more adversely than winter crops as during winter crops are not so sensetive to fluctuation of water supply. Food crops occupy 80·7% of the harvested acreage. Cash crops are relatively unimportant on account of irregular water supply. The following figures give the details of acreage under various crops in the village

Rabi Crops	1843	Acres	*Kharif Crops*	826	Acres
Food crops	1435	,,	*Food crops*	720	,,
Wheat	1382	,,	Rice	290	,,
Gram	53	,,	Jowar	430	,,
Cash Crops	..	,,	*Cash crops*		
Vegetables	1	,,	Cotton	85	,,
Oilseeds	107	,,	Fodder	101	,,
Fodder	300	,,			

Distribution of crops in this village shows a close relationship with the quantity of water supply. Wheat occupies 51·7% of the harvested acreage and is mostly distributed

all over the village land in the south and east in per acre irrigated by inundation canals. Northern and western parts are *rod kohi* areas where the hill torrents supply the irrigation water only during the summer rains. No crop, therefore, is sown in this area during winter.

Rice is an important food crop grown in *kharif*. It occupies 10·8% of the harvested acreage and is mostly grown in the *nehri-chahi* land in the south eastern part of the village. There is hardly any rice grown east of Gadai minor canal (Fig. 11) for want of adequate water supply. *Jowar* is more important than rice, occupying 16·1% of the total harvested acreage. It is an inferior type of coarse-grain millet which accepts inferior soils, requires less quantity of water and can withstand variations in the quantiy of water. It is, therefore, the only crop grown in the *rod kohi* area.

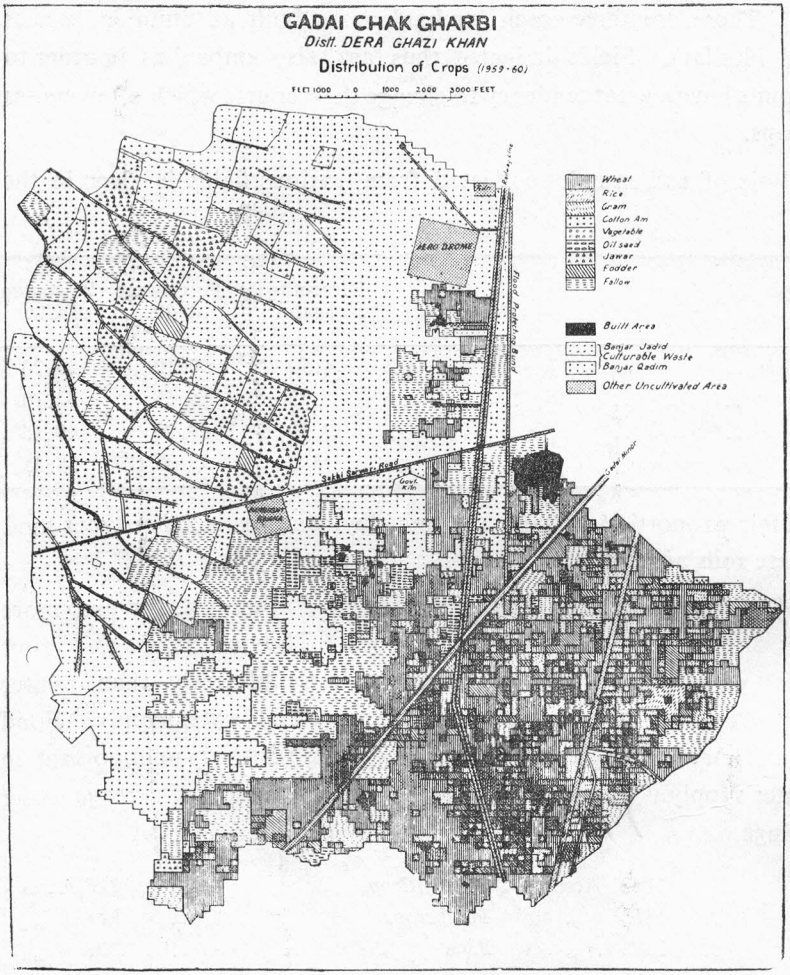


Fig 11.

Because the water supply in summer is not dependable, larger acreage of cash crops is grown in *rabi* (15·5% of the total harvested in *rabi* and 4% in *kharif*), Fodder crops occupy the largest acreage under cash crops and 3/4th of it is grown in *rabi*. The other cash crop grown are oilseeds, all being sown in *rabi*. Cotton in *kharif* is of very little importance.

Crop yields in this area are better than in Kot Warah and Mangal Sain, but lower than the highly irrigated plains. Wheat yields about 8½ maunds an acre, Jowar 9 maunds, while rice yields only 8 maunds. The cause for low yields of rice is the lack of regular water supply for the crop.

Generally three years rotation followed is as below: 1. wheat, fallow, 2. fodder, rice, 3. fodder and fallow. As no other crop grows in *rod kohi* except *jowar* therefore a different rotation of 1. *Jowar*, fallow for one season 2. Jowar and then fallow for 1½ year is practised.

Only about 10% of the area is double-cropped. Rice and wheat or rice and fodder or wheat and fodder are the crops associated with double-cropped area (Fig. 11). This small percentage of double-cropped area is again due to the quantity of irrigation water, being inadequate for a year-round supply.

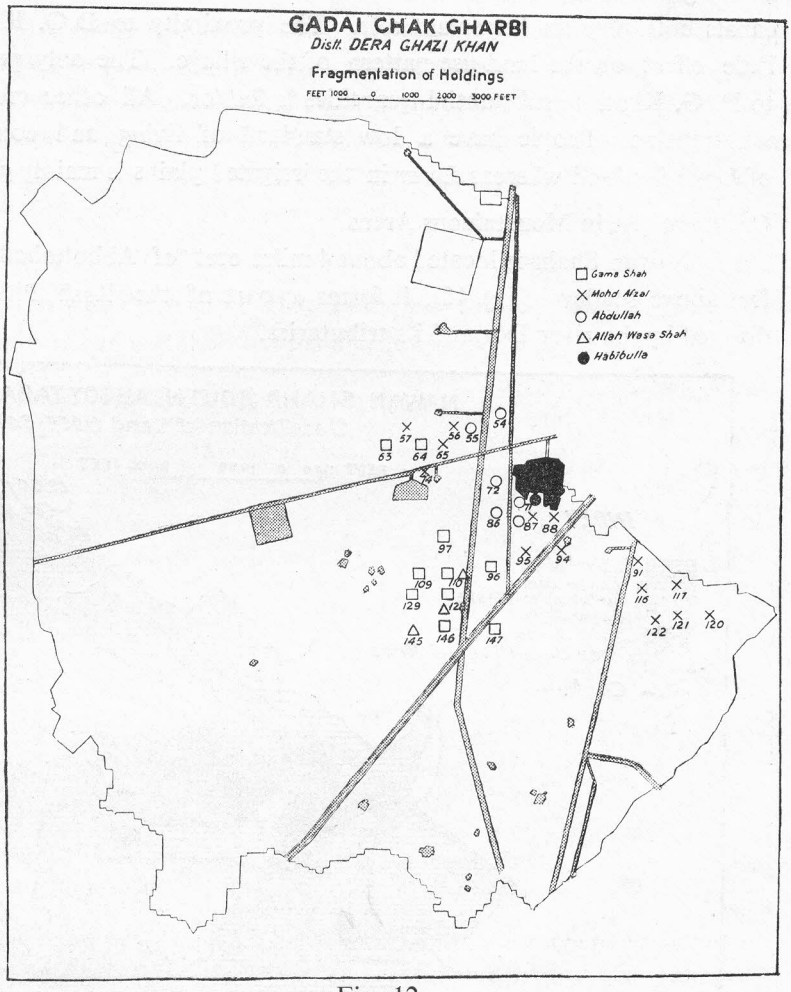


Fig. 12.

About 3·1% of the cropped area fails to mature. The extent of failure varies from year to year. Sometimes the percentage is greater in the case of wheat and sometimes it is high for rice. Occasionally when Indus is in abnormal spate during the rainy season the rice crop is washed away.

The average size of cultivated holdings is 6·5 acres. It varies from 3 to 15 acres. Larger number of holdings (39%) are between 5-8 acres. About one third of the cultivated area is owner-cultivated and owner-cum-tenant cultivated. The rest is tilled by tenants, of which tenants with rights of occupancy (which now have become owners after the land reforms) is about 20%.

Several cases of subdivision and fragmentation of holdings were studied. (Fig 12) It was found that sometimes within two generations, the size of holding is reduced

considerably. A holding of 372 *kanals* (1 kanal = $\frac{1}{8}$th acre) belonging to one man was divided amongst his two wives, 3 daughters and five sons. Originally there were 26 shares which were split up into 260 after the subdivision. On the whole the village furnishes a very good example of a submontane area where irrigation from hill torrents and canals both play an important role. The proximity to D.G. Khan seems to have very little effect on the land use pattern of the village. The only produce that is marketed to D. G. Khan in substantial quantities is fodder. All other crops are grown for local consumption. People have a low standard of living and consume, large quantities of *Jowar* for food whereas *Jowar* in the irrigated plains is mainly grown for fodder.

C. Land Use in Mountainous Areas

Nawan Shahr is located about 4 miles east of Abbottabad at an altitude of 4,020 feet above sea level (Fig. 13). It forms a part of the Rash Plain, an undulating plain drained by the river Dor and its tributaries.

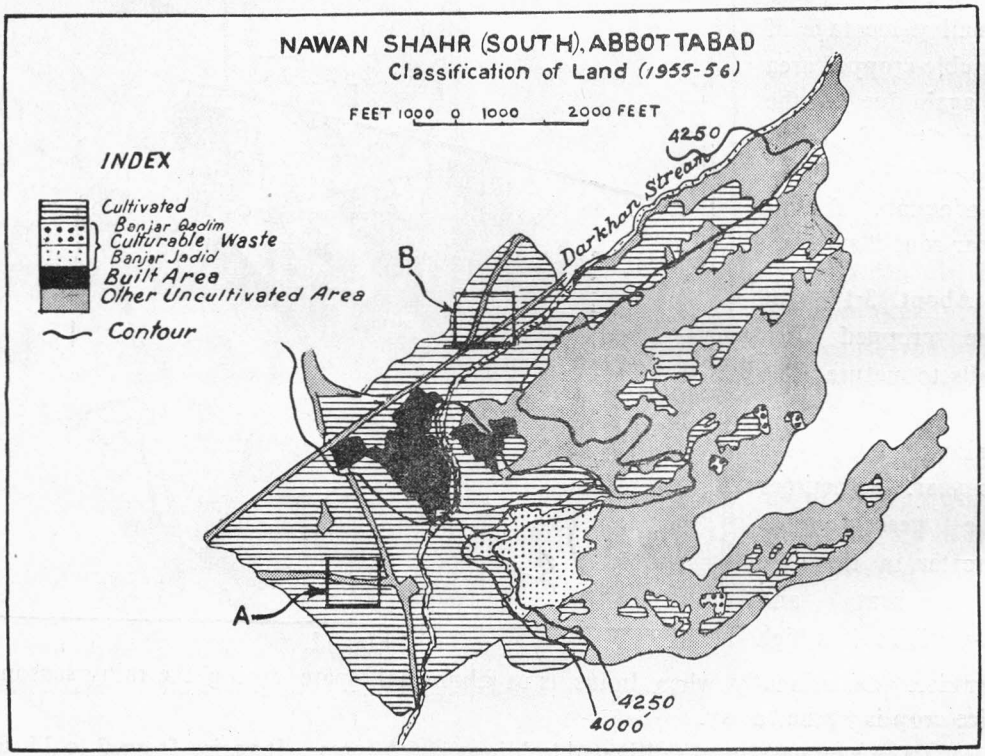


Fig. 13.

The area experiences very cold winters, with frequent snow fall. The annual rainfall is 49″ of which 29″ falls during the summer months from May to September. Due to the low rate of evaporation, on account of altitude, summer rains provide enough moisture for the crops to be grown with little or no irrigation. Unlike the

plain areas, low winter temperature and rough terrain limit the extent of cultivated land here.

Out of a total area of 2,346 acres, only 34·1% is cultivated. About 11·3% of the total cultivated is left fallow. Most of the cultivated area lies below 4025′, above which the slopes are too steep for agricultural purposes (Fig. 13). The uncultivated area covered by the hill slopes generally provides poor grazing ground. A small area is classed as *banjar* which is the land gone out of cultivation for the last three years or more. Most of the cultivated area is dependent on rainfall, only 6·4% being irrigated. Direct irrigation from the streams is practised. There is only one well, which irrigates only about one acre of land. The valley is covered with alluvial soils which become coarse-textured towards the adjoining hill slopes.

Crop pattern is very different from that in the plain areas, as here *kharif* crops are all important and *rabi* crops are almost insignificant.

	Acreage as percentage of total harvested
Rabi	5.70
Wheat	5.58
Barley	0.12
Kharif	94.30
Maize	65.96
Pulses and Maize	22.32
Pulses	4.02
Bajra	0.20
Vegetables and fodder	1.80

Wheat and barley sown in autumn and harvested in May are of little importance as food crops. Local varieties of wheat, *ratta* and *chitti moni*, are generally grown. *Chitti moni* yields higher than *ratta* and matures in time for the summer crop to follow. It is, therefore, generally sown on double-cropped area.

Maize is the chief crop grown in summer. It occupies 65·96% of the total harvested area as a single crop and 22·32% as an intertilled crop with pulses. It is the staple food of the people and provides fodder for the livestock. A great variety of pulses, including horse grain, *mash* and *moong* are grown in summer generally on poorer soils. *Bajra* is grown in small patches and covers a very small acreage. Vegetables and fodder are also unimportant.

About 25·9% of the total sown is double-cropped. The double-cropped area as seen from Fig. 14 is sown with maize and wheat or maize and pulses. Maize and pulses both are sown in the same fields as intertilled crops in the same season. This accounts for the unusually high proportion of double-cropped area in a *barani* land.

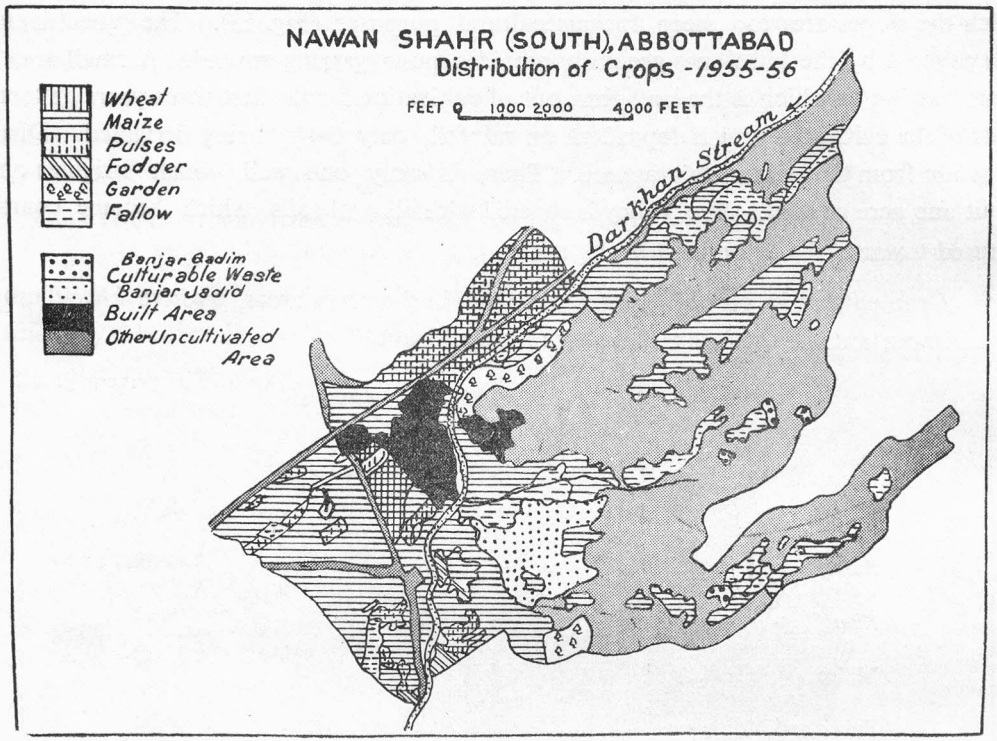


Fig. 14

Rotation and manuring are practised only on irrigated and double-cropped area. On single cropped land maize is sown for two successive summers and then the land is left fallow for one year.

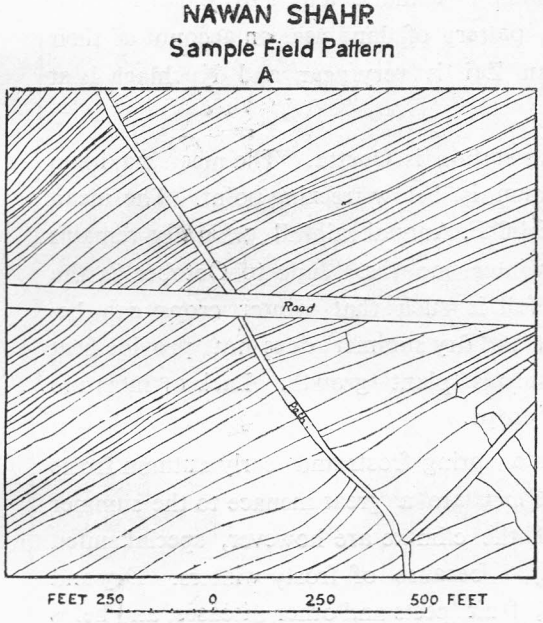
Crop failures, as revealed by the study of the agricultural records of the area for a period of ten years ending in 1956 are high on the unirrigated area. Percentage of failure is highly variable. The highest failure of more than 50% is recorded on *rakker kalsi*, a course-textured soil on the lower slopes of the hills. On other types of land, failures are less in extent. On the whole about 20—40% of the total cropped fails to mature. The main reasons are :

1. Occurrence of drought, especially in summer months, when most of the cultivated area is sown and water demands are high.
2. Occurrence of hail storms, which often do great damage to the standing crops.

3. Gully erosion on the lower hill slopes damages the crops.
4. Soil depletion. The continuous use of land without manuring reduces the soil fertility and sometimes results in partial failure of crops.

Very unlike the irrigated plains, where no particular field pattern was noticed definite field pattern exists in these mountainous areas. It was noted that, in Nawan Shahr, fields were remarkably elongated and their orientation changes from transverse in the lower central part to lateral in the higher land as shown in the two Figures 15 and 16 respectively. The field pattern seems to have been influenced by :

(*i*) the soil distribution,
(*ii*) direction of water courses,
(*iii*) direction of means of communications.



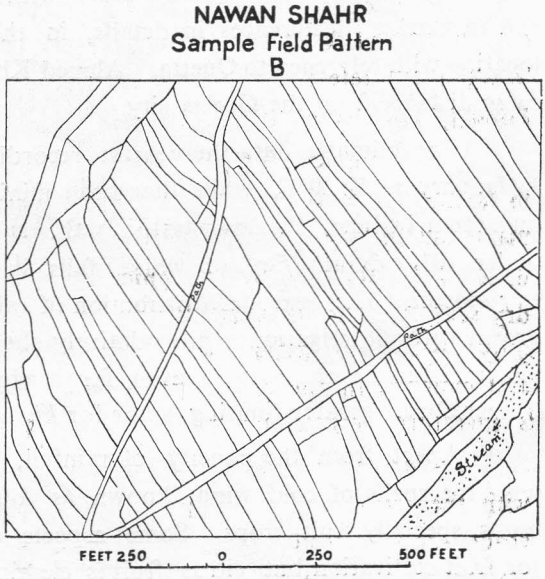


Fig. 15 and 16

Soil factor is more important in the case of fields in higher land while access to road and availability of irrigation water are important factors in the lower fields.

As judged by the above noted outstanding characteristics of land use in the village, it furnishes another example of subsistence farming. The average size of the holding is about $\frac{1}{2}$ an acre. About 60% of the cultivated land is owner cultivated, 20 per cent by tenants with rights of occupancy* and 20% by tenants at will. About one third of the population supplement their source of income by working in the neighbouring town of Abbottabad as most of the holdings are uneconomic.

*With the introduction of Land Reforms in 1960 all tenants with rights of occupancy have become owners.

D. Land Use in Range Lands

(*Baluchistan Plateau*)

The land use pattern in Baluchistan, though different in many datails, retains broad general characteristics of land use in the rest of West Pakistan. The cultivated area in Baluchistan is restricted by the rough terrain, severe climate, with complete summer drought and scarcity of water supply.

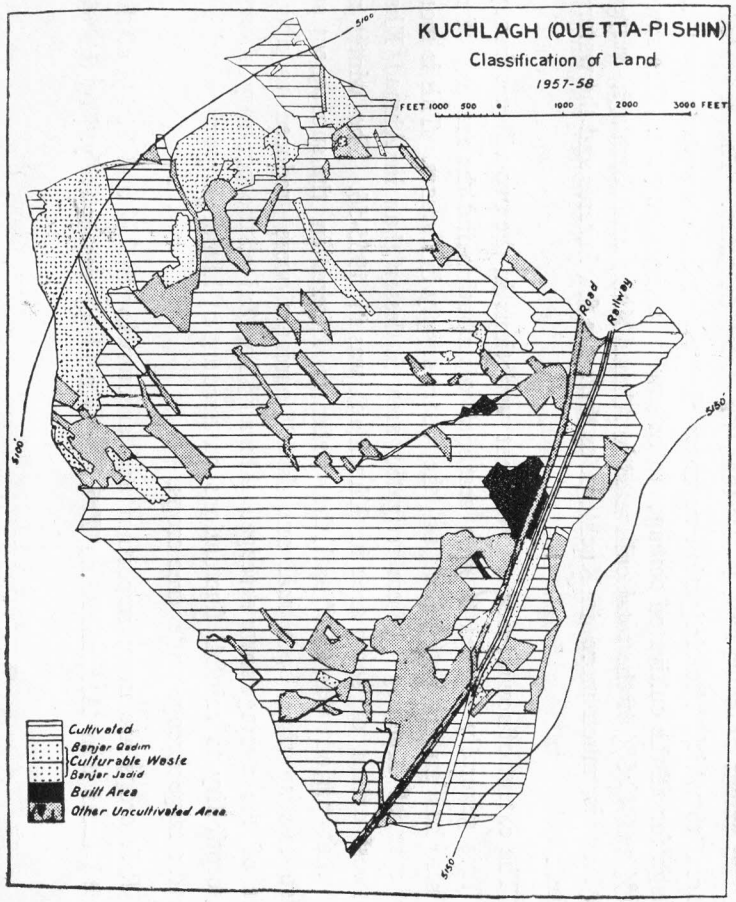
The two villages which provide the sample studies are 1. Ahmed Khan Zai, located on the Quetta Sariab road, 3½ miles southeast of Quetta, and 2. Kuchlagh, 14½ miles north west of Quetta on the Zhob Valley road. Both these villages are representative of only those areas of Baluchistan where irrigation water is available. These are located in the Quetta basin with similar climatic and soil conditions but exhibit marked differences in details, in the pattern of land use, on account of their location with reference to Quetta. Ahmed Khan Zai is very near and Kuchlagh is at same distance from the Quetta city.

For climatic data the nearest recording station is Quetta. The mean maximun in January is 50·20°F, while the mean minimum is below freezing point. The mean maximum in June, the warmest month, is 94·0°F. Annual rainfall generally remains under 10″, about 2/3rd of which falls in winter months. June to October is the dry season. The seasonal distribution of rainfall is such that winter crops can be grown without irrigation while relatively short and dry summer does not provide heat and moisture in the same season for a vigourous plant growth. Lack of moisture is, therefore, greater limiting factor for *kharif* crops.

Apart from the paucity of rainfall, late spring frosts and early autumn frosts with the spells of cold wind, known as *kandhari*, are a great menace to the summer crops, specially fruit crops. Some aspects of the climate are however, special suited for fruit cultivation but citrus fruit is eleminated because of frosty winters. Dry and moderately warm summer discourages fungus, fruit pests and other diseases, and helps in the slow ripening that gives a high sugar content to fruits.

Soils of the lands of these villages have not been scientifically classified. The villagers use their own terminology for various types of soils, the basis of classification being the texture more than any other quality. The best soil in these villages is the *rakha* soil in the central parts. It is a fine textured soil containing a fair proportion of clay. It yields good harvest with plenty of water-supply. The second best is *mattana*, which is a sandy loam. *Regi* soils are sandy and gravelly, best suited for vine cultivation. *Regana* is the coarse textured soil near the foot hills strewn with pebbles.

The statement of land classification (table 11) shows that 78·4% and 71·3% of the total areas are cultivated in Ahmad Khan Zai and Kuchlagh respectively. (Fig. 17 and 18)


KUCHLAGH (QUETTA-PISHIN)
Classification of Land
1957-58
FEET 1000 500 0 1000 2000 3000 FEET
5100
5100'
5500
5500'
Road
Railway
Cultivated
Banjar Qadim
Culturable Waste
Banjar Jadid
Built Area
Other Uncultivated Area

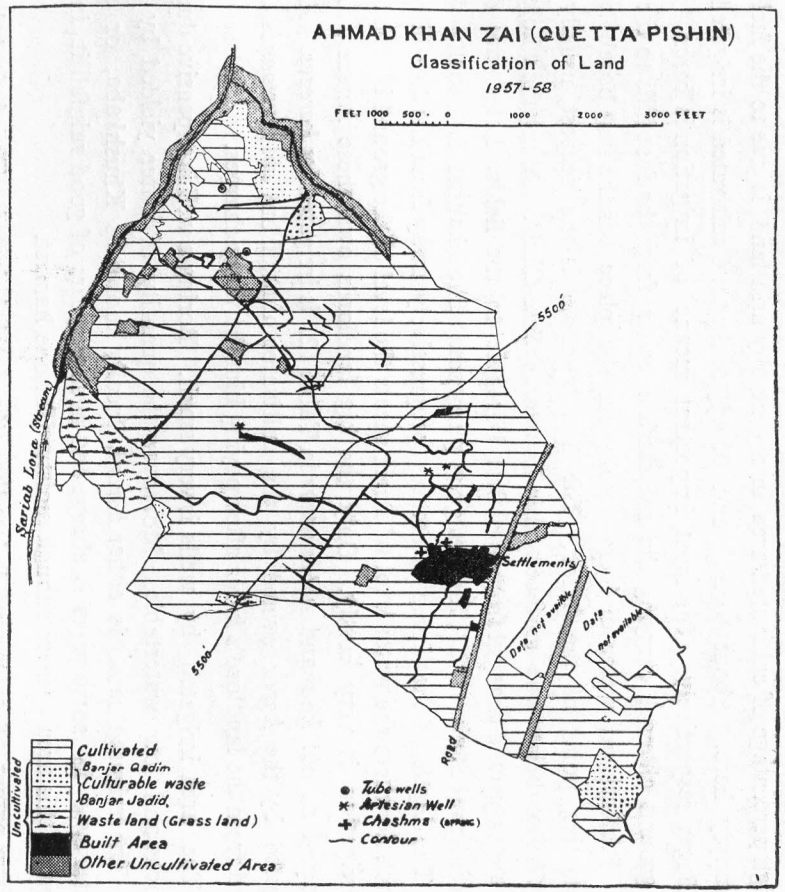

AHMAD KHAN ZAI (QUETTA PISHIN)
Classification of Land
1957-58
FEET 1000 500 0 1000 2000 3000 FEET
5500'
5500
Sariab Lora (Stream)
Settlements
Date not available
Date not available
Road
Uncultivated
Cultivated
Banjar Qadim
Culturable waste
Banjar Jadid
Waste land (Grass land)
Built Area
Other Uncultivated Area
Tube wells
Artesian Well
Chashma (stream)
Contour

Fig. 17 and 18

This high percentage of cultivated area, in a generally arid land, is due to the facilities of water supply here. About 91·5% and 65·4% of the total cultivated is irrigated in the two villages respectively. The most important means of irrigation is *karez*. It is an under ground channel carrying the sub-surface water from the foot hills to the village lands. Professional water diviners usually fix the place for the first borehole, which is the starting point of the *karez*. The first borehole is the deepest, usually about 130—158 feet below the surface and is known as '*Sare-Chah*'. Along the whole length of the under ground channel from the first borehole to the fields, holes are dug at a regular interval of about 20', for dredging purposes. The channel is usually 4-5 feet wide. The depth of the *karez* decreases progressively away from the foot hills. The last borehole where the water level of *karez* meets the level of the ground is 'Sare-Chak'. *Karez* irrigation is very costly. Only the big landlords own these *karezes*, All the land classed as *abi khas* and *abi mustaar* in Table 12. is irrigated by *karezes*. *Abi khas* is irrigated by the *karez* owned by the cultivator himself but *abi mustaar* is the land irrigated from the landlord's *karez* after paying him the water charges.

The area irrigated by wells is very small. Boring a well is expensive due to the hard rocks and low watertable. Moreover the quantity of water yielded by well is small. The irrigated land is either *barani*, locally known as Khushkaba, or *sailaba*. This later type in some years is absent and in some years of good rainfall it increases in extent as this area gathers enough moisture for one harvest.

The extent of sown area is less than the total irrigated. The irrigated land is that area to which the irrigation water can find access but the water supply may not be enough for all the cultivated acreage to be sown during one year. The sown area is 69·6% and 42·6% of the total cultivated in Ahmad Khan and Kuchlagh respectively. Fallow land is much more in Kuchlagh as there are few *karezes* and the water supply is limited.

The extent of sown area shows great variations in the two villages from year to year. It is generally related to the seasonal distribution and the amount of rainfall which also has an indirect effect on the water supply in *karezes*. This is more true in the case of Kuchlagh where irrigated area is lesser than in Ahmad Khan Zai. The lowest extent of sown area in Khuchlagh was in 1955-56. The winter rainfall during that period was 4·88" and the water in *karezes* in the subsequent summer was also less so that both *rabi* and *kharif* acreages were reduced to about one quarter of the average sown acreage. Ahmad Khan Zai on the contrary shows much less susceptibility to rainfall fluctuations on account of higher proportion of irrigated area and a large acreage under tree crops.

Rabi crops are more important and account for 54·2% and 86·1% of the total harvested acreage in Ahmad Khan Zai and Kuchlagh respectively. In the former,

more equable distribution of *rabi* and *kharif* is due to better irrigation facilities whereas in the latter the lesser extent of irrigated area reflects in more area sown under winter crops when water demand is less. The distribution of acreage under food and cash crops also presents the same picture. In Amad Khan Zai, 45·8% of the harvested acreage is under cash crops while in Kuchlagh it is only 13·7%. It is partly due to lack of adequate water supply and partly to greater distance from Quetta.

The details of average harvested acreage of various crops is as follows:

Ahmad Khan Zai	(Area in acres)	Kuchlagh
Rabi Total	294	391
Food crops	292	391
Wheat	282	385
Barley	10	6
Cash crops	2	
Kharif Total	248	63
Food crops	2	1
Maize	1	1
Jowar	1	..
Cash Crops	246	62
Fodder	40	19
Melons	13	6
Vegetables	54	..
Vine Orchards	66	..
Tree orchards	73	37

Almost all the acreage under food crops falls in *Rabi*. Wheat occupies 96·6% and 98·2% of *rabi* acreage and 52·0 and 84·8% of the total harvested in Ahmad Khan Zai and Kuchlagh respectively. (Fig. 19 and 20) Barley occupies a very small acreage.

Kharif crops are mostly cash crops. The largest acreage of cash crops in Ahmad Khan Zai is under fruits including vine yard and tree orchards which amounts to 25·9% of the total harvested. In Kuchlagh there are no vine orchards, only 8% of the harvested is under orchards, mainly apple orchards. It is due to inadequate facilities of transport so that only those fruits are grown which have better keeping qualities.

Fodder and vegetables are other cash crops in order of importance in Ahmad Khan Zai. Both these are marketed to Quetta. In Khuchlagh again due to reasons explained above no vegetables are grown and fodder is only grown for local consumption.

Crop failures are a common feature but the extent varies in the two villages and also from year to year. On an average about 17·5% of the total sown fails to mature in Ahmad Khan Zai. In Kuchlagh the ratio of crop failure is high being 31·8% of

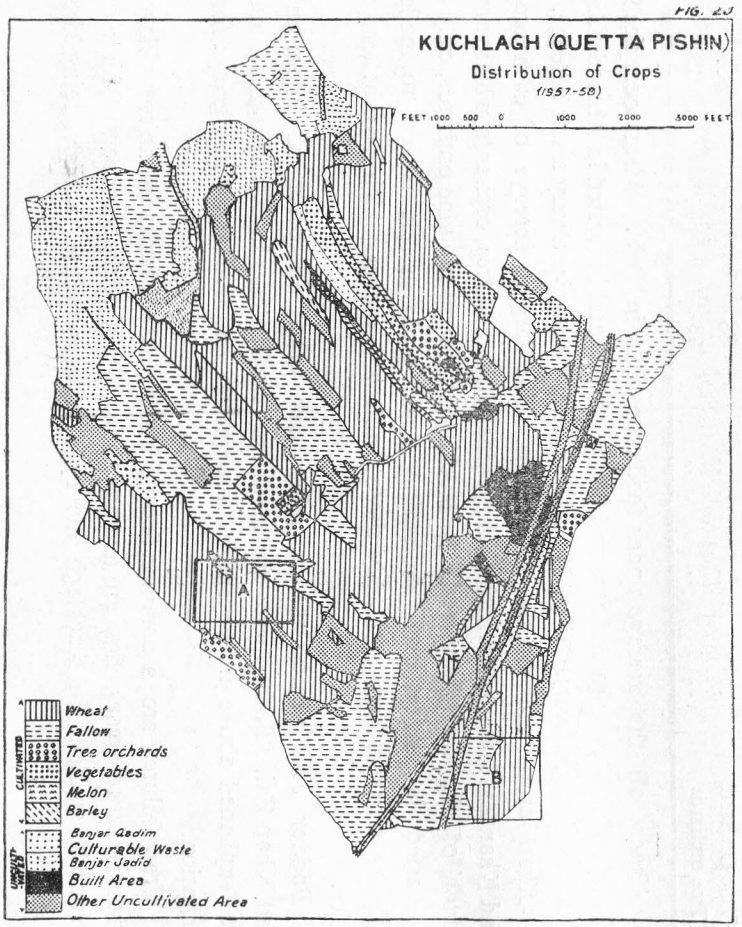


FIG. 20
KUCHLAGH (QUETTA PISHIN)
Distribution of Crops
(1957-58)
FEET 1000 500 0 1000 2000 3000 FEET
CULTIVATED
UNCULTIVATED
Wheat
Fallow
Tree orchards
Vegetables
Melon
Barley
Banjar Qadim
Culturable Waste
Banjar Jadid
Built Area
Other Uncultivated Area

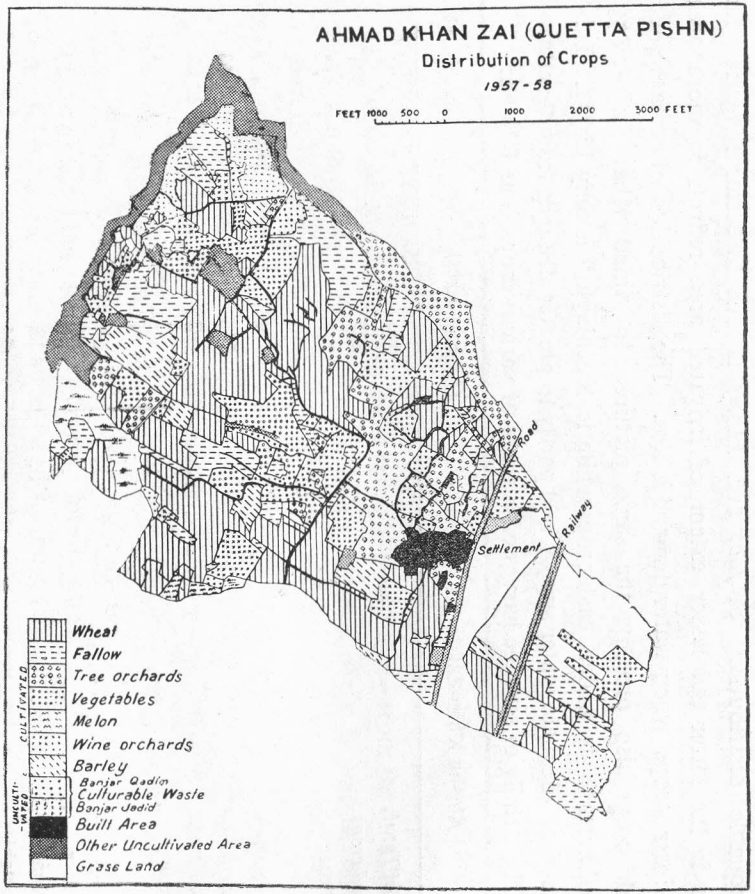

AHMAD KHAN ZAI (QUETTA PISHIN)
Distribution of Crops
1957-58
FEET 1000 500 0 1000 2000 3000 FEET
Road
Railway
Settlement
CULTIVATED
UNCULTIVATED
Wheat
Fallow
Tree orchards
Vegetables
Melon
Wine orchards
Barley
Banjar Qadim
Culturable Waste
Banjar Jadid
Built Area
Other Uncultivated Area
Grase Land

Fig. 19 and 20

the total cropped. On account of large unirrigated area in Kuchlagh the variations in the weather condition and amount of rainfall have greater effect than in Ahmad Khan Zai. Two thirds of the *rabi* crop in Kuchlagh and 60% in Ahmad Khan Zai failed on account of abnormally low winter temperature and late spring frosts and heavy rainfall during February (5·72″) in 1953-54. *Kharif* crops, which are less dependent on rainfall, show much smaller percentage of failure in both the villages.

Crop rotation that is generally followed is wheat-fallow-fodder and wheat-fodder-fallow. Vegetable fields have potatoes or tobacco followed by fallow for one season then sown with maize or melons in next summer followed by fallow. Fruit orchards are perennial and occupy the same land for decades. There is hardly any manuring done for food crops. Only vegetables and fruits are manured. Because of smaller number of livestock, animal manure has to be brought from outside the villages.

In Ahmad Khan Zai, 54·5% of the cultivated land is held by only three big landlords, who own between 100—300 acres of land each. In Kuchlagh too about 50% of the cultivated area is with the landlords. Holdings of small peasant proprietors vary from 2½ to 15 acres in Ahmad Khan Zai and 15—20 acres in Kuchlagh. For tenants, the size varies from 5—10 acres in Ahmad Khan Zai and 20—25 acres in Kuchlagh. The larger holdings in Kuchlagh are due to greater proportion of unirrigated land with relatively low productivity.

About 80% of the people in these villages are dependent on agriculture. Some tenants of Ahmad Khan Zai also work as part-time labourers in Quetta.

In plain areas where irrigation channels are numerous and water distribution more equable, the fields do not acquire any special pattern but in areas where slopes are considerable to allow the flow of water in any one particular direction with greater case or where soil grades are well marked, interesting field patterns are to be found. In Ahmad Khan Zai fields are generally rectangular but in Kuchlagh most of the field, except in the south eastern part, are narrow and ribbon shaped running from north west to south east in alignment with the general slope of the ground which helps the easy flow of irrigation water Fig 21 and 22. In the south eastern part, because of the very gradual slope and no irrigation, fields are of no definite pattern.

The most noteworthy feature of the land use of these villages is the absence of double-cropped area in Kuchlagh and its very small extent in Ahmad Khan Zai which has adequate irrigation facilities. It is partly because most of the acreage under cash crops is given to fruit cultivation, which occupy the land for years together, and partly because winter is too severe for vegetables to be double-cropped. Only about 19 acres of sown area, most of it under vegetables in Ahmad Khan Zai is double-cropped in *Kharif*.

Conclusions

From the foregoing discussion of landuse in West Pakistan, it seems clear that there is a great scope for improvement in the agriculture of West Pakistan. Availability of water, more than the land itself, sets the limits on the extent of cultivated area. Intensity of agriculture and cash cropping also depend largely on water supply, and to a lesser extent on various other factors discussed earlier in the body of the article. Choice of crops is also to a great extent dependent upon the availability of water. On the whole, the agricultural scheme is simpler in the hilly and *barani* areas and satisfactorily diversified in the irrigated plains.

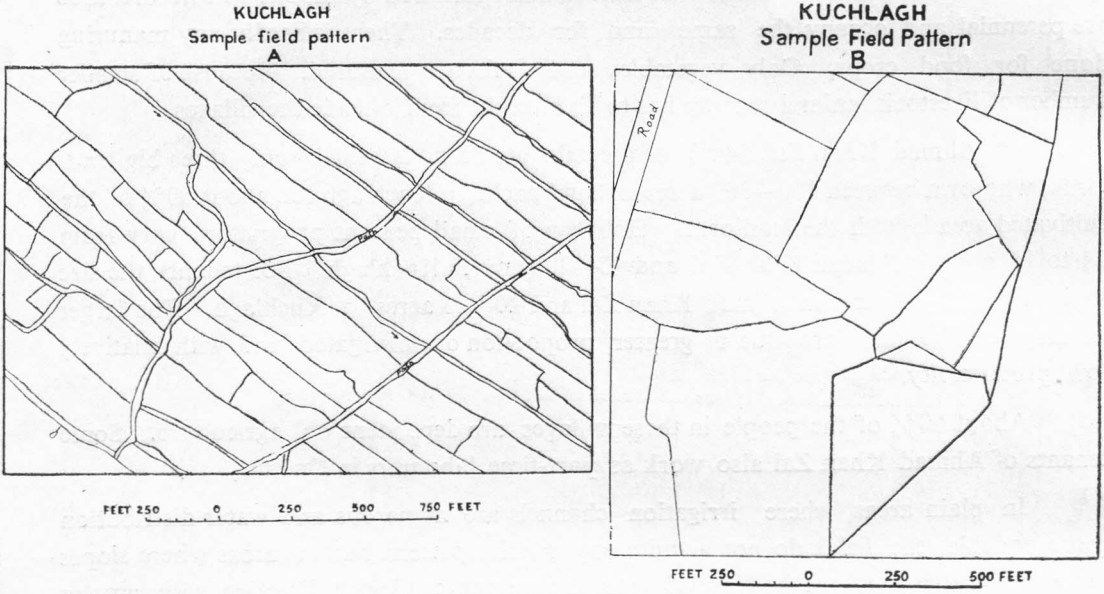


Fig. 21 and 22

In the event of a decreasing land-man ratio as we have in West Pakistan, the proper utilization of the available water resources is also a real consideration for the improvement of agriculture, particularly relating to an increase in yields per acre and to combating the growing menace of salinity and waterlogging. The sample studies of land use undertaken do not include a specimen of salinity affected areas or of waterlogged areas, but the growing dimensions of the menaces in West Pakistan are well known. While the requirements of a decreasing land-man ratio seem to suggest an extensive use of irrigation water, the considerations of the improvement in agriculture with reference to per acre yields and reclamation of salinity affected areas make out a case for the intensive application of water. A judicious use of water in different areas according to their specific needs is therefore, to be worked out.

While the per capita income of Pakistan as a whole is as low as Rs. 246 per annum, that of the agricultural section is lower still, being only Rs. 191. It further

emphasises the need for improvements in agriculture, especially when the purchasing value of a rupee has been decreasing and is likely to decrease all the more in the next 10—13 years, the period of implemention of the Indus water Treaty.

The industrial development has to be co-ordinated with agricultural improvement, as the main market for industrial products is provided by the rural masses which form 77·5% of the total population of West Pakistan. It is satisfying to note that the Land Reforms of 1960 are going a long way in bringing about improvements in tenancy system, ownership of land, and consolidation of holdings tending to make them economic units. But, while the consolidation of holdings is easy in the canal colonies, where the fields are of a rectangular or square shape, killa bandi (reducing the fields to the geometrical shapes of squares or rectangles) as a precurser of consolidation is difficult in most of the hilly and submontane areas. Besides, in the latter areas, consolidation is unacceptable to the agriculturists on account of pronounced differences of soil fertility and facilities of water supply from field to field.

TABLE 1

CLASSIFICATION OF AREA WEST PAKISTAN

(Area in thousand acres)

(Figures in bracket denote percentages. Percentages in columns 2-6 are on total area, in colmnns 7-8 on total cultivated, and in clumn 10 on total cropped).

Year	Total	UNCLTIVATED				CULTIVATED					
		Not Reported	Forest	Not Available	Cultruable Waste	Total	Current fallow	Net Sown	Total	Double cropped	Total cropped
1947-48	198,444	83,992 (42·3)	3,433 (1·7)	51,729 (26·6)	22,750 (11·0)	77,912 (39·3)	9,999 (27·4)	26,541 (72·6)	36,540 (18·4)	2,303 (8·1)	28,844
1951-52	198,444	83,384 (42·0)	3,485 (1·8)	51,121 (25·7)	22,852 (11·5)	77,458 (39·0)	9,455 (25·1)	28,147 (74·9)	37,602 (19·0)	2,197 (7·2)	30,344
1952-53	198,444	82,830 (41·7)	3,196 (1·6)	51,636 (26·0)	22,864 (11·6)	77,696 (39·2)	10,179 (26·8)	27,739 (73·2)	37,918 (19·1)	2,197 (7·3)	29,936
1953-54	198,444	82,823 (41·6)	3,124 (1·5)	51,406 (25·9)	22,519 (11·4)	77,049 (38·8)	8,591 (22·3)	29,991 (77·7)	38,572 (19·6)	2,824 (8·6)	32,815
1954-55	198,444	82,846 (41·7)	3,121 (1·5)	51,379 25·8)(	22,998 (11·8)	77,498 (39·1)	8,855 (23·2)	29,245 (76·8)	38,100 (19·2)	3,513 (10·7)	32,758
1955-56	198,444	82,699 (41·6)	3,148 (1·5)	51,638 (26·0)	22,518 (11·4)	77,304 (38·9)	7,982 (20·8)	30,459 (79·2)	38,441 (19·5)	3,912 (11·4)	34,371
1956-57	198,444	82,591 (41·7)	3,181 (1·6)	51,716 (26·0)	21,947 (11·0)	76,844 (38·6)	7,931 (20·4)	31,078 (79·6)	39,009 (19·7)	39,30 (11·2)	35,008
Avcrage 1952-53 to 1956-57	198,444	82,758 (41·7)	3,154 (1·5)	51,555 (25·9)	22,569 (11·4)	77,278 (38·8)	8,706 (22·6)	29,702 (77·4)	38,407 (19·5)	3,275 (9·9)	32,977

Source :—Land and Crop Statistics of Pakistan, 1959, Ministry of Food and Agriculture, Karachi.

TABLE 2.

CLASSIFICATION OF AREA WEST PAKISTAN

Averages from 1952-53 to 1956-57 (In thousand acres)

Division and Districts	Total area	Not reported (Percent of total area)	UNCULTIVATED (Percent of total area)				CULTIVATED Current fallow			
			Forests	Not available for cultivation	Cultivable Waste	Total	(Percent of total cultivated area)	Net Sown	Total (Percented of total area)	Double croped area (Percent of total area croped)
	1	2	3	4	5	6	7	8	9	10
West Pakistan	187,773	36·6	1·7	27·0	14·2	42·9	22·5	77·5	20·5	9·8
Peshawer .. Division	8,872	40·1	2·3	19·5	16·4	38·2	14·3	85·7	21·7	77·4
Peshawar ..	1,049	11·0	2·2	25·2	20·3	47·7	20·9	79·1	41·3	23·6
Hazara ..	3,990	52·4	4·0	4·6	25·4	34·0	11·5	88·5	13·6	1·0
Mardan ..	766	8·5	0·6	12·9	5·0	18·5	12·3	87·7	73·0	1·8
Kohat ..	2,235	23·1	0·6	52·4	8·3	61·3	17.2	82·8	15·6	—
Malakand ..	NA	NA	NA	NA	NA	N A	NA	NA	NA	NA
Kurram ..	832	92·8	—	1·6	0·7	2·3	7·3	92·7	4·9	—
D.I. Khan Division	5,524	40·1	0·2	15·3	23·9	39·4	17·4	82·6	20·5	2·7
D. I. Khan	3,062	27·7	0·3	17·7	34·3	52·3	25·3	74·7	20·0	5·4
Bannu ..	1,110	3·5	—	27·1	24·4	51·5	8·2	91·8	45·0	—
N. Waziristan	1,352	98·1	—	0·3	0·1	0·4	4·8	95·2	1·5	—
Rawalpindi Division	7,190	0·1	9·7	32·8	8·7	51·2	9·3	90.7	48·7	6·9
Rawalpindi..	1,315	0·2	16·1	30·4	9·4	55·9	4·8	95·2	44·0	8·3
Attock ..	2,651	—	7·7	42·4	6·9	57·0	14·7	85·3	43·0	5·5
Jhelum ..	1,775	0·2	12·7	34·8	11·0	58·4	12·0	88·0	41·4	6.5
Gujrat ..	1,449	—	3·8	19·1	8·8	31·7	4·2	95·8	68·3	8.1
Sargodha .. Division	10,943	0·3	1·5	14·3	28·5	44·3	13·4	86·6	55·4	5.9
Sargodha ..	3,051	—	4·4	12·4	20·6	37·4	15·0	85·0	62·6	6.3
Mianwali ..	3,458	0·7	0·6	22·5	34·8	57·9	16·7	83·3	41·4	0.9
Lyallpur ..	2,254	0·3	—	8·2	12·8	21·0	7·1	92·9	78·7	11.3
Jhang ..	2,180	0·3	0·4	10·3	45·9	56·6	17·8	82·2	43·1	0.6
Lahore Division	5,694	0·3	0·9	12·3	17·9	31·1	10·4	89·6	68·6	16·1
Sialkot ..	1,323	0·4	2·1	13·5	3·6	19·2	6·0	84·0	80·4	9·5
Gujranwala	1,476	0·2	0·1	12·7	22·6	35·4	11·0	89·0	64·4	21·5
Sheikhupura	1,476	—	0·3	8·8	28·5	37·6	10·6	89·4	62·4	20·7
Lahore ..	1,419	0·7	1·3	14·6	15·4	31·3	14·7	85·3	68·7	12.1
Multan Division	15,880	16·1	0·7	14·0	29·7	44·4	14·8	85.2	39·5	14·4

Source :—Land and Crop Statistics of Pakistan, 1959, Ministry of Food and Agriculture, Karachi.

Excludes figures for Mohmand, Kyber Agency and Malakand areas of Peshawar Division and for South Waziristan area of D.I. Khan Division Figures not available. .. Nil.

TABLE 2.

CLASSIFICATION OF AREA WEST PAKISTAN (*Contd*).

Division and Districts	Total area	Not reported (Percent of total area)	UNCULTIVATED (per cent of the total area)				CULTIVATED			
			Forests	Not available for cultivation	Cultivable Waste	Total	Current fallow			
							Percent of total cultivated area	Net Sown	Total (Percent of total area)	Double croped area (Percent of total area croped)
	1	2	3	4	5	6	7	8	9	10
D.G. Khan..	5,981	41·9	0·1	17·2	24·4	42·1	27·9	72·1	15·7	3·0
Muzaffargarh	3,592	0·9	2·2	16·1	55·8	74·1	16·5	83·5	25·0	4·6
Montgomery	2,691	—	0·6	10·5	15·3	26·4	12·9	87·1	73·6	14·3
Multan ..	3,616	0·3	0·5	9·3	23·4	33·2	10·4	89·6	66·5	10·9
Bahawalpur.. Division	11,205	58·0	0·1	7·8	7·9	15·8	12·6	87·4	26·2	6·3
Bahawalpur	6,136	80·0	0·03	5·0	3·6	8·6	13·2	86·8	11·1	7·2
Bahawalnagar	2,194	21.0	0·1	13·0	13·9	27·0	12·4	87·6	52·1	7·1
Rahim Yar-Khan	2,875	39.4	0·3	9·6	12·5	22·4	12·4	87·6	38·2	4·8
Khairpur Division	12,433	28·6	3·4	21·8	9·3	34·5	35·6	64·4	36·9	22·7
Khairpur ..	3,872	70·2	0·1	10·7	6·9	17·7	12·8	87·2	12·1	3·3
Jacobabad	1,309	—	2·4	19·0	14·8	36·2	36·5	63·5	63·8	34·1
Sukkar ..	3,553	—	7·8	48·2	9.5	65·5	50·4	49·6	34·5	25·2
Nawabshah	1,864	13·1	3·9	6·9	10.2	20·8	38·5	61·5	66·1	4·1
Larkana ..	1,835	32·2	1·8	7·2	8·8	17·8	45·6	54·4	50·0	38·9
Hyderabad Division	23,694	12·1	1·2	39·7	17·4	58·3	46·3	53·7	29·6	4·3
Sanghar ..	2,651	1·1	0·6	53·5	7·2	61·3	41·5	58·5	37·6	1·5
Tharparker	7,920	14·6	0·02	38·2	14·1	52·3	41·6	58·4	33·1	1·2
Dadu ..	4,731	19·9	1·1	36·7	18·5	56·3	52·2	47·8	23·8	11·2
Hyderabad ..	3,254	13·1	2·2	8·7	20·2	31·0	49·0	51·0	55·9	1·5
Thatta ..	5,138	6·2	2·9	57·2	25·0	85·1	58·3	41·7	8·8	35·6
Kalat Division	46,401	99·7	0·1	0·1	0·02	0·1	9·8	90·2	0·3	—
? ? ? ? ..	19,711	99·6	0·0	0·0	0·0	0·1	13·3	86·7	0·3	—
Kharan ..	11,845	99·3	0·2	0·2	0·0	0·1	—	100·0	0·2	—
Makran ..	14,845	100·0	NA	NA	NA	NA	NA	NA	NA	NA
Quetta Division	34,852	3·0	3·4	79·7	11·5	94·5	21·8	78·2	2·5	5·1
Quetta ..	3,398	5·8	3·4	84·3	4·5	92·2	4·4	95·6	2·7	—
Zhob ..	6,706	12·8	0·5	85·6	0·1	86·2	61·2	38·8	0·9	—
Loralai ..	4,720	—	1·5	88·6	5·1	95·1	26·5	73·5	4·9	—
Sibi ..	7,593	0·0	0·9	93·4	1·0	95·4	0·0	100·0	4·6	9·3
Chagai ..	12,435	—	7·2	63·4	28·3	98·9	72·8	27·2	1·1	—
Karachi Division	5,085	3·7	0·4	9·1	82·3	91·8	64·8	35·2	4·3	—
Karachi ..	520	36·3	—	31·0	19.4	50·4	24·6	75·4	13·3	—
Lasbela ..	4,565	—	0·4	6·6	89·4	96·4	83·3	17·7	3·6	—

TABLE No. 3.

PER CAPITA CULTIVATED AREA IN WEST PAKISTAN, 1931, 1951 AND 1961.

Districts	1931	1951	1961
West Pakistan	1·40	1·12	0·91
Hazara	0·63	0·58	0·39
Mardan	1·10	0·88	0·69
Peshawar	0·75	0·55	0·36
Kohat	1·40	1·10	0·55
Malakand	NA	NA	NA
Mehmand	NA	NA	NA
Khyber	NA	NA	NA
Kurram	NA	NA	NA
D.I. Khan	2·50	2.30	1·59
Bannu	1·90	1.70	1·16
N. Waziristan	NA	NA	0·05
S. Waziristan	NA	NA	..
Campbellpur	1·70	1·50	1·48
Rawalpindi	0·80	0·66	0·50
Jhelum	1·30	1·03	0·98
Gujrat	1·10	0·89	0·78
Mianwali	2·50	2·30	1·92
Sargodha	1·80	1·50	1·29
Lyallpur	1·30	0·90	0·66
Jhang	1·40	1.08	0·87
Lahore	0·88	0.51	0·43
Gujranwala	1·20	0·89	0·73
Sheikhupura	1·40	1·06	0·85
Sialkot	0·80	0·70	0·66
D.G. Khan	1·90	1·70	1·27
Muzaffargarh	1·20	1·06	0·90
Multan	1·40	1·07	0·88
Montgomery	1·20	1·06	0·92
Bahawalpur*	2·08	1·53	0·94
Bahawalnagar			1·38
Rahim Yar Khan			1.08
Hyderabad	2·04	1·90	1·41
Dadu	2·70	2·35	2·32
Thatta	3·40	2·40	1·24
Sanghar	NA	NA	2·31
Tharparker	5·20	3·90	3·60

NA—Figures not available.

*Formerly Bahawalpur state comprised of Bahawalpur, Bahawalnagar and Rahim Yar Khan districts and separate figures for the constituent areas ware not available.

TABLE No. 3 *Contd.*

Districts	1931	1951	1961
Khairpur	NA	1·20	0·98
Jacobabad	3·03	2·38	1·57
Nawabshaw	2·40	2·40	1·77
Sukkar	1·6	1·55	1·36
Larkana	2·09	1·70	1·51
Sibi	NA	NA	2·83
Loralai	NA	NA	2·07
Zhob	NA	NA	0·70
Chagai	NA	NA	3·12
Quetta	NA	NA	0·32
Kalat	NA	NA	0·17
Kharan	NA	NA	0·49
Mekran	NA	NA	NA
Karachi	NA	NA	00.03
Lasbela	NA	NA	1·65

TABLE No. 4.

PER CAPITA CULTIVATED AREA IN SOME COUNTRIES OF THE WORLD

Country	Per capita cultivated area in acres.	
France	1·20	(1955)
Japan	0·13	(1956)
Iraq	2·78	(1955)
India	1·01	(1955)
Burma	1·35	(1954)
Malaya	1·34	(1953)
Indonesia	0·65	(1954)
Lembodia	1·62	(1954)
Vietnam	3·20	(1953)
Laos	2·48	(1955)
Thailand	1·32	(1956)
Philippines	1·02	(1955)
Pakistan	0·72	(1955)
West Pakistan	0·91	(1961)

Source :—Year Book of Food and Agriculture—FAO 1961,

TABLE No. 5

YIELD OF PRINCIPAL CROPS WEST PAKISTAN

(Statistical Year Book 1958) (In maunds per acre)

Crops	1947-48	1952-53	1957-58
Food crops			
Rice (cleaned)	9·0	9·9	8·9
Wheat	9·2	6·8	8·5
Bajra	4·0	3·3	4·1
Jowar	5·2	4·6	5·1
Maize	10·7	9·7	11·2
Barley	7·3	5·2	7·7
Gram	5·8	4·2	5·7
Non food crops			
Sugarcane	333·8	313·4	300·6
Rape & Mustard	4·8	3·2	4·3
Cotton (Lint)	1·7	2·5	2·2
Tobacco	14·3	16·6	17·2

TABLE No. 6

YIELD OF SOME IMPORTANT CROPS IN FEW SELECTED COUNTRIES 1956-57.

Country	Wheat (In maunds per acre)	Rice (In maunds per acre)	Cotton (Lint) (Lbs per acre)	Sugarcane (In tons per acre)
World	12·2	20·2	214·7	—
U. K.	34·0	—	—	—
France	22·0	—	—	—
Italy	10·9	52·3	—	—
Japan	22·8	46·4	—	—
Iraq	6·3	16·0	116·4	—
India	7·6	25·8	89·4	13·3
Burma	3·3	17·5	93·4	22·0
Malaya	—	23·8	—	—
Indonesia	—	18·8	—	33·9
Combodia	—	12·9	313·1	—
Wietnam	—	14·6	340·0	10·8
Laos	—	10·9	214·7	—
Thailand	—	15·6	232·2	12·8
Philippines	—	13·2	71·5	19·4
Egypt	25·5	58·7	420·5	—
U.S.A.	14·7	38·5	411·6	22·8
Pakistan	8·0	16·4	195·9	12·1
*West Pakistan	8·5	8.9 (cleaned)	180·4	10·8

Source :—Year Book of Food and Agriculture-FAO 1957.

*Figures for West Pakistan are for the year 1957-58 form the Pakistan Statistical Year Book 1958.

TABLE No. 8

CLASSIFICATION OF AREA (IN ACRES)

Name of the village	Total Area	CULTIVATED							UNCULTIVATED								
		Net area sown	% of total cultivated	Current fallow	% of total cultivated	Total	% of total area	Not available for cultivation	% of total area	Forests	% of total area	Culturable Waste Banjar	% of total area	Other uncultivated area	% of total area	Total	% of total area
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
Ludeki Chak 47 N.B. Distt. Sargodha:—																	
Average 1954-55 to 57-58.	25,87	1,952	89·1	200	10·9	2,152	83·2	40	1·5	..	..	144	5·6	251	9·7	435	19·8
Average 1958-59*	2,587	1,035	80·9	245	19·1	1,280	49·4	1,170	45·2	..	..	90	3·5	47	1·9	1,307	50·6
Chunian Distt. Lahore :—																	
Average 1949-50 to 53-54.	15,641	6,606	64·0	3,828	36·0	10,434	66·0	1,738	11·0	..	..	497	4·0	2,972	19·0	5,207	34·0
Sanda Kalan Sanda Khurd Distt. Lahore:—																	
Average 1950-51 to 54-55.	1,204	690	87·7	97	12·3	787	65·0	376	31·2	..	..	41	3·8	..	..	417	35·0
Kot Warah & Mangal Sain Distt. Jhelum :—																	
Average 1948-49 to 52-53	1,238	415	85·0	73	15·0	488	39·4	590	47·6	..	..	80	6·5	80	6·5	750	60·6
Gadai West Distt. D. G. Khan :—																	
Avereage 1959-60	7,105	2,476	66·5	1,205	33.5	3,726	52·4	84	1·2	..	..	3,140	44·2	155	2·2	3,379	47·6
Nawan Shahr Distt. Hazara :—																	
Average 1951-52 to 55-56.	2,346	710	88·7	90	11·3	800	34·2	148	6·2	..	..	155	6·6	1,243	53·0	1,546	65·8
Ahmad Khan Zai Distt. Quetta :—																	
Average 1953-54 to 57-58.	1,166	638	69·6	278	30·4	916	78·4	143	12·2	36	3·2	4	0·4	50	4·3	250	21·6
Kuchlagh Distt. Quetta :—																	
Average 1953-54 to 57-58.	2,182	665	42·6	891	57·4	1,556	71·3	29	13·3	..	..	47	2·2	288	13·2	625	28·7

*In 1958,1,130 acres of the village land was acquired by the Govt. which resulted in many differences in the ratio of land under each class.

This ratio is calculatd on a total area of 1457 acres exculding 1130 acres which have been acquired by the Govt. for constructional purposes.

TABLE No. 9

CLASSIFICATION OF CULTIVATED AREA ACCORDING TO SOURCES OF WATER SUPPLY

Name of the village	Total cultivated Area (in acres)	IRRIGATED. (PERCENTAGE OF TOTAL CULTIVATED)												Unirrigated (percentage of total cultivated)		
		Nehri	Chahi	Chahi and Nehri	Chahi Abi	Chahi Sailaba	Chahi, Abi Sailaba	Abi Sai laba	Abi	Abi Khas	Abi Mustaar	Rod Kohi	Total	Barani	Sailaba	Total
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
Ludeki Chak 47 N.B. Distt. Sargodha:—																
Average 1954-55 to 1957-58.	2,152	100	..	..	..	..	..	..	..	..	..	..	100	..	..	0·0
1958-59	1,280	100		..	..	..	..	..	..	..	..	..	..	..	..	..
Chunian, Distt. Lahore :—																
Average 1949-50 to 53-54.	10,434	83.0	14·2	..	..	..	..	..	..	..	..	..	97·2	2·8	..	2·8
Sanda Kalan and Distt. Sanda Khurd Lahore:—																
Average 1950-51 to 54-55.	787	..	12·5	..	6·2	1·2	0·6	19.2	28·6	..	..	..	68·3	0·6	31·7	3·3
Kot Warah and Mangal Sain Distt. Jhelum:—																
Average 1948-49 to 52-53.	..		4·0	..	..	..	..	..	..	..	..	..	4.0	..	..	96·0
Gadai West Distt. D.G. Khan :—																
Average 1959-60.	3,726	37·9	7·1	39·0	..	..	..	..	..	..	..	16·0	100	..	..	0·0
Nawn Shahr Distt. Hazara :—																
Average 1951-52 to 55-56.	800	..	0·12	..	..	..	..	..	..	..	..	5·28	6·40	93·60	..	93·60
Ahmad Khan Zai Distt. Quetta :—																
Average 1953-54 to 57-58.	916	..	1·9	..	..	..	..	..	..	86·2	11·9	..	91·5	8·5	..	8·5
Kuchlagh, Distt. Quetta :—																
Average 1953-54 to 57-58.	1,556	..	0·8	..	..	..	..	..	..	6·7	57·9	..	65·4	34·3	0·3	34·6

Note :—

Nehri	.. Canal irrigated.	Chahi ..	.. Well irrigated.
Nehri Chahi	.. Canal and well irrigated.	Abi ..	.. Irrigated by city drain.
Abi Chahi	.. Irrigated by city drain and wells.	Sailaba ..	.. Land having sufficient subsoil moisture.
Chahi & Sailaba	.. Well irrigated as well as having suffcient subsoil moisture.	Abi Sailaba	.. Irrigated by city drains as well as having sufficient subsoil moisture.
Chahi, Abi & Sailaba	.. Irrigated by wells, city drain and having sufficient subsoil moisture.	Rod Kohi..	.. Irrigated directly from the stream.
Abi Khas ..	.. Irrigated by self owned Karez.	Abi Mustaar	.. Irrigated by Karez owned by the landlord.

TABLE No. 10

Crop Acreages

Name of the village	FOOD CROPS				CASH CROPS													
	Rabi	Kharif	Total	% of total Harvested	Rabi	Kharif	Total	%of total Harvested	Total Rabi	% of total Harvested	Total Kharif	% of total Harvested	Total Harvested	Failed	% of total sown	Total sown	Area sown more than once	% of total sown
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
Ludeki Chak 47 *N.B. Distt. Sargodha*:—																		
Average 1954-55 to 57-58.	669	374	1,043	44·9	640	640	1,280	55·1	1,309	56·3	1,014	43·7	2,323	20	1·3	2,352	470	20·0
1958-59.	491	255	746	54·1	336	295	631	45·9	827	60·0	550	40·0	1,377	15	1·0	1,392	362	26·0
Chunian Distt. Lahore:—																		
Average 1949-50 to 53-54.	3,017	1,005	4,022	43·9	1,774	3,341	5,115	56·1	4,791	52·4	4,346	47·6	9,137	708	7·6	9,845	3,239	32·8
Sanda Khurd, Sanda Kalan Distt. Lahore:—																		
Average 1950-51 to 54-55.	170	189	359	24·8	714	[illegible]	1,086	75·2	884	61·1	561	38·9	1,445	147	0·9	1,592	902	56·6
Kot Warah & Mangal sain Distt. Jhelum:—																		
Average 1948-49 to 52-53	284	78	362	95·8	1	[illegible]	16	4·2	285	75·3	93	24·7	378	54	12·5	432	17	3·9
Gadai West Distt. D.G. Khan																		
1959-60	1,435	720	2,155	80·7	408	106	514	19·3	1,843	61·5	826	38·5	2,669	86	3·1	2,755	279	10·0
Nawan Shahr Distt. Hazara:—																		
Average 1951-52 to 55-56.	46	754	800	98·2	..	15	15	1·8	46	5·7	769	94·3	815	144	15·0	959	249	25·9
Ahmad Khan Zai Distt. Quetta:—																		
Average 1953-54 to 57-58.	351	3	354	53·8	14	289	303	46·2	365	55·5	292	45·5	657	115	..	772	19	..
Kuchlagh Disstt. Quetta:—																		
Average 1953-54 to 57-58.	391	1	392	86·1	..	62	62	13·9	391	86·1	63	13·9	454	211	..	665	..	..

*In 1958, 1,130 acres of the village land was acquired by the Govt. which resulted in great differences in the ratio of cropped acreages.

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8. Four unpublished records of the Revenue Department made available by the village officer (Patwari).

8.1. Misle Haqiat (Contains details of ownership from the time of first settlement of the area).

8.2. Jama Bandi. (Records changes in ownership).

8.3. Khasra Girdawri. (Records details of each field as regards number, area, class of land means of water supply and the crops sown during the year).

8.4 Lal Kitab (Contains information about classification of land according to its use, details of crop acreage, failure and double cropped area).

9. Cadastral Map (1″ = 200 feet).

Outline map of the village with field boundaries and their numbers which serve as the basis for the recording of the data.

Apart from these refrences field work had provided some valuable information on some specific problems of the villagers and other unrecorded information.

NEWS & NOTES

DEVELOPMENT OF NEW MINERALS SINCE INDEPENDENCE

An account of the minerals whose recorded production began after the creation of Pakistan is given in the following. It is possible that some of these minerals were produced in small quantities before Independence but their commercial exploitation certainly began from the dates shown in the records maintained by the Government.

Barite production began in 1958 with 305 tons and rose to 633 tons in 1960 but droped to 110 tons in 1961 output rose again to about 2,700 tons in 1962. Large deposits exceeding 7,000,000 tons have been discovered in Kharan but they are relatively inaccessible at present.

Bauxite production rose from 1,024 tons in 1955 to 3,317 tons in 1957 but subsequently decreased to 2,139 tons in 1959 and dropped to 405 tons in 1961. No production has been reported for 1962. Bauxite is used in refractory bricks as well as in the manufacture of cement but the low consumption suggests that the ore offered is not readily usable. Discoveries of bauxitic material have been made in Campbellpur, Azad Kashmir and Ziarat (Sibi). Investigations are under way to determine the feasibility of erecting an aluminium plant but no substantial progress has been made so far. Most of our ores are aluminous laterites.

Bentonite made a shaky start with 136 tons in 1958 and reached a production 987 tons in 1961 but fell to less than half that amount in 1962. Extensive deposits occur in Salt Range, Jhelum and Azad Kashmir. Deposits are very thin usually averaging under a foot. This greatly increases their extraction costs. The great variety of uses to which this mineral can be put will certainly encourage its increased exploitation in future.

Celestite production started in 1951 with 136 tons attained a peak of 1,332 tons in 1960 and dropped to under 300 tons in 1962. Fluctuations are partly due to irregular nature of the deposit.

China clay was a late starter. First production of 73 tons was reported in 1960 which jumped to 726 tons in 1961 but fell off to 20 tons in 1962. China has a great future because its uses are many and paper industry which is one of its main consumers is at present depending upon imports from Britain. Moreover ceramics industry has not started using china clay till very recently and is bound to use this staple raw material in ever increasing quantities. Discoveries of China clay have been made in Hazara, Salt Range and Nagar Parker. The last named area is being investigated. Clay has also been discovered in east Pakistan.

Copper ore production of 134 tons in 1960 only shows that some prospecting work has been done in Chagi. Subsequent investigations have proved only 50,000 tons of magnetite ore including about 20,000 tons of 2% grade copper ore and a mere 5,000 tons of +2% copper ore associated with garnet. These quantities are too small for a copper processing plant and exploration work has been terminated.

Dolomite is another late starter with 151 tons in 1960, production climbed to over 450 tons in 1962. Large reserves are available in Salt Range and Hazara.

Fire clay production of 6,997 tons was first recorded in 1949. It, however, appears to be a certainty that the mineral was being produced even before 1949. The production reached 16,065 tons in 1961 but dropped to about 8,800 tons in 1962. This mineral also has a good future for home consumption but its quality must be improved.

Fuller's earth production 1960 was 98 tons and jumped 9,545 tons in 1961 and then dropped to

8,600 tons in 1962. There has always been a demand for this clay mineral in domestic chores though it may now be commanding a growing industrial market. The total production is likely to be much more than what is shown by records.

Natural Gas is probably the biggest find in the sub-continent during the last fifty years. Natural gas associated with oil occurs in Dhulian and is being used now. The gas fields found by the companies drilling for oil with reserves expressed in Trillion (1,000,000,000,000) cuft. are Sui (5·0), Zin (0·1) Uch (2·5), Khairpur (1·0) Khandkot (0·2), Mazarani (0·3), and Mari (4·95) in West Pakistan and Sylhet (0·28), Chhatak (0·02) and Rashidpur (0·47) in east Pakistan. All these finds were made during the period 1952—1960. Commercially exploitable Kailash Tila and Titas Gasfields have been discovered lately and are under investigation. Since drilling for oil is in progress more gasfields may be discovered in the future.

Sui, Sylhet, Chhatak and Dhulian are producing gas for commercial uses. Sui is the biggest gasfield and was the first to be discovered and developed. In 1955 this field started production with 1,587,059 cuft. per diem and reached a production 5,000,000,000,000 cuft. per diem in 1961. The total production of gas in Pakistan rose from 1,779,832,000 cuft. per year in 1955 to 42,076,334,000 cuft. per year in 1962.

Iron ore production has been recorded since 1954. This apparently pertains to the production of ore from West Pakistan Industrial Development Corporation's exploratory workings in Kalabagh area where prospecting of iron ore has been in progress.

Lead ore is being prospected and this accounts for a little production now and then.

Magnesite—a small quantity of chemical grade magnesite is produced from Hindubagh. Demand is small. Magnesite has also been discovered in Waziristan. The mineral is not being used for refractory purposes which is one of its main uses.

Manganese has been located in Las Bela, Hazara, Waziristan and Kohat but the reserves of good quality ore are limited. Much of the production in the years 1959 to 1962 is a product of exploratory work.

Marble (onyx) of green, yellow and red colours was discovered in early fifties in Chagi. Geologically a travertine is beautiful to look at and takes an excellent polish. White marble of superior quality is found in Mardan and Peshawar Districts. Gundai Tarako white marble of Mardan District has been selected for Quaid-e-Azam Mausoleum. A production of 882 tons was first reported in 1957 and the output increased to 4,921 tons in 1961 but dropped to about half that quantity in 1962. The increase in output has brought prospects provided works of art are also produced in the country.

Ochres have had a steady production of 400—500 tons a year though fluctuations in the output have been considerable. In 1952 production was 408 tons and it grew to about 800 tons in 1962.

Silica sand may have been produced before the independence in small quantities but regular production began in 1949 with 1,178 tons. The annual output shows great ups and downs. The maximum output of 25·873 tons was recorded in 1960. This declined to about 15,000 tons in 1962. Several new deposits have been discovered in both wings.

Soapstone is available in Hazara, Azad Kashmir, Khyber and Kurram agencies. A production of 259 tons in 1955 was the start but it quickly reached 3,370 tons in 1960. There was a big drop to 1,215 tons in 1961. The output in 1962 was 1,200 tons.

Abstract from the Presidential address of Mr. A.H. Khan, President of the Geography and Geology Section of 15th All Pakistan Science Conference, Lahore, March, 1963.

FIFTEENTH ANNUAL ALL PAKISTAN SCIENCE CONFERENCE

The fifteenth annual Science Conference was held at the Panjab University, Lahore from 21st March to 26 March, 1963. The official opening by the President Muhammad Ayub Khan, H.P., H.J. took place in the University Hall. Dr. I. H. Usmani, Chairman of the Atomic Energy Commission was the general president.

The meetings of the Geology and Geography Section were held in the department of geography. Mr. Abdul Haye Khan presided over the meetings and Mr. F. A. Shams, Reader, Department of Geology worked as the secretary.

The meetings of the section were attended by delegates from the various universities and government departments and delegates from U.S.A, U.S.S.R, U.K and Germany.

After the sectional meetings a few field trips were arranged. The foreign delegates visited the water-logged areas in Rechna Doab, Reclamations Farms and WAPDA Reclamation Project areas.

The following papers were contributed :—

"Hab Valley : A Study in Urban Response" By Dr. Shamsul Islam Siddiqi, Department of Geography, University of Karachi, Karachi.

"Woollen Textile Industry in Pakistan" By Kazi S. Ahmad and Dr. Miss M. K. Elahi, Department of Geography, University of the Panjab.

"Means of Transportation in Lahore" By Mushtaq Tahir, Department of Geography, Panjab University.

"Food Supply and Population Growth of West Pakistan" By Miss Amina Rehman, Department of Geography, Panjab University.

"Socio Economic Survey of Kakul" By Capt. S. H. Burney, P. M. A. Kakul.

"Geographical distribution of Electrical Energy and its sources in West Pakistan" By Dr. Muhammad Ismail Siddiqi, Department of Geography, Karachi University.

"Geology of Khewra Salt Mines" By Asrar Ullah, Geological Survey of Pakistan.

"Some undescribed Faunas from the Middle Cambrian Rocks of St. Davis, Pembrokeshire". Dr. Farshoori, Department of Geology, Sind University.

"The Mechanism of quartez 'flattening' and orientation in some schists of the Mansehra Area, Hazara District." By F. A. Shams, Department of Geology, Panjab University.

"Structure of the Western Ras Koh Range, Chagi and Kharan districts, Queeta and Kalat Divisions, West Pakistan." By M. Abu Bakr, Geological Survey of Pakistan.

"Structural Features of an Area between Sharigh and Nakus, District Sibi." By M. Yar Khan, Geological Survey of Pakistan.

"Si-Al Relationship in Mg-Fe Olivines." By F. A. Shams Department of Geology, Panjab University.

"Lead Mineralization in the Abbottabad Area, Hazara District." By F. A. Shams, Department of Geology, Panjab University.

"Land use Mapping of Indus plain" By Anis Ahmad Abbasi, Panjab University.

"Microscopic study of heavy detrical minerals and its use in mineral Prospecting." By Kh. Gulzar Ahmad.

"Application of Statistical Methods to Geology." By Munir Ahmad, Institute of Statistics, Panjab University.

"Morphology of the Lalmati-Mainmati Hills near Comilla." By Prof. M. I. Chowdhury, Dacca College, Dacca.

"Rural Settlement Patterns in Sind." By Dr. Mushtaq-ur-Rehman, Department of Geography, Sind University.

"The Rural Markets of Rajshahi." By Ahmed M. Patel, Geography Department, Rajshahi University, East Pakistan.

"A study of the Sedimentary Features and probable condition of deposition of the Sedimentary Sequences exposed in the Chittagong Hill Tracts." By M. A. Latif, Department of Geology, Panjab University.

"Geomorphology of the Southern Slopes of Salt Range in Thal Doab." By Anis Ahmad Abbasi, Department of Geography, Panjab University.

TRAINING COURSE IN GEOMORPHOLOGY OF ARID REGIONS

In Pakistan Geologists and Geographers are fairly well established and trained specialists in these branches are available. There is however a great need of trained Geomorphologists. A training course in geomorphology was therefore organized by the department of meteorology from 27th May to 8th June, 1963 at the Geophysical Institute, Quetta under the direction of R. L. Wright of UNESCO. It was attended by 20 participants from the departments of Meteorology, Soil Conservation, Forest, Geological Survey, Food and Agriculture of the Government of Pakistan and by 4 lecturers from Sind, Punjab and Peshawar Universities.

The first week was devoted to lectures and laboratory work. The lectures covered various aspects of the fundamental principles in Geomorphology. In Laboratory work, the participants were trained in the basic principles of the interpretation of air photographs, topographical and geological maps.

The second week was devoted to field work in and arround Quetta which was conducted by Prof. Savigear of Department of Geography, University of Shieffield along with Mr. W. L. Wright. Prof. Savigear also delivered a few advanced lectures on denudation chronology and geomorphological mapping.

PUBLICATIONS OF WATER AND SOIL INVESTIGATIONS DIVISION OF WAPDA, WEST PAKISTAN, LAHORE.

WAPDA since its inception has started a huge programme of investigations. Its water and soil branch publishes reports in the form of Series. The reports contain the results of investigations and research work and will be made available as described below :—

Basic Record Release Series

Translation of basic data collected in the course of field surveys. These reports will include descriptions of data collection methods, appropriate maps showing the sampling sites, and a minimum of interpertative text and illustrations.

Technical Paper Series

Reports describing the results of specialized hydrologic analyses and investigations. These will serve as references for comprehensive reports in which exhaustive treatment of material would not be feasible.

Preliminary Report Series

Includes interim reports on all kinds of project studies, and reconnaissance reports of proposed development and reclamation areas for which there is insignificant time to make detailed investigations.

Bulletin Series

Comprehensive terminal reports of hydgologic and soil investigations. These reports will present the final synthesis of all data and technical studies, and will not contain tabulated data which have been published in the Basic Record Series.

BOOK REVIEWS

SOVIET POTENTIALS, A GEOGRAPHICAL APPRAISAL. By George B. Cressey. 232 pp.; maps, ills., bibliogr., stat. tables. Index. 6×9 inches. Syracuse University Press, 1962.

In this book George B. Cressey, the well known author of "Asia's Lands and Peoples" and "China's Geographic Foundations" attempts to answer the question, "Does the Union of Soviet Socialist Republics have the environmental potentials with which to become the world's greatest state?"

Professor Cressey sketches in the background of this vast Union, relating her resources to the possibility of their economic development and indicating her present position in world output of the major minerals and agricultural products.

While not denying her vast resources and potentialities for further development of H. E. P. and extension of irrigated land, Professor Cressey does not fail to point out that the U. S. S. R. has large tracts of country which are inaccessible and which suffer from disadvantages of infertile soils and inhospitable climates.

After considering the wealth of the country as a whole, the Union is divided into some twenty five geographic regions, and a brief regional description is given of each. Finally there is a discussion of Soviet International Relations, with an interesting reference to Sir Halford Mackinder's "Heartland" concept.

Based on four personal visits to the U. S. S. R. between 1923 and 1960 this is a useful and stimulating book. An appendix contains valuable statistical data, and the book itself is well illustrated with pictures gleaned from a variety of sources, it is a pity therefore that the general standard of the regional maps is low, lacking clarity and ambition.

MARY P. COOPER,

1960 ANNUAL REPORT OF RIVER AND CLIMATOLOGICAL DATA OF WEST PAKISTAN. Prepared By Surface Water Circle and Harza Engineering International Lahore. 162 pp.; Maps, 6×9 Inches. WAPDA Press Lahore, 1962.

The report presents data collected by the surface water circle of water and soils investigations division of WAPDA and other organizations. The data in this report include river discharges, sediment concentration, water temperature, precipitation, evoparation, air temperature, relative humidity and wind movements for the year 1960.

It is the first of the series of annual reports on River and Climatological data to be published by WAPDA.

The purpose of the collection of the data is to provide information which can be translated into development programmes that will help to increase agricultural production through the construction of dams, canals; reclamation of saline and waterlogged areas and improve agricultural practices in west Pakistan.

The report has four main chapters which include Discharge Station Records (arranged in down stream order) of the Climatological Station Records and Precipitation Records at miscellaneous sites. The report also includes a location map of data collection stations. Though the data relates only a few rivers including Indus, Gilgit, Siran, Kabul, Kalapani Haro, Kohat Toi, Soan, Gomel, Jhelum Kanshi, Poonch and Hub and only a few meteorological stations in Northern mountainous area, it is a useful publication if the records are maintained regularly in future.

A.A.A.

PAKISTAN, A COMPENDIUM. Ray R. Platt, Editor-in-Chief, compiled and edited by Robert C. Kingsbury, Jame L. Mcpherson and others, 883 pp. American Geographical Society, New York 32, June, 1961. For limited circulation only.

The compendium is claimed to be designed to facilitate easy access to information of a comprehensive character on the resources, economy and the population of Pakistan and on the relations between the Pakistan is and their environment. Not exhaustive with respect to any subject, it represents an attempt togather togather within the confines of a single volume general information about a new country for which little up-to-date material of a trustworthy nature is yet available.

There are 11 chapters and an appendix on Chitral, with 39 maps and statistical tables. The first chapter gives a brief history of Pakistan from the Arab invasion of Sind in 711 A. D. till the Revolution of October, 1958. In the second chapter, under shape and composition, a variety of subjects are briefly treated including partition, population, language, transportation and regions. The remaining chapters are devoted to village types, agriculture, land tenure and land tax, irrigation, land reclamation and conservation, minerals, cottage and principal factory industries, industrial potential and power resources.

Attempt has been made to bring out the complementary nature of the geography and economy of the two wings which has encouraged unity between them. Various subjects have been well treated and they contain quite useful information for the economist and the geographer. They are well illustrated with beautiful maps both from the cartographic and educational point of view. Then constitute a special feature of the compendium. There are, however, some maps like those of geology, precipitation and variability of rainfall and forests, the subject matter of which, though important, is not dealt with in the text. The maps showing roads in 1952 and railroad system in 1956 have not been properly oriented obviously for saving space. The agricultural maps are based on the figures of 1944-45/1948-49 and industrial on the figures of 1955. The tables relate to the years, 1948 to 1955.

The editors deserve compliment for the production of this well-balanced and instructive publication. It is unfortunate that its circulation should have been limited.

K. S. A.

(*ii*) **Shorter Contributions** of research and semi-research type which present a summary of work in progress and results achieved. General accounts of field trips are also included in this category. They should not exceed 1,500 words.

(*iii*) **Correspondence** in which contributors may communicate their views and comments on papers appearing in the journal. A space limit of 1,000 words should be observed.

(*iv*) **News and Notes** which contain brief accounts of new discoveries of resources, development projects and other news of geographical interest. They should not exceed 500 words.

3. The manuscripts should be typewritten, double spaced, typed on one side of the paper with wide margins. The diagrams and photographs should be clear. The tables should be consistent with the size of the Review. References should be listed at the end of the paper either in order of citation or alphabetically and indicated in the text by the corresponding number written in parenthesis.

4 The contributions are accepted with the understanding that they have not been published elsewhere.

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