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CONTENTS

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SOIL DETERIORATION AS A FUNCTION OF ENVIRONMENTAL DEGRADATION IN PAKISTAN

M. ALIM MIAN AND JALAL-UD-DIN*

Soil as a component of environment, contributes a good deal both for its improvement as well as degradation. The contribution is mostly through plants. Its magnitude is measured by soil qualities and the kind and quantity of the flora they support. In Pakistan there are two types of soil deterioration physical and chemical, resulting in the degradation of environment. Soil erosion by water and wind pertain to the physical, whereas salinization/alkalization indiscriminate use of poor quality ground water, waterlogging and depletion of soil fertility relate to the chemical type of soil deterioration.

INTRODUCTION

Soil is one of the components of environment.. The other important components are climate, vegetation, water, landscape including soils, and man. These components are interdependent and have always been operating together for the build up of environment.. Understanding of functions of each component leads to better awareness of environment.. However, it will not be possible to discuss here the role of all these elements except that of the soil and its uses by man.

Soil contributes a good deal both to the improvement as well as degradation of the environment.. The contribution is mostly through plants. Plants are grown on soils. They provide food and fibre for man and animals. Man is also blessed with the beauty of soil flora which maintain a balanced proportion of oxygen and other gases in the atmosphere. Hence these are the only source of environmental purification.

The magnitude of soil effects on the environment is determined by its qualities. Good soils always have a healthy effect on the environment. They have been and are always a great natural asset of the civilized nations. The nations prosper because they have productive soils. Their standard of living and health of the individuals is often determined by the quality of soils they own and the kind and quantity of crops/plants they grow on them. On the contrary there are instances in history, of downfall of such nations simply because their productive soils were damaged.

Director and Deputy Director respectively, Soil Survey of Pakistan,

DETERIORATION PROCESSES YS. ENVIRONMENTAL DEGRADA nON

In Pakistan there are two types of soil deterioration, physical and chemical. . Their nature and magnitude is different in various regions of the country. Each type comprises a number of processes which are described in relation to the environmental degradation in the following sections:

1. Processes of Physical Deterioration

Soil erosion both by water and wind is the main process of physical deterioration. It involves destruction of natural soil from its original setting and removal to other places. The two types of erosion are discussed below:

(i) *Water Erosion.* It is particularly acute in major part of NWFP, Murree hills and Azad Kashmir where the slopes are steep and rainfall is high. Shallow soils on these slopes are highly vulnerable to erosion. Gully erosion is prevalent in the Potwar upland since times immemorial and as a result, wide-spread gully systems occur side by side with the cultivated lands in the area.

In the northern hills cutting of forest and overgrazing of natural flora are being practised at a massive scale. Consequently the erosion processes are being accentuated and whatever soil cover is there, is being removed and transported down to the Indus basin. The hills are being gradually denuded and their environmental beauty is on the decline.

During monsoon season the river waters are loaded with slit-sized sediments that are dumped at the bottoms of dams and barrages and even in the beds of rivers and irrigation channels. Their beds have been raised and their desiltation has become a serious problem. The silt load is also spread over narrow strips of land along the active river channels. A small proportion of it goes to the normal irrigation fields as well. It has been estimated that in 10 to 20 per cent of the total flooded area, the soils are degraded by deposition of silt and sand in this fashion (Rafiq, 1978).

(if) Wind Erosion. Wind erosion is dominant in sandy regions like ThaI, Cholistan and Thar. . Removal of natural vegetation either by overgrazing or cutting for use locally as a fuel wood, is the main cause of soil losses by wind erosion. The finer soil particles are picked up by wind and transported to far off places and the resultant 50ils are converted into shifting sand dunes. Thus man is also accelerating the process of desertification and adversely affecting the environment.

2. Processes of Chemical Deterioration

Loss of normal productive soils by salinization, indiscriminate use of low-quality tubewell waters, waterlogging and depletion of soil fertility are the main processes of chemical deterioration taking place in the country. These processes viz-a-viz the environmental degradation are described below:

(i) Salinization. It is a process of gradual accumulation of soluble salts in the root zone in such quantities that the plant growth is adversely affected. As the process progresses, salts start appearing on the soil surface in patches making the stand of crops patchy. In the advance stages, a thick puff of salts accumulates at the surface rendering the soil incapable of growing any vegetation except a few salt-tolerant bushes. Salinity when associated with sodicity is still a worse type of chemical soil degradation which, in extreme cases, renders the soil absolutely barren.

The surface appearance of the salt-affected soils depend upon their nature and amount.. Generally the tone is white but where the salts are hygroscopic they impart an 'oily' look to the surface. Such salts absorb moisture from air, make the surface muddy and slippery and create conditions precarious for traffic. As such, they release a nasty smell to the environment.. In dry conditions the puff is blown with the wind and is harmful to human health. In summer the salt glare is detrimental to eyes. Such soils occur in the form of saline flats, scattered mostly in the canal irrigated areas of Punjab and Sind (M. Bashir, M. Alim and M. Raflq, 1978) but the phenomenon is fairly widespread in the Indus delta.

(ii) Indiscriminate Use of Low-quality Tubewell Waters. Investigations (lalal and Rafiq, 1973) have shown that indiscriminate use of low-quality tubewell waters foi"irrigation is damaging the good agricultural land. These waters have generally moderate sodicity hazard but medium to low salt content. Their use makes the soil sodic in reaction and a white encrustation appears on soil surface. The soils lose their structural stability and become, especially the clayey one, almost impervious to water. When dry, they are pretty hard. Seedbed preparation of such soils becomes rather difticult. Seed germination is considerably retarded. The presence of excessive exchangeable sodium is toxic to plant as well. In such areas the sensitive crops (vegetables, tobacco, pulses and gram), have already gone out of cultivation and the yields of hardy crops (rice, whea!, mustard and sugarcane) is on the decline.

The use of hazardous water also adversely affects the availability of nutrients for plants. Prolonged use of food produced from much soils, therefore, results in nutritional imbalance in bodies which ultimately becomes a cause of ill-health. After irrigation such waters stagnate on the surface of

dense, sodic soils for more than normal days. Such fields release an unhealthy smell to the environment..

(iii) Waterlogging. Waterlogging is also an important process of soil deterioration. It refers to the presence of watertable at such a depth that a part of the rootzone is saturated with water and the creps suffer for want of air. As the watertable rises the crops start showing signs of failure. Rise of subsoil water brings some salts to the surface in its wake and gradually the migration of healthy soil flora sets in. When the watertable comes still closer to or at the surface, the soils are abandoned. They remain open to the inclemencies of weather unless artificially drained and as such the water remains stagnant and the land supports vigorous growth of reeds. sedges and other hydrophytic plants and animals. Such marshy places generate an obnoxious and suffocating smell all the time to the environment. Such situations are very conducive for the breeding of mosquitoes and flies which ultimately give rise to the spread of epidemics. **In** waterlogged areas roads become humpy, buildings are damaged and even drinking water is salty and contaminated. Life in such areas become miserable and ultimately the habitants start migrating to safer places.

Waterlogging is, no doubt a serious problem in certain low-lying strips of land in some districts of the Punjab and Sind. However, according to a relevant data (Hussain, 1970, M. Rafiq, 1975), never more than 0.6 per cent of the Canal Commandeded Area was severely waterlogged in Pakistan.

(iv) Depletion of Soil Fertility. Soils in the Indus plain have been under cropping for centuries. Since the advent of canal irrigation certain soils are being cultivated very intensively. Consequently their natural fertility level has been considerably gone down. This depletion is replenished by use of artificial fertilizers containing only the macro-nutrients especially nitrogen and phosphorus. Even this use is generally indiscriminate and inadequate. Addition of micronutrients is mostly ignored. As a result of this, an overall nutritional imbalance has been created in the plants which adversely affects their growth, yield and taste of their produce. This imbalance is further translocated to the human body and eventually tells heavily upon the human health.

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THE CHANGING PATTERN OF MOHENJODARO'S NATURAL ENVIRONMENT

ANIS A. ABBASI*

Mohenjodaro is one of the ancient cities of the world. Located on the right bank of Indus, about 5,000 years ago it was a well planned urban centre and covered approximately 1.59 sq. miles. It was a major settlement of the Indus valley civilization which spread from foot hills of the Himalayas to the Arabian sea in the flood swept plains of the Indus. More than fifty settlements belonging to this civilization are known. A large number still remain burried under the alluvium or appear as large heaps or mounds throughout the Indus Plains. Mohenjodaro had its own irrigation system, canals, bunds, dykes, flood control structures, remnants of which can still be noted on aerial photographs. The system was probably as extensive and carefully planned as those of Mesopotamia or Egypt. At its peak development, Mohenjodaro was the capital of the civilization where trade, commerce, manufacturing of pottery, tools, boats, loading docks, civil and public health engineering, architecture and town planning had achieved unparallel sophistication. Some of its hydraulic achievements rival those of American cities today. For example many private houses were two storied and had the rooms and the house drains connected with covered sewers that ran along the streets to join trunk lines emptying into cesspools. Continuous threat of the floods and the consequent losses suffered by the inhabitants may have been one of the major causes of its desertion. Depositional fluvial changes in river Indus regime buried the city and the surrounding area under alluvium. Its ruins survived as long as they remained burried under the soil. Since their excavation in 1929, the ruins are adversely threatened by weathering, river erosion, waterlogging, salinity and salt damage to the bricks. In this paper the changing pattern of Mohenjodaro's natural environment has been discussed.

Location

The archaeological remains ofMohenjodaro are located in northern part of the province of Sind. It is 267 miles from Karachi Cantt, the nearest railway station for Mohenjodaro is Dokri. From Dokri the site can be approached by a metalled road.

Associate Professor in the Department of Geography, PunjaJ University, Lahore.

TOPOGRAPHY

MOHEN_JO_ DARO AND SORROUNDING AREA

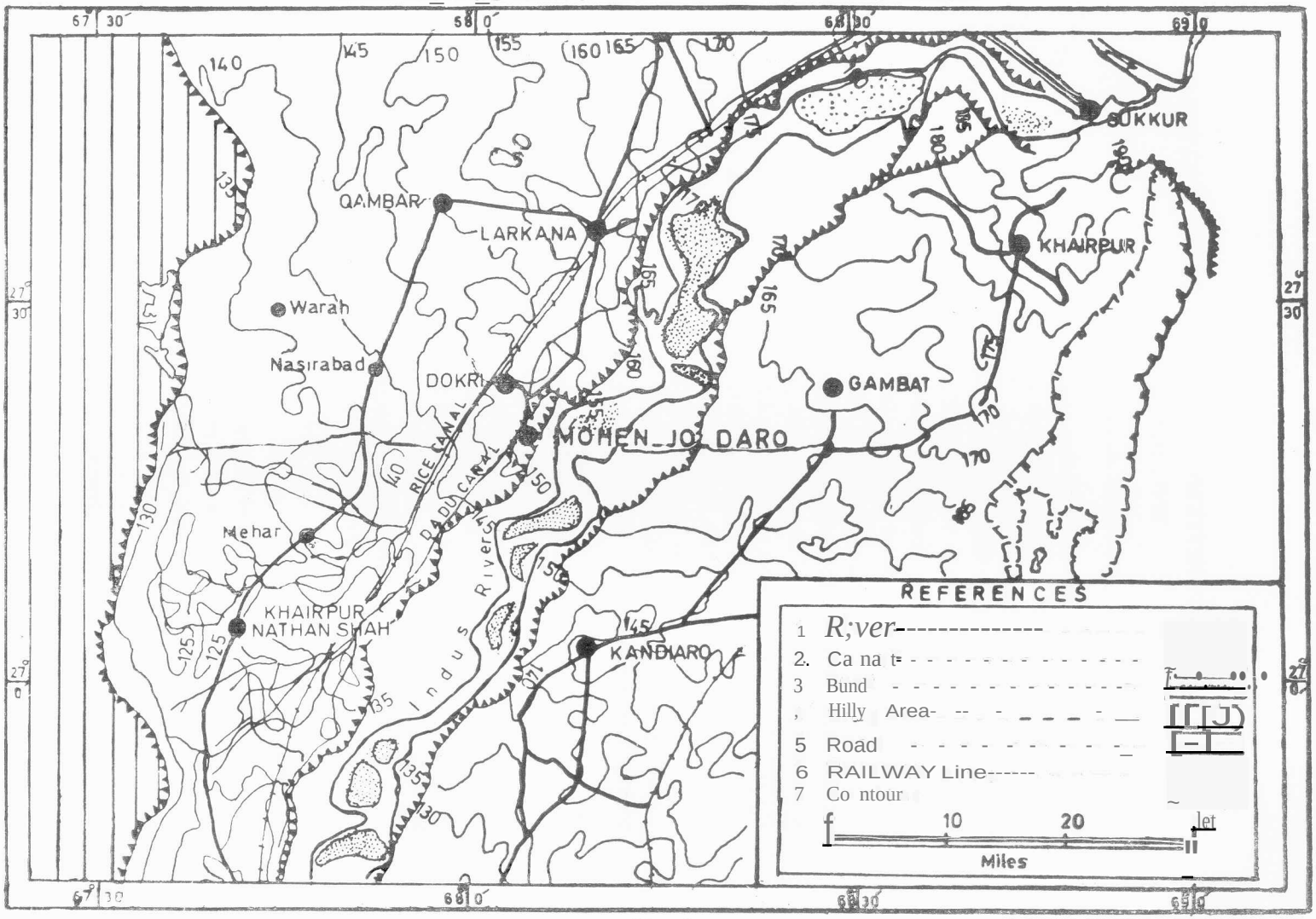

Fig. 1

Topography

On the east at about 1/2 mile distance from the ruins is the levee of river Indus. The Dadu perennial canal flowing in a north-south direction is about 2 miles to the west of the monument. . The entire archaeological site is surrounded by a man made earth embankment. . (Fig. 1). The]50 ft. contour line touches its southern edge and the] 55 ft. contour is very close to its north western boundary. Maximum flood levels in river Indus near the monument in the past have reached] 75 ft. above sea level. The Dadu canal in the neighbourhood has water flow level of]58 to 160 ft. above sea level..

Geology

The land surface on which Mohenjodaro lies has evolved through thousands of years of alluvial sedimentation. During the post glacial period enormous sediments were spread out on the Indus plains to great depths. Most of the sediments were laid down in the late quaternary subrecent to recent times The Mohenjodaro flood plain developed on the inside of meander bend and grew slowly by repeated migration of the meanders. During the course of shifting successive series of alternating arcuate ridges and sloughs were formed, With the passage of time the low lying areas of sloughs were sealed off and became the site of poor drainage with swamps, ponds and lakes. High flood of the Indus gradually filled them with fine sediments.

The Gher Branch and the western Nara, both these spillways prior to 1932 had a tortuous course and regularly and extensively produced bank topping floods for centuries. In the pre-canalization period, both the spillways and bunds may have played a significant role in reshaping the land forms. Their remenants in some places show an elevation of few feet from the surrounding natural surface level.. It is amazing how the people of the area may have maintained the agriculture and the irrigation works over period of centuries.

Texturally, the sediments are well sorted and have an intricate pattern of stratification and show frequent lateral and vertical changes in lithology. The predominant textural group of alluvium ranges to a mixture of fine sand, silt and silty clays.

Like the rest of the rivers of the Indus plain the Indus has a tendency to migrate westward. The geological history of the river is not well known. From the reconnaissance geomorphological studies carried out in the recent years it appears that the river once reached its western alluvial limits and is

now touching in many places the piedmont plains formed by the material contributed by the kirthars.

During the Greek period, according to Mackay,1 the Indus flooded the surroundings of Mohenjodaro at least three times. The city near about 2,000 B.C. was most probably a little to the east of Mohenjodaro.2 Continuous flood losses and the consequent disasters suffered by the residents may have been one of the major causes of desertion of the city.

The Mohenjodaro plain and the surrounding area appears almost flat on the aerial photographs and Mosaics. One meander flood plain can be identified running southwards from Larkana but appears to have been filled in by sediments of the two inundations canals.

Climate

One of the significant factors controlling the climate of the area is the weak regional effect of prevailing south to north and vice versa flow of air. The warm moist air blows from the sea and dry air from the north. Weather records for proper Mohenjodaro are not available, only rainfall data for Dokri, located a few miles north west of the site, is available which is given below :

DOKRI RAINFALL

Month	Rainfall	Month	Rainfall
January	0.24	July	1.40
February	0.08	August	0.79
March	0.00	September	0.31
April	0.08	October	—
May	0.01	November	6.02
June	0.17	December	0.22
Total Annual Rainfall		=	3.56"

20 years average figures. Source: North West Canal Circle Larkana.

Today Mohenjodaro has typical desert climate. The maximum summer temperature in the surrounding area may rise to 110°F and mean minimum to 104°F. Similarly the mean minimum and maximum winter temperature

1. E. Mackay *The Indus Civilization* (1935) p. 20.

2. M. M. Memon, Changing Courses of Rivers in Lower Indus Plain, Presidential Address, All Pakistan Science Conference.

may range upto 7QoF and 60uF respectively. Average rainfall is very low amounting to 3.56". Dust storms commonly occur during summers. However, it is our belief that the close proximity of river Indus, canals and the rise of ground-water near the natural level may have considerably modified the microclimatological environments of the area. Microclimatological data for Mohenjodaro is not available as yet.

In this arid area evaporation is very high. Although no evaporation data for Mohenjodaro is available, an estimate of evaporation has been made on the basis of surrounding stations. The lake evaporation for Jacobabad, Sukkur, Nawabshah, Haiderabad and Khanpur clamatological stations was determined on mohthly basis from the co-axial graphic correlation method using the following formula [1]:

$$E = 0.7 \left[\frac{Q + E_a Y}{6 + Y} \right]$$

where

E = lake evaporation in inches per day

Q = net radiation exchange in langleys per day

t = slope of saturation vapor pressure curve at air temperature

y = factor defined by Bowens ratio (0.005 inch Hg/FO)

$E_a = (e_j - e_a) 0.88 \quad (0.37 + 0.0041 \; Up)$

e_j = saturation water vapour pressure of air temperature.

e_a = saturation water vapour pressure at dewpoint temperature.

Up= wind movement in miles per day.

Average monthly air and dewpoint temperatures and wind movement data were taken from "Climatological Summary, West Pakistan Observatories", West Pakistan Meteorological Tables. The generalized Isopleths were drawn on the basis of the computed values and no weight was given to the pan values. On the basis of in-terpolation of isopleths the average annual evaporation for Mohenjodaro was determined to about 72.5" which is approximately twenty times more than the average annual rainfall of Mohanjodaro.

LANDFORMS

Piedmont Plains

At the foot of the Kirthar mountains lie the piedmont plains which slope undulating and gently from west to east in a transverse direction to that of

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1. U. S. Weather Bureau, Evaporation from Pans and Lakes, Research Paper No. 38, 1955.

Indus fluvial plains. The detrital material transported from the mountain front was deposited as piedmont plain by a number of streams flowing eastward. The plains relatively have permeable unconsolidated material.. Many hill torrents have entrenched their valleys in the piedmont plains, the lower parts of these hill torrents have been embanked by local people for using torrent water for cultivation pruposes. In the lower parts the boundry between the piedmont plains and the subrecent flood plains forms a wide imperceptable transitional zone. (Fig. 2)

Subrecent Flood Plains

Which have been mapped as meander flood plains by Colombo Plan Project are generally level to nearly level plains and contain in them shallow and broad basin and covered levees. This landform has been dated ranging in age from 400 to 6000 years back.

Active and Recent Flood Plains

The active and recent flood plain of the Indus river is the surface bordering the river that is periodically largely covered by flood water. Microphysiographic features such as sand dunes, meander loops, meander scrolls, abandoned channels, and flood flow channels OCcur in active flood plain belt all along the river width.

Soils

Study of reconniassance soil maps show that soils of Mohenjodaro belong to Lodhra association. The eluvial or A horizon material consists of dark greyish brown silty clay with pH varying from 8.8 to 9.6. Top soil are calcareous saline-alkaline which when dry are friable. The structure is weak and coarse to subangular blocky. The topmost dark colour of the soil is suggestive that the minerals in this horizon contain a strong admixture of organic matter.

The B Horizon is a region of maximum accumulation of calcium carbonate and other salts. It is very dark greyish brown, firm calcareous dense silty with weak medium coarse subangular structure.

The C Horizon is either stratified or is composed of material of a buried eroded soil. It generally lies beyond the zone of major biological activities. The major lithological characteristics of Lodhran association, are shown in the

LANDFORMS

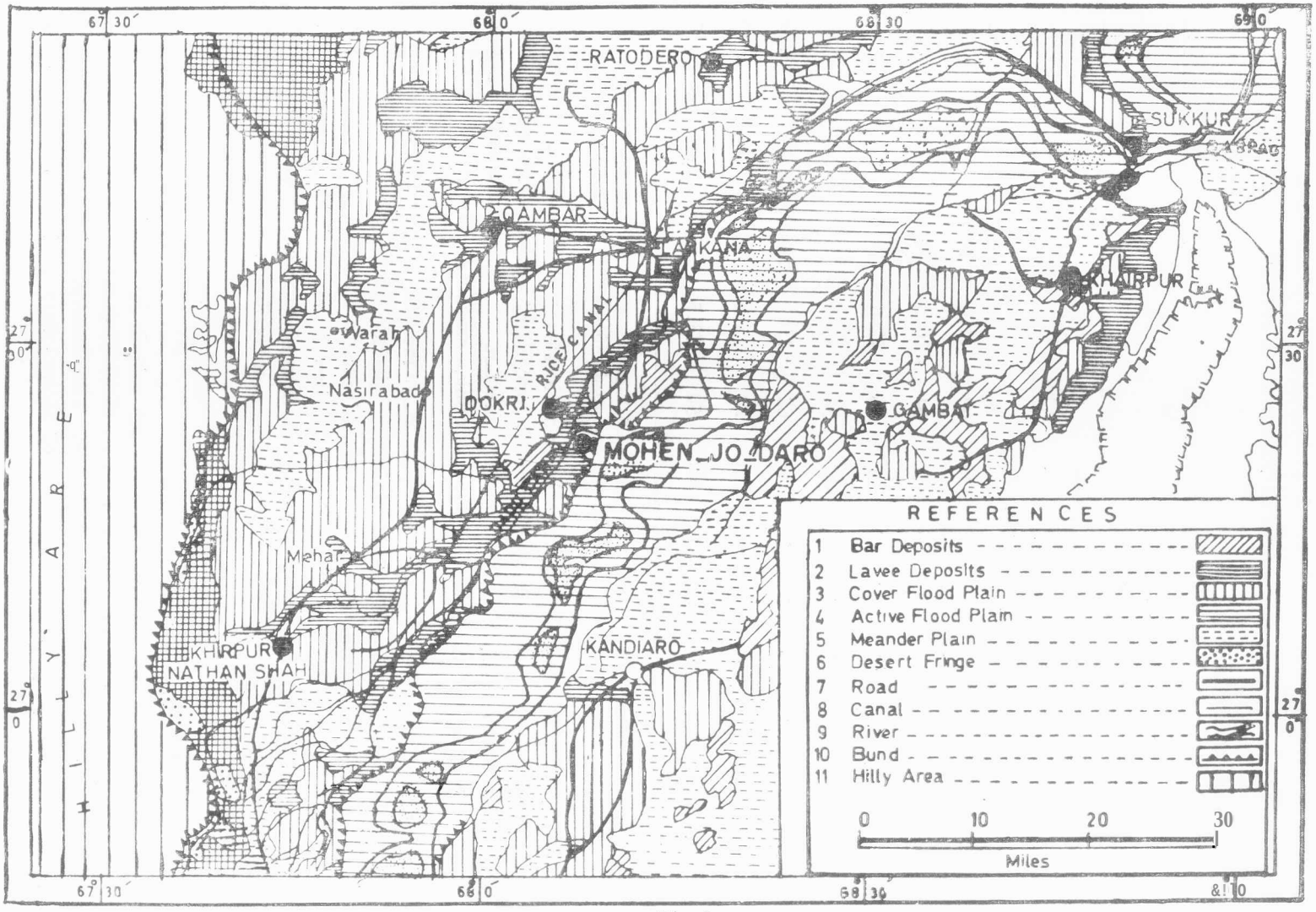

Fig. 2

following table :

pepth m cms	Mechanical Analysis (Hydrometer)					Chemical analysis			
	% Sand		% Silt		% Clay	% $CaCO_3$	CEC	% C	pH
	Int.	U.S.	Int.	U.S.					
0-8	6	0	34	40	60	11.0	16.8	0.36	9.94
8-16	10	4	26	32	64	10.5	16.&	0.20	10,40
16-38	12	7	32	37	56	12.0	J4,4	0.14	10.20
38-76	4	0	38	42	58	13.5	14,4	—	9.80
76-93	6	3	32	35	62	11,0	16.0	—	9.60
93-108	14	8	38	44	48	13.0	13.6	—	9,40
108-133	14	9	36	41	50	13.5	13.6	—	9.15

Lodhram Series, Location: About 136.8 meters south (180° magnetic bearing) of furlong stone No. If4 on Dokri-Mohenjodaro road. (Soil Survey of Pakistan).

The soils of Lodhran association are located in broad basin of subrecent flood plain which have flat smooth topography is which excess water is not removed rapidly, The topographic expression has significant influence on the climate vegetative effects on the soil forming process in the area.

Being located in the neighbourhood of the zone of transition of piedmont plains and the river food plains, the parent material may have a marked influence on the type of clays minerals present in the soil profile (Fig. 4) the data on major soil minerals of the area is not available at the moment, which would indicate its provenance or determine to a certain extent the source 9f origin of the material whether, it is entirely fluvial or partially belonging to piedmont area.

Hydrology

River Indus plays an important role in the hydrology of the area as it flows close on the eastern boundary of Mohenjodaro. Maximum discharge occurs in summer and low in winter. The discharge of the river at Sukkur nearest gauging station upstream of Mohenjodaro is given in the following

table:

Month	Discharge thousand cusecs	Montll.	Discharge thousand cusecs
January	32'68	July	375.90
Febnlary	32.71	August	503.06
March	35.51	September	262.58
April	64.69	October	96.92
May	119.17	Novembar	44.10
June	203.17	Decembar	35,40

As can be seen from the table the river discharges during the months of June, July, August are the highest.. Duriing this period the river overflows and indundates narrow belts of land along its active channel.. The intensity of the floods in the adjoining areas has been considerably reduced due to construction of bunds around the river and barrages upstream. During the flood season maximum recharge of water into the aquifer takes place and the watertable rises in the Mohenjodaro area. The floods start receding during the months of Septembar, but the soil moisture remains for the rest of the winter period.

The data on the bank erosion, its annual changes in the channel geometry and sediment load of the river Indus near Mohenjodaro is not available as no sediment observation station Is maintained by any agency.

Groundwater

Prior to 1932 the land on both the banks of river Indus was irrigated by inundation <:anals taking off from the river Indus north of Mohenjodaro. The right bank inundation canals carried huge discharge of water. From them extensive and intensive irrigation was practised. Mostly rice was grown in these irrigated areas

Due to ground water recharge through canals and intensive irrigation, watertable in the area started rising sharply creating waterlogging of land in

some parts. According to Shaikh[3] "the water table in some of these areas on the right bank of the Indus had risen to within a few feet of the surface though in most of these areas it was 12 feet deep".

On the opening of Sukkur Barrage system in 1932, the inundation canals were replaced by the perennial Dadu and the Rice Canals. In the early stages of development of the new canals excessive water was available which contributed substantially towards ground water recharge and accelerated the rise of water table.

According to Colombo Plan Report and the Reconnaissance Soils Landform and Landuse reports, 90% of the Upper Sind Plain have been mapped as predominantly poorly drained or waterlogged. Poorly drained areas also include marshes with standing water and clayey wet rice soils.

Although the problem of waterlogging in Sind was identified in 1917, however, the results of reclamation and preventive measure were not effective and were negated by continuous rising of the ground water table, today the alluvial sediments around Mohenjodaro are saturated with water to less than few feet of the ground. The ground water is not in a static position but very slowly moves in the down valley direction. (Fig. 3.)

It is probable that ground water in the area originated at the time of formation of the fluvial plains of the Indus. Since then the ground water hydrological and climatic condition in the area were such that the native ground water dissolved lot of minerals in it. It is generally believed that the fresh water originating from the river and the canals lies superimposed over the highly mineralized ground water. During the ground water investigation of the lower Indus Plain in mid-sixties no where fresh ground water was found to extend up to the bedrock basement. There appears some association of fresh ground water and landforms in the area, in some places it lies beneath the active, meander and cover flood plains but this distribution of fresh ground water is not well understood.

Salinity

The western surrounding area of Mohenjodaro though arid in character appears to have played a significant role in the concentration of salts near the site. The run off from the Kirthar Mountain piedmont slopes, and the severely saline areas and patches of saline land during the high and intense rainfall periods carried with it dissolved salts to the east and laid them down in poorly

3. A. R. Shaikh, Waterlogging and Salinity in Lower Indus Region, *INDUS 1980* p.26.

MOH EN_JO_DARO

WATER TABLE CONTOURS

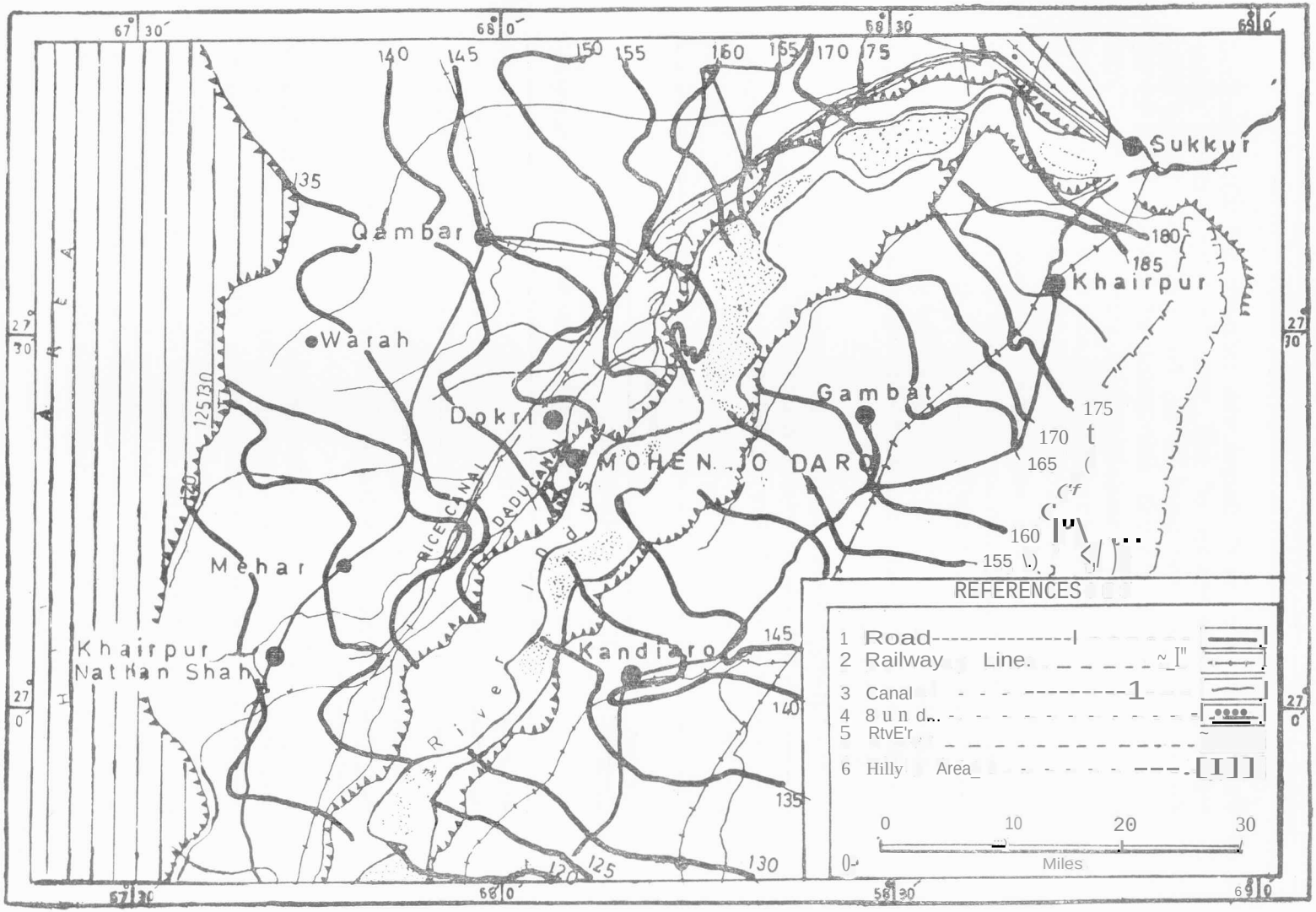

Fig. 3

drained areas. The runoff charged with sediments and salts accumulated and created saline patches of soil. With the filling in of the poorly drained areas, the runoff found its way further eastward. Though slow, however, the process repeated over periods of centuries helped in the transport of salts towards Mohenjodaro plains near the Indus Bank. The salts in the past before man started interfering with the natural environments. washed out by the annual floods of the Indus. The construction of flood embankments, irrigation canals and the agricultural fields interfered with the natural runoff from the western slopes entering into the river Indus and thus upsetting the natural salt balance in the area. (Fig. 4)

According to Frazer[4] 23.2 % of the Upper Sind plain has been mapped as predominantly severely saline and 64.5 % of the region as area in which saline patches are common.

The following table showing the nature of salinity in Dadu and Rice Canal Command has been compiled from a WAPDA's Lower Indus Report.. The salt concentration in soils in Rice and Dadu Canal command area can possibly have the following explanation:

Canal Command	Percentage of gross area			
	Non Available	Moderately salt effected	Severely salt effected	Unclassified seasonal swamps
Rice Canal	4	70	21	5
Dadu Canal	1	51	47	1

From the table it appears that 91% of the Rice Canal and 98% of Dadu Canal Command is moderately too severely effected by the presence of salts in varying quality.

The first category covers all soils where the average electrical conductivity (saturation extract of both the upper soil (0. 150 ems.) and of substratum (150-450 ems.) is less than 16 millimohos per em. Clearly this is a very broad category, covering entirely non-saline soils and those on which crop growth is seriously effected. It embraces the majority of soils now in use, which with drainage and proper watering will improve, and it indicates the unused land where irrigation will be immediately practicable without leaching programmes. The severely salt effe:;ted land includes all greater degree of salinity and again is a very broad category.

MOHEN_:JO_DARO

UPPER SOIL SALINITY

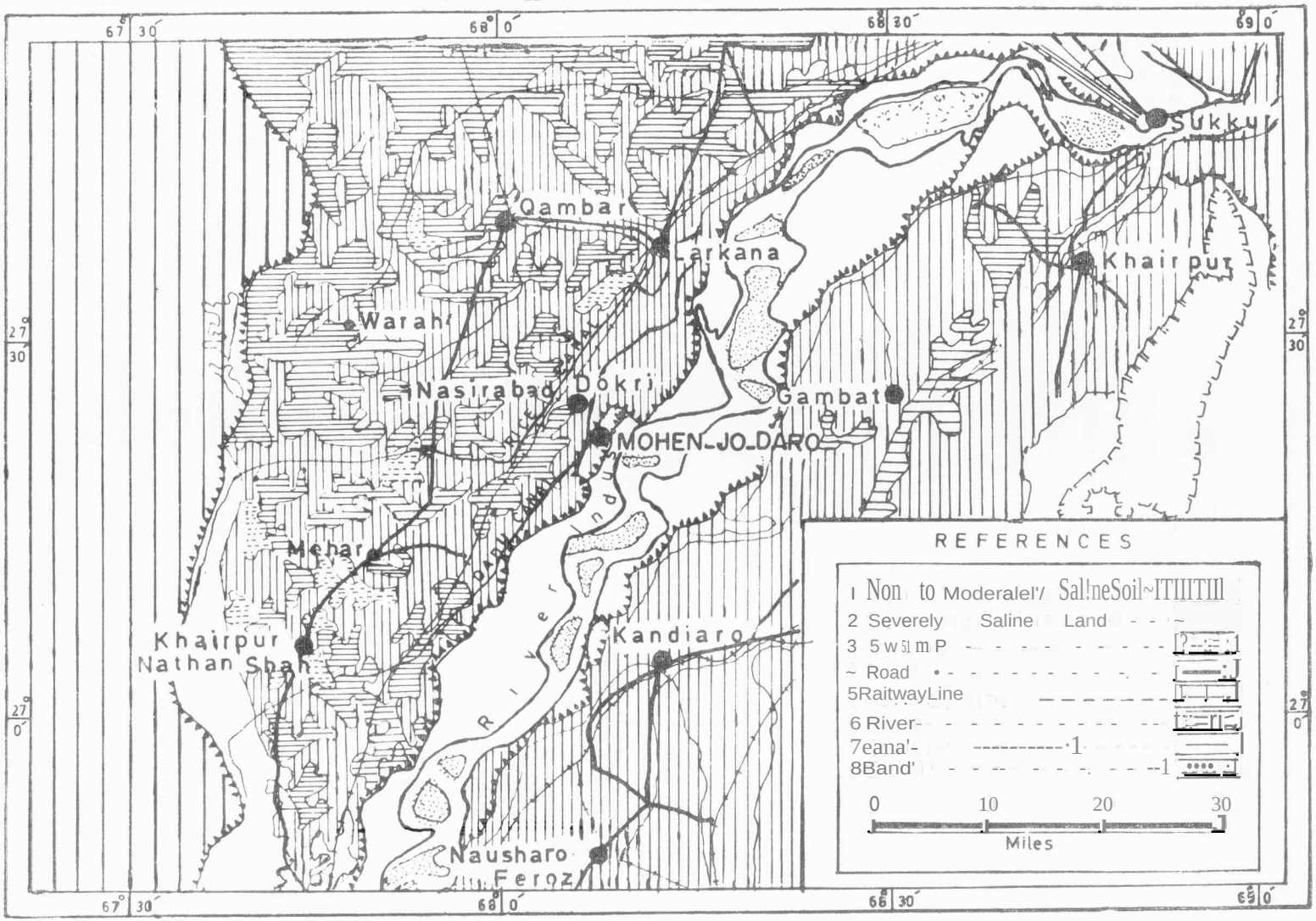

Fig. 4

Conservation and Restoration

The problem of salt damp was identified by the archaeology department in early sixties, and appeal was made to UNESCO, for help which was responded very well. UNESCO and Pakistani experts investigated the problem which led to the preparation of a comprehensive master plan for the restoration of Mohenjodaro in 1972. The salient features of the master plan were:

1. Control of Groundwater and lowering of watertable.
2. Conservation of Architectural and other structures.
3. River training for Bank protection from river erosion.

Systematic conservation measures suggested by various agencies are being taken up to restore the monument from the salt damp problem.

For the control of rising of watertable WAPDA has been assigned the project. It is hoped that about 65 tubewells shall be installed in two rings in three phases which should be able to lower the groundwater level to about 60 feet depth. In the first phase 14 tubewells are planned to lower the water-table to 20 feet depth, on the second stage 12 more tubewells will lower the watertable to 30 feet. In the last phase 30 tubewells shall lower the water table to 60 feet depth. If further exploration of Mohenjodaro to greater depths is required the water table shall have to be lowered and maintained below 70 feet. The cost of continued tube wells operations and other restoration work shall amount to very high financial commitments.

For the conservation of structural remains, provision of mortar and cement support, laying of damp proof course with plastering, the removal of salts from the monument and effective drainage have been suggested. For bank erosion a river training programme through the construction of various kinds of spurs has been suggested.

Discussion

Conservation of the monument shall depend on careful day to day study, efficient maintenance and keeping pace with modern technological advances. As has been discussed earlier that the environmental characteristics in and around the monument are continuously changing with the fluctuation of ground water-table. Even when all the planned tubewells become operational and the water-table starts lowering in the area, there will be changes in temperature near the ground, soil moisture, soil temperature, humidity and evaporation and vegetation which will react with Mohenjodaro's environments continuously to induce different chemical and physical activities in different quarters.

The study of landforms and distribution of soil salinity shows that soils of poorly drained areas are more saline than the relatively well drained soils. This

type of rise of salts in soils may take place upto a depth of several meters, specially in relation to salt damp problems of buildings. The presence of moisture near the ground and high evaporation rates can become serious. Unlike salts in agricultural land, which percolate back into the soil to some extent after infiltration of rain water, the process of salt damp on buildings appears to be irreversable.

The rise of salt moisture from the ground to the walls generally produces salt damp problems in buildings. Damage to structures also depends upon the nature of bricks whether they are well burnt or imperfedly burnt..

Usually, the major defects in the quality of bricks arise in the techniques and methods used in baking the bricks in the Kilns. Although today the bricks are baked using coal from the mines, some kilns use mixture of coal, rice husk and diesel oil mixture for firing the bricks. The quality of bricks varies widely from place to place.

Five thousand years ago, it may be assumed, that coal was not mined in Sind and Baluchistan. The artisans of Mohenjodaro possibly used dried wood for firing the bricks for the construction of their city. It is likely that due to improper firing techniques and the use of saline soils resulted in lots of poor quality bricks.

Under existing climatological conditions, groundwater regime, threat of floods, proximity of irrigated lands and canals, keeping the soil at the base of plinth dry is a difficult challenge which would require huge efforts and large sums of money.

The installation of large number of tube wells around the monuments for lowering the watertable and creating a zone of aeriation so that instead of water air is contained in the soil pores at contact with the plinth surface is another remedy.

There is such a great need of setting up of microJimatological observatories throughout the country. It is not at Mohenjodaro alone, but all the important historical monuments of the country which need preservation need this data. The growth of the cities, mechanization of agriculture, use of fertilizers and insecticides, increase in traffic, construction of multistoried buildings, and multiple other causes bring changes in microclimate. Unlike climate a few meters above the ground which is more related to a beneral circulation and overall changes in climatic elements in lar ger areas, microclimates are deeply rooted to the ground. Vegetation can cut down the intensity and duration of insolation of the areas lying directly underneath. Dry soil temperatures may shoot very high on exposure to sun while moist or wet soil may lower its temperature due to evaporation and water holding capacity of soils, the position of watertable may play equally important role.

Location and installation and number of micro climatological stations may have an important bearing on the kind and type of data. Its usefulness may also depend upon the accuracy of punctuality and continuity and regular scrutiny and tabulation by professional staff. Short term data may be used for immediate needs, but to establish the changes, or continuity of the prevailing conditions long term data shall be required. Microclimatological data alone may serve little until it is profitably related to soil temperatures, moisture thelmal conductivity, chemical, hydrological and engineering properties of the soil. For which detailed topographic, geologic, pedologic and hydrologic maps alongwith maps of engineering properties of soils shall be required. All micro-climatological observatori-::s may have with them sensitive thermo-couples installed in soil at various levels upto depth of the order of 10 meters. In order to compliment the microclimatological data and its interpretation horizontal and vertical variations m:ty be recorded using time lapse photographic techniques.

A few photographic stations may be made on fixed ground preferably (3L x 3W x 2h) on which either a single camera or double stereocamera should be fixed. At some known distance from the photo station a marker preferable a 2f' dia pipe coated white may be fixed in the ground with cement, while taking photograhs camera should be placed on tripod at a fixed height and levelled and brought in the alignment of marker, the top of the marker should be brought in the centre of the cross wires of the camera atd the film exposed. From one station several photographs can be taken. to start with a series of monthly photographs can be taken. Each exposure should give the number of stations number of marker, time date month year and the suns angle. Preferably the same type of films printing paper 9"′ x 9" be used throughout. . If any change is made in the type of film, exposure time and, sun's angle, all changes should be recorded. The study of such photographs in a series will bring out the changes taking place in time and space. If possible yearly maps showing environmental conditions may also be made using the photographic prints by stereoscopic paral!ex plotting machines. This data would compliment the microclimatological studies. Appearance of salt and the decay of bricks may also be monitered through time-lapse-photography. The photographic record would also help a lot the future conservationists.

The first environmental equilibrium in the area was achieved when the plains were formed in cenozoic period. Seepage from the surface water and evapotranspiration maintained the native groundwater in equilibrium at a constant depth without any serious fluctuations. The study of the past climates[1] shows that around 400) - 3COO B.C. the climatic optimum

1. W. D. Seclers, Physical Climatology. Chicage University Pr. 1965.

mean temperatures for the middle latitudes were 2.5°C. above the present. The rainfall was higher than the present. These conditions may have certainly produced some imbalance in the environments of Mohenjodaro. With the passage of time cooler and drier conditions prevailed in the area round 3000-750 B.C This was the period when possible Mohenjodaro civilization had almost lived up and the remains of the city were being burried under the alluvium deposited by the river Indus. Once the monuments were burried under alluvium changes in the surfacial environments did not effect the burried parts; the alluvium deposit worked as protective blanket for the monuments. From 1550 to 1880 A.D. with the onset of little ice age mean temperatures in the northern hemisphere fell 1°C below the present, possibly drier weather conditions prevailed in the lower Indus plain during this period, coupled with slight change in the range of S. W. Monsoons led to extreme arid conditions. Surrounded with the Thar Desert, the Rann of Kutch and the Baluchistan, the strong summer winds and dust storms lift lot of sand and have the tendency to destroy the scanty vegetation and thus further intensifying desertification in the area.

With the begining of the present century man has become an important geologic agent. With the use of modern engineering has been able to extend is influence from the coast to the mountains in north. Unfortunately the dead Mohenjodaro came out of door when the man was busy in engineering the enviorment around it. It was man's engineering and technology discussed earlier in the article that have created huge problem for its preservation.

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REGISTRATION OF VITAL DEMOGRAPHIC EVENTS IN THE PUNJAB

MASAUD A. MIAN*

Introduction

There is ample evidence to the effect that the subcontinent of Indo-Pakistan had, since ancient times, a complex and quasi-religious system of registering births, deaths and marriages in her self-sufficient rural communities!. Thus a beginning in this regard had been made in the remote past, though the scope and accuracy of such a registration system cannot be ascertained. However, the introduction of a systematic registration of vital events in its modern form owes its origin to the British period.

The available record reveals that the system of vital registration in the various constituent parts of Pakistan is a legacy of the system introduced in British Punjab during the second half of the nineteenth century. Registration of mortality was initiated under the orders of the Inspector General of Police vide Section 12 of the Police Act, 1861.. Consequently, the statistics of deaths were published for the first time in the "Annual Report of Inspector General of Dispensaries, Punjab" for the year 1865 and in the "Annual Health Report of the Punjab" for 1867. The registration of both births and deaths was provided a locus standi in the form of by-laws framed under Section 11 of Act XV of 1867 which were first adopted by all the towns of the Province. These by-laws made the head of the household responsible for reporting the occurrences of births and deaths to the municipal registry office. In some towns this duty was assigned to the *mohalladar* (ward keeper) and the sweeper of the *mohalla* (ward)2.

The birth statistics in the Punjab were first published in the Annual Report of the Sanitary Commissioner Punjab for 1870. In rural areas however birth registration did not begin until 1880. The events of births and deaths in the rural areas were to be registered by the village *chowkidar* (watchman) who was supposed to maintain two separate books for the purpose of births and deaths in which entries could be made by any resident of the village who could write. However, it was the responsibility of the village *numberdar* (headman) to get the entries made. In 1876, *Chowkidara* Rules were notified under the Punjab Laws Act, 1872. According to these rules the duties of the village headman and the village *Chowkidar* were explicitly defined and

*Dr. Masaud A. Mian is Assistant Professor in the Department of Geography, Punjab University, Lahore.

they were made responsible *inter alia* for reporting the occurrences of natality and mortality.3

The above system continued after the birth of Pakistan until it was streamlined in 1959. Thereafter the registration of births and deaths in rural areas started to be carried out under the Basic Democracies Order, 1959 and in the Urban areas under the Municipal Administration Ordinance, 1960. Under both these legal orders, the head of the household was made responsible for getting the events of births and deaths registered. In rural areas such a registration was to be made in the union council offices directly by the head of the household or through the *chowkidar.* In the urban localities, the occurrences of births and deaths were to be reported and registered in the registration office of the town or municipal committee.

The responsibility of getting these events registered was that of the head of the household. In 1974, the Basic Democracies Order, 1959 and the Municipal Administration Ordinance, 1960 were repealed and replaced by new Local Government Acts. But by-laws under these Acts could not be framed and therefore the regirtration of briths and deaths continued within the legal framework of 1959-60. In 1979, however, the fun;tions of registering births, and deaths and maintenance of vital statistics was entrusted, under the Punjab Local Government Ordinance 1979, to the rural local councils for rural areas and the urban local councils for urban localities.

Modus Operandi

For the purpose of recording births and deaths, two separate registers are kept in the concerned office in which the following information is entered:

Birth Register	Death Register
1. Annual Serial Number	1. Annual Serial Number
2. Date of registration of birth	2. Date of registration of death
3. Date of birth	3. Date of occurrence of death
4. Sex	4. Name, caste, religion and residence of the deceased
5. Father's and/or Grandfather's name	5. Father's name (or husband's name for married woman)
6. Place of birth	6, Sex
7. Occupation, caste, religion and residence of the father	7. Age at the time of death
8. Name of the child	8. Cause of death

Birth Register	Death Register
9. Name of the midwife who attended delivery	9. Place of death
10. Name, parentage and residence of the person reportihg the birth with his signatures or thumb impression	10. Name, parentage and residence of the person reporting the death with his signatures or thumb impression

A copy of the entries collected in respect of births and deaths is sent by the municipal and town committees at the end of every week to the District Health Office. The copies of rural birth and death registers are, however, sent to this office after the expiry of a month by the respective union council.. The copies collected for a month by the district offices are tben transmitted to the Divisional Health Directorates where the data are processed by the statistical sections.

Major Defects in the System

At face value this method looks straight-forward and very efficient and the final tables based on the returns of anyone month should be ready regularly in the following month. In practice, however, the system has not proved to run on an even keel and a few years' delay is not quite uncommon. This may be due to the lack of a sense of responsibJity among the personnel concerned, unawareness about the importance of these statistics, poor means of communications and inadequate facilities for copying etc. in the relevant offices. The basic reason for the failure of this system however seems to be the lack of training of the local registrars as well as the inadequate supervision of their work. There is a general lack of realization about the importance of this work *vis-a-vis* other administrative duties assigned to them. And this sort of carelessness added to the low degree of coordination b;:tween the Health Department and the Local Government Department is mainly responsible for the limitation *oc* the system. This deficiency is further confounded by underregistration of vital events prevalent in varying magnitudes in various urban and rural localities. And the net result of this is that the registration system is inadequate in coverage as well as in quality.

Accuracy of the Vital Statistics

The earleist inquiry into the scope and accuracy of vital registration in Pakistan was conducted by Khan (1957) who estimated that in the Punjab Province, where the registration system was comparatively better than in other areas, there was 27.2 per cent underregistration of births and 53.4 per cent that

of deaths during the period 1950-52.4 In a subsequent study, Khan and Ziauddin (1959) estimated that during 1954 in the whole of Pakistan, the underregistration of births and deaths was 29 and 46 per cent respectively.s

In view of the low level of accuracy and reliability of vital statistics through the official registration system, the need was felt to develop a reliable system of vital data collection. As a result, the Population Growth Estimation (PGE) Project was launched in 1961. This was aimed at collecting birth and death statistics through a sampling approach in selected sample areas.

The overall objective of the PGE Project was to provide reliable estimates of birth and death rates by employing simultaneously a dual system of data collection viz. Longitudinal Registration (LR) and Cross Sectional Survey (CS). The PGE experiment conducted by the Central Statistical Office in collaboration with Population Council, New York, National Health Centre, U.S.A., and Pakistan Institute of Development Economics covered the period 1962-1967 and yielded estimates of the vital rates for 1962-65. In January 1968, the PGE Project was replaced by a similar experiment-the Population Growth Survey (PGS)-which was aimed at estimating vital ra~es through a single system approach of periodic surveys. The Population Growth Survey (PGS) produced data for the years 1968, 1969 and 1971. But, although a good deal of improvement in the quality of data has b;en witnessed, information on the populatoin growth rate and its components is not yet as accurate as the population analysts would wish.[6]

Numerous studies have been undertaken on various population aspects by using the PGE and PGS data, all of which have pointed out a massive degree of underregistration of births and deaths in the area.

Gustafson (1965) estimated Crude Birth Rates (CBRs) and Crude Death Rates (CDRs) on the basis of the 1964 data of some PGE sample areas? and her results are set out in Table 1. The wide degree of a:-eal variation in these rates depicts, more than anything, enormous variation in the quality of coverage as well as massive underregistration of vital events. While the LR system of the PGE indicated in 1964 a CBR and COR of 41 and 15 per thousand respectively, Gustafson's inquiry for the same sample areas revealed that almost 50 per cent of the vital events were not recorded by the official registration.

Seltzer (1968) suggested an underregistration of 43 and 50 per cent in births and deaths respectively8, while another study, through its investigation of the birth and death statistics of Pakistan's twelve biggest urban localities, found that the level ot underregistration in these localities ranged between 20 and 90 per cent in the case of births and between 40 and 94 per cent in

TABLE I

VITAL RATES FROM OFFICIAL REGISTRATION SYSTEM IN THE PGE SAMPLE AREAS, 1964

(Per thousand)

Sample Area	CBR	CDR
Aliwah (Punjab)	6	6
Bhedian Chak 35 (Punjab)	15	3
Chak 821GB (Punjab)	32	14
Hyderabad (Sind) Urban	10	2
Karak (NWF)	45	10
Khudadad (Sind)	3	1
Leghari (Sind)	0	0
Mochh (Punjab)	27	3
Raman (Punjab)	4	1
Rawalpindi (Punjab) Urban	21	2
Simbli (Punjab)	9	14
Wazirabad (Sind)	14	14
PAKISTAN	21	8

Sources: Gustafson (1965).

deaths.[9] For the rural areas, it was discovered that there was an under-registration, in 1968, of 57 and 60 per cent respectively in births and deaths,[10]

Another inquiry looked into the performance of the vital registration system in Rawalpindi city. Comparing its findings with the 1968 PGS rates, it discovered that in 1967 there was an underregistration of 39 and 80 per cent in births and deaths respectively.[11] In the case of the Punjab, an under-registration of 40 and 73 per cent in births and deaths respectively was discovered during the period 1971-73.[12]

As we see, all these inquiries support the common conclusion that there is a substantial degree of underregistration of vital events in the area. In these circumstances, published birth and death rates for the region are to be taken with great caution.

Marriage Statistics

Registration of marriages bears an altogether different picutre. It was in 1886 that the "Births, Deaths and Marriages Registration Act" was passed by the Government of India. The Act, enforced in 1888, provided for voluntary

registration of these events amongst some communities such as Jews, Araminians, Parsis and Christians. The registration of marriages in these classes continues to be carried out under the same Act and the Deputy Commissioner of the district acts as the Registrar. There exists no arrangement however for the processing and publication of the statistics of these marriages.

Amongst the Muslims, marriages were made registerable, for the first time, under the Muslim Family Laws Act, 1961. The registration form, called *nikah nama*, contains the following information :

(i) Year of marriage (ii) Name of the union/town committee (iii) Age of bride and groom *(iv)* Marital status of the bride at the time of marriage *(v)* Amount of *mehr* (dower) in Rupees. *(vi)* Date of marriage according to the *Hijri* (Islamic) Calendar

Keeping record of these marriages is the responsibility of the union committees in the urban areas and union councils in the rural areas. There is however no arrangement for this record to be transmitted to any central or higher office. Tabulation and compilation of marriage statistics therefore is not done at any level. Consequently nuptial statistics collected on the basis of marriage registration are not available in a compiled form.

Conclusion

In conclusion, it should be understood that the system of collectng vital demographic data in the Punjab and other parts of Pakistan is inadequate and suffers from various snags and limitations. Besides, there is a widespread underregistration of births and deaths. Even in the urban localities, where due to relatively better conditions one would expect a better level of registration and accuracy, there are wide ranging errors and omissions in vital statistics. The system needs to be streamlined in a way that the statistics collected through it become reliable. There is also great need for improving the publication of these statistics regularly. Attention should also be paid to the tabulation and publication of marriage statistics.

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LAHORE : A STUDY IN HOUSING PROBLEMS

M. MUSHTAQ*

The city of Lahore has evinced an immense increase in its population during the last 100 years or so. It is now the second biggest city of Pakistan. In this study the inflated population and its related housing problems have been discussed. During the first 50 years of its British occupation the city grew rather steadily, but later the decennial increase was, in general, markedly accelerated, as the following table shows[1]:

TABLE

Year	Total Population	Total Population Increase	% Increase for the previous decade
1868	125,493	—	—
1881	157,287	31,794	25.3
1891	179,854	19,750	12.4
1901	202,964	26,110	14.6
1911	228,637	25,725	12.67
1921	281,781	53,044	32.22
1931	429,747	147,966	52.51
1941	671,659	241,912	56.29
1951	849,476	177,817	26.47
1961	1,296,477	477,001	52.26
1972	2,022,577	726,100	64.70

1. Census of India, 1881,!Punjab, Vol. II, App. A., Table, No. XIX, 1891, Punjab and its frontiers, Part II, Table, IV, p. 4.1901, Punjab and NWFP, Vol. XVIII, Part IV, p. 10. 1921, Punjab ard Delhi, Vol. XV, Part II, Table IV, p. 10. 1931, Pnnjab XVII, Part II, Table IV. 1941, Punjab Vol. IV, Table IV, p. 25. Cenus of Pakistan, 1951, Punjab and Bahawalpur, Vol. V, Table 11-3. Poluplation Census of Pakistan, 1961, Distt. Census Report Lahore, Table 3. p. IV-4. Population Census of Pakistan 1972, *Distt.* Census Report Lahore. Table 2, p. 28.

*Dr. M. Mushtaq, is Assistant Professor Department of Geography Department, University

It is not difficult to cipher out the causes of gain of population by the city of Lahore. Before the establishment of British rule this part of the sub-continent had a purely agrarian economy, supplemented by pastoralism near the foot hills. Agriculture largely depended on rainfall and therefore, was confined either to the areas with enough rainfall to carryon agricultural pursuits or to the river valleys where well-irrigation was possible. The years of low rainfall were the year of scarcity, in some cases accompanied by famine and diseases.

The British Government paid immediate attention towards this problem. By the year 1860 the upper Bari Doab Canal was completed to provide perennial irrigation to the region around Lahore. By the end of 1930 the canalisation in the Punjab was complete. The enormous development in agriculture brought a boom to be city's trade and commerce. The then western Punjab had become noted for its fine quality cotton as well as wheat. Cotton became the major cash crop of the region and until 1954 almost all of this crop was exported. The city of Lahore, being the financial centre of the region, enjoyed major benefits of this trade. The expansion and improvement in the means of transportation also played an important part in strengthening the position of the city in the field of trade and commerce. At the same time centralization of functions, like civil and military administration, education, health and railway beadquarters and workshops were strong enough to attract a large number of people of all walks of life from other parts of the subcontinent and thus helped the multiplication of population and areal expansion of the city.

The growth of Lahore city is closely linked with the overall economic prosperity of the region. The gigantic canalization in the then west Punjab had changed the economic and social pattern of the region. The economic developments and industrialisation, mainly in Lahore, were enough to attract a large number of people from other parts. At the same time the city, as a regional capital, exerted its influence over the region. This component become even more assertive when in 1956 the whole of West Pakistan was merged into one political unit with Lahore as its capital. This decision proved vital to accelerate the expansion of the city's size. By virtue of this decision the auxiliary functions, allied with political authority, multiplied enormously. This brought in its wake large number of functionaries, advisers and others to the city from the whole of the country.

Again in 1959, the decision to establish the Federal Capital of Pakistan at Islamabad, proved equally important to stimulate further the rate of growth in the cit~'s size. These decisions infact had reversed the direction

of urban forces responsible for migration. Previously the focus was Karachi and noW the new foci had become Islamabad and Lahore. Apart from the functional concentration in the city, the rapid industrialisation in the towns like Faisalabad, Gujranwala, Gujrat, Wazirabad, Sialkot and Sheikhpura enhanced enormously the financial and commercial status of Lahore. Naturally these factors are important contributors to the prosperity and caused rapid expansion in the city-space.

The swelling of population developed enormous pressure on accommodation and created its acute shortage. This has resulted in the sprawl of the city of its worst kind and of serious magnitude.

Housing Position

In 1951 the city had only 82,000' houses which increased to 212,000 in 19612. Still the housing problem was not so tight as is now-a-days. The increase of population was 50%. There existed a precarious balance. Houses for rental purposes were ahyhow available. The expansion tempo of brick and mortar area was good. The cost of building on the whole remained low and land prices were very reasonable. The migrating people belonged to well to do sections of the country's population. This trend continued throughout the post-1961 decade. The land and building material prices remained alomst stable.

The expansion of housing, mostly in the form of detached bungalows, continued. The financially healthy section of population continued investing In the house building sector. This trend remained strongly visible in the Housing Schemes of Gulberg and Model Town. This scheme specially represents financially strong community capable of establishing spacious bungalows on large compounds. It in fact shows the extension of the housing policy adopted in the civil lines, planned and established before the establishment of Pakistan as a residential quarter for the Anglicised community of bureaucrats and other professionals and rich people of the city. Model Town also was planned and executed on the same lines, with extensive compounds and spacious houses. This shows the lack of vision of the planners to continue such a policy. It needed a rational approach keeping in view the future influx of population. There was a need of strictly controlled higher density housing schemes where both higher and middle sections of population could be accommodated.

1. *The Civil and Military Gazette,* Lahore's Report dated Feb. 17,1950.
2. Population Census of Pakistan District, Census Report Lahore. Table 10, p. 111-20.

Any-how the establishment of West Pakistan as one unit and shifting of Federal Capital to Islamabad, as referred to before, brought in large number of functionaries to the city. They chose to stay in Lahore and thus a house renting race commenced. This resulted in an imbalanced housing situation. It also accelerated the pace of expansion cosniderably, but the pressure of housing shortage continued accomulating. So, by 1971 the number of houses had risen to 318,803[3]. There however was shortage of residential accommodation, but was not so acute, still the city was accommodative for the low and average earners.

In the post-1971 period there has been a rapid inflow of people from the country-side into the city which influenced the city-scape enormously. The new entrants to the city's population had attacked every available open spece whether it was meant for vital civic functions or was under private ownership. The growth of shanty settlements generated anarchy of such a great dimensions in the urban areas all over the country that: it successfully bedevelled the political, economic, social and even organizational structure of the country. This influenced the city-scape considerably by adding a large number of 'kachi Abadies'. These unauthorised settlements contain fairly large number of economically loWer section of people. They number nearly 90 (Fig. 1) and constitute 29,960 households over a land occupance of more than 800 acres. They house more the 1,00,000 peaple without any kind of civic facilities.[1] So much so that even in some settlements drinking water may not be available easily. These shanty clusters, as is clear from the map, are scattered all over the city areas and show their concentration in the congested parts of the city. Here, no matter whether left over open space was meant for somevital use for the community or some one's personal or even meant for road-widening, parks or even drains, has been raided by them mercilessly. Ob"Jiously these parts of the city are economically very active and these residents provide cheap labour.. Also they carryon their petty day to day economic pursuits.

Apart from this, other low paid functionaries of government and other organizations also abound. They also compete to acquire residential premises of their own. This has developed an unmanageable situation and created worst kind of problems for the organizers ever known in the history of the city.

The commercial policy of development of the Lahore Development

3. Statistical Tables Punjab, Hou~ing, Economic and Demographic Survey 1973, Vol.. II, Part III. Table V, p. 292.

1. Information given by the Metropolian Planning Section Lahore Development Authority. 42 Lawtence Road, Lahore.

Authority, as a matter of fact, has encouraged the well to do people of the country to acquire plots at very high bids. This has inflated the land prices many folds. Therefore the people with financial strength or those influencial enough to secure funds from the financial institutions, succeeded in the aquisition of plots in the residential or commercial schemes launched by Lahore Development Authority. The following Table gives an idea of the plot areas in the schemes developed with predetermined layouts and provided with essential services :

Plot Areas in Different Schemes

Area Location Scheme	Size of Plots	Number of Plots	Area in Acres	% of the Distributed area
MODEL TOWN				
	2 Kanais	105	26.28	12.14
	1 Kanal	690	86.25	39.87
	% Marla	1000	62.50	28.8
	7 Marlas	870	11.81	5.46
	5 Marias	945	29.53	13.64
	Total number of all kinds of Plots 3010			
NEW GARDEN TOWN				
	8 Kanals	53	53.00	12.15
	6 Kanals	128	96.00	22.87
	4 Kanals	339	169.50	38.86
	2 Kanals	471	117.66	26.97
	1 Kanal	556	69.50	12.50
	1/2 Kanal	262	16.38	2.94
	7 MarIas	116	5.01	0.90
	5 MarIas	915	28.62	5.14
	Total number of Plots 2841			
NEW MUSLIM TOWN				
	8 Kanals	6	6.00	4.45
	4 Kanals	75	37.50	27.83
	2 Kanals	329	82.25	6.68
	1 Kanal	72	9.00	6.68
	Total number of Plots 482			
IQBAL TOWN				
	2 Kanals	242	60.50	8.84
	1 Kanal	515	64.38	9.40

Ara Location Schemr	Sixe of Plots	Number of Plots	Area in Acres	% of the Distri-buted area
	1/2 Kanai	6241	385.00	56.25
	7 Marias	1124	49.10	5.55
	5 Marias	3147	48.03	14.32
	3 MarIas	1449	27.20	3.97
MUSTAFA TOWN				
	1 Kanal	140	17.50	15.44
	1/2 Kanal	815	50.94	44.93
	7 MarIas	332	94.46	12.75
	5 Marias	975	39.47	26.87
FAISAL TOWN				
	2 Kanals	40	10.0	5.23
	8 Kanal	415	54.9	27.17
	1/2 Kanal	1850	115.6	60.52
	7 MarIas	140	6.8	3.19
	5 MarIas	230	7.4	3.87
Total D Area				
	1 I<:anal	177	22.12	7.86
	1/2 Kanal	3423	213.90	76.08
	7 Marias	598	26.16	9.30
	5 MarIas	606	18.94	6.73

A cursory glance reveals the distribution of development scheme areas in the city and parcelling of different size plots. The first five schemes are situated in the region of higher firm land. The distribution of this land, is generally among the financially better people. This may be taken as areas of minimum problems. On the other hand Gulshan-e-Ravi Scheme lies in lowland, and is weak soil are a with many problems.

Moreover the current land value reveals that in these schemes it is difficult for a person of everage means to acquire land and construct a house. Even plots of 5 or 3 marlas are beyond the reach of a person of average income.

It is a fact that most of the working population in the city has limited Jesources. If the percentage of the people, who have been pushed out of the house acquiring race, may be taken more than 75%, it is not an exaggeration. This worsened the position to such an extent that it has become difficult to get

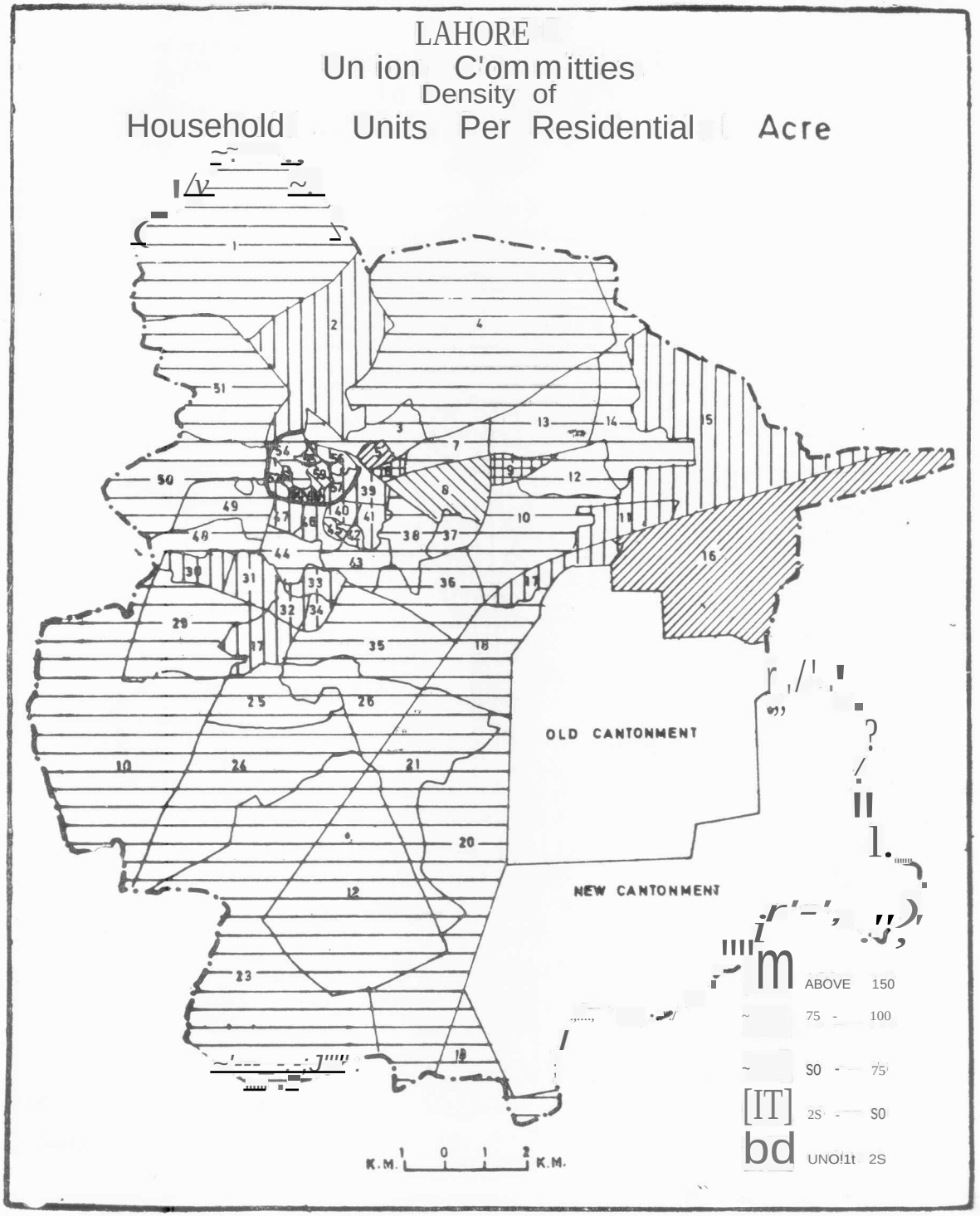
LAHORE
Union Committies
Density of
Household Units Per Residential Acre
OLD CANTONMENT
NEW CANTONMENT
ABOVE 150
75 - 100
50 - 75
25 - 50
UNDER 25
K.M. 1 0 1 2 K.M.

Fig. 1

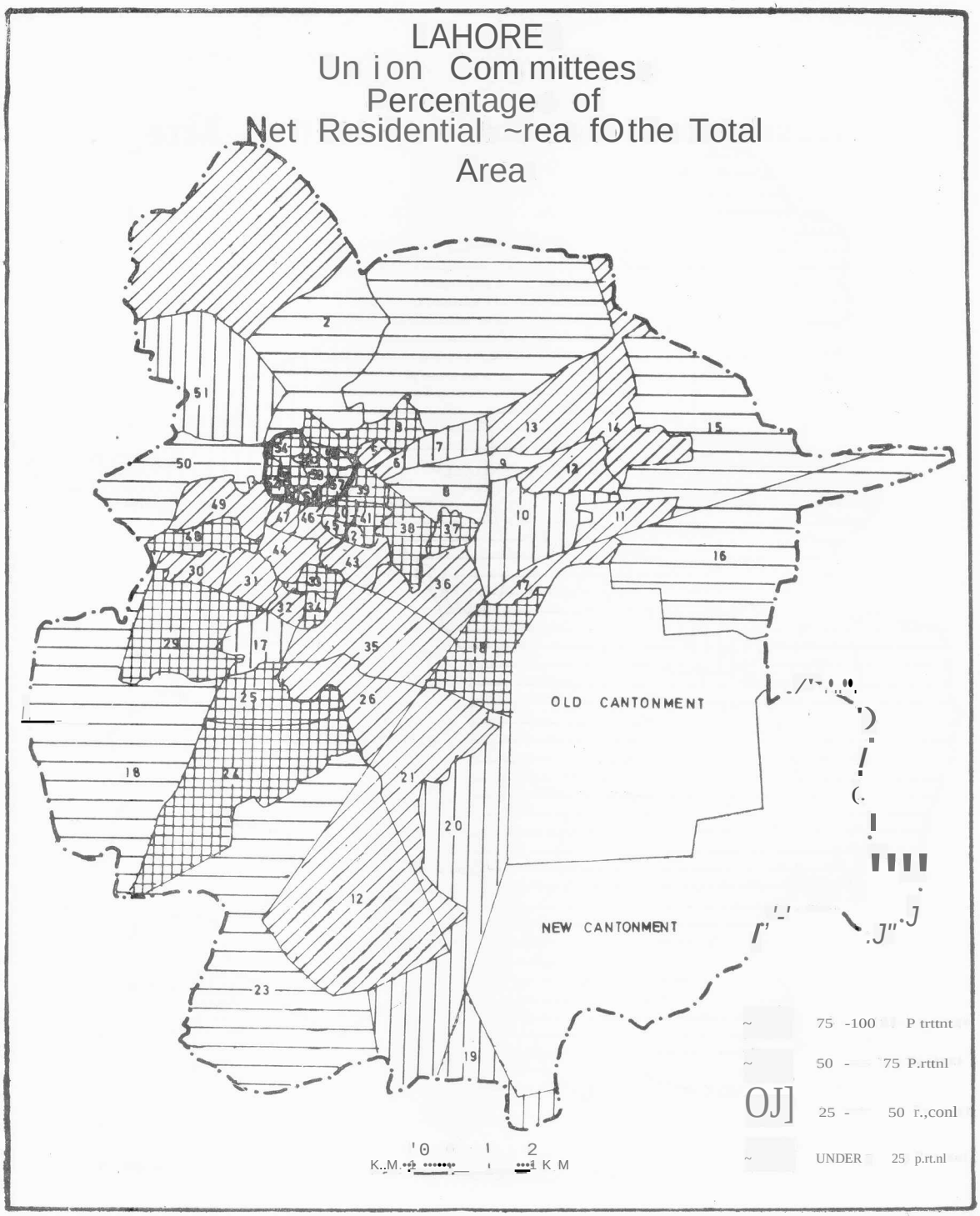
LAHORE
Union Committees
Percentage of
Net Residential Area of the Total
Area
OLD CANTONMENT
NEW CANTONMENT
75 -100 P trttnt
50 - 75 P.rttnl
25 - 50 r.,conl
UNDER 25 p.rt.nl
0 1 2
K.M. K M

Fig. 2

on rent one room accommodation even. All the houses being detatched and mostly silLgleunits and are meant for single family. There is no provision or means or even trend to buid multiple housing units which can allow a portion for rental purpose. That is why, as will be seen in the foregoing account, population piling up is going on in the old citys multiple buildings which are based on 'row housing'.

To assess the actual position of the built up area within the metropolitan limits it will be helpful to know the areas occu:;>ied and available for further extension of the residential function in different union committees in the city of Lahore. Map (Fig. II) has been compiled on this information to bring out the overall position. The walled part of the city i.e. the old part, is almost saturated. There is hardly any chance of lateral development. Only vertical expansion may be possible, that too presents great problem, as the base area of each housing unit is very small. Therefore, the idea of mansion or even vertical expansion is not applicable here. Two to three room multistorey buildings already exist here and further development is unimaginable. This area of negative potential extends to the south-esat, north and north-eastern Union Committees. The same position exists in the southern part covered by Union Committees 18,24,25,28,33 and 34. The rest of the area clearly shows the Union Committee with a ratio of 50-75 households per acre. Therefore, there is, possibility of vertical as well as lateral expansion. The main low residential density area is ~ituated on the north, east, west and south-western part of city. And, as a matter of fact, major residential expansion is taking place towards the south and Western side. The northern and eastern sectors are vulvenable to the River Ravi and have the disadvantage of being to the Indian Border.

Map (Fig. III) shows the household units density per acre. Here again the walled city shows high density. There is a ring of high density area around the walled city and covers up Union Committee 2 in the North. The Union Committees 27,30,31,32, 33 and 34 also are comprised of high density region. Again Union Committee 8 possessess a density of 50-55 households similar to that of the old part of the city and Union Committees 5 and 16 possess a concentration of more than 80 household units per acre. Whereas Union Committees 9 and 6 have the highest concentrations of 109.8 and 143.5 respectively. Such high concentrations of households, in the absence of good basic urban amenities are unbelievable. This is a clear indication of accommodation plight of the city. The rest of the city area shows over all low densities.

The old part of the cit)/ is a compact mass of buildings with very narrow anes of uncertain direction. Tbe houses are congested. The outlook is dark

and gloomy.

The following account shows the present intensity of housing' At the time of establishment of Pakistan there were only 82,000 houses. The numbers in 19'>1increased to 203, 883 and after 10 years in 1971 become 318, 803. The increase is considerably slow as complred to the po.:mlation increase. The defieit is increasing year after year. The following table gives the actual housing position in the city in 1972.

Total Housing Units	Number of Rooms/Units[1]								
	1	2	3	4	5	6	7	8	9
318803	123,763	96,531	43,538	26,772	11,661	7,682	2,829	2,599	3,123
100 %	83.82	30.28	13.75	8.40	3.66	2.40	0.89	0.82	0.98

The central part and its contigenous areas have greater densities as compared to the outer parts. In other wards the concentration goes on increasing as one moves towards the centre of the city. The average number of p<:rsonsliving in each household unit is 6.34 which has increased from 6. I in 1961. This indicates that deterioration has taken place in the 1961-71 decade. Considering the nature of houses this number is very high. The condition of buildings in all the high density area generally is bad. This also reveals that 1, 2 and 3 rooms, housing units constitute 82.85 % of the total residences. And if four rooms housing. units may also be considered along with the small ones, the percentage becomes 91.25 which is not at all satisfactory. The spacious housing unit percentage remains only 8.75. The plot sizes of spacious houses is indeed large as can be seen in the Civil Lines, Gulberg, Model Town, Garden Town, New Muslim Town and Shadman etc., the newly established housing schemes.

Further analysis of one-room population shows the results which are hardly believeable and perhaps are the characteristics of the poor nations of the world. The following table examines in more detail the household percentages living in one room housing units according to the number of persons per falllily :

Total of one room household	persons in one room[1]								
	1	2	3	4	5	6	7	8	9 and above
123.763									
100%	12.00	9.48	10.69	12.64	13.90	12.49	10.31	7.87	10.43

1. Based on population census 1972, Housing, Economic and Demographic Survey, 1973 Vol., II part II Tal be J. P. 292.

1. Based on population censu 1972, op. cit., Tables 1.

The table makes it clear that households having 7 to 9 persons as one room residents, constitute 68.6 % of the total population. If on the otler hand, families having 3 to 10 persons are considered together than the percentage becomes 78.33 of the total.. In 1961 it was 23.1 and 76.92 respectively. This indicates deterioration over the time. These facts also are a sufficient proof that the city is greatly over croweded and congested.

The general morphology of the city shows that the walled city represents a compact mass of buildings, with narrow lanes of undertain width and direction. The general outlook is very depressiug. Next are lacalities around the old city which have been established according to the plan laid down by the civic authority. The buildings are spacious, multistoreyed and also compouni in character. AU these localities such as Misrishah, Krishanagar, Rajgarh, Gowalmandi and others have been established on "row-housing" basis and indicate higher densities.

On the whole the demand for possessing one's own house or acquisition on rental basis is increasing fast.. The present policy of the planning authority, discussed already, is very much commercial in every respect. This has resulted in a strong competion Which will not h~lp is ease the accommodation problem. A large m!l.jority of population is poor, therefore, wiU not be able to compete in the open market or even if allotment policy is adopted, they would not be able to get one at astronomical prices of plots or constructed flats.3 Hence it is essential to adopt some other policy to help the numerous genuine house neeing families. At the sametime detatched homing might be good for aesthetic and health point of view, but it is 'spreading' the city area enormously. This undoubtedly will bring forth other serious problems for the city dwellers. Therefore it is needed that higher density housing planning should become the rule. This can be achieved by adopting "row housing"' and with a minimum hight of three to four stories. It is believed that such a housing policy would be able to provided maximum results with minimum area demand. Already the existing policy has deprived the city of extensive arable tracts of land which formerly provided vegetable etc. and acted as a green belt around the city. The utility of precious land on the urban fringe needs very careful and thorough thinking before starting any development plans.

2. Population Census of Pakistan, 1961 Dist.. Census Report, Lahore Table 10, P 1II-20.

3. Such flats cost seventy to eighty thousands ruppees for two bedroom accommodation.

CHANGES IN LAND PRICE IN THE PUNJAB CANAl. COLONY DISTRICTS, 1881-1931

FAREEHA ZAP AR *

In the Punjab, determination of the land according to Regulation VII of 1822, stimulated the demand for land and the development of a land market.. The right to transfer ownership, superior rights, as well as occupancy rights to the land, was recognised during the settlement of the Punjab districts, and Was clearly embodied in the Punjab Tenancy Act of 1868. As a result, the sale and transfer of land became possible and combined with the introduction of the Civil Procedure Code in 1861 and the Penal Procedure Code in 1862, created the conditions for easy and rapid alienation of land in the Punjab Canal Colony Districts[1] during the last quarter of the nineteenth century. At this stage, the sale and transfer of land was largely connected with settlement of debts and consequently the price of land remained low.

Alienation of Land Act and the Price of Land

The freedom to sell land for settlement of debts combined with strict enforcement of the law to repay debts, resulted in the rapid alienation of land from the agricultural classes to the non-agricultural classes to which most of the moneylenders belonged. The impoverishment of the Punjab peasantry became a matter of concern for the British administration and the Alienation of Land Act was passed in 1900 to counter the economic and social deteriioration of the agricultural classes.

In the decade prior to the passing of the Act, the prospect of impending restrictions on land sales and transfers was sufficient in itself to raise the price of land (Figure 1). After the implementation of the Act in 1900, it took a few years for the effect of the restrictions to become apparent in the figures of land alienation and the price of land. Thus, while the Land Alienation Act had the effect of shifting the transfer of land from non-agriculturists to those designated as belonging to the agricultural tribes only, its impact on land prices was to raise them even further. As it became more difficult for non-agriculturists to acquire land under the provisions of the Act, they were ready to pay much higher prices for land whenever and wherever the opportunity was offered to them. The average price of land paid by members of agricultural tribes was less than by others, and this resulted in the practice

*Dr. Fareeha Zafar is Assistant Professor, Department of Geography, Punjab University, Lahore

of fictitious land prices being quoted to defeat pre-emption claims.[2] Thus, while the average price paid by agriculturists in the Khangah Dogran tehsil was Rs.21 per acre for all kinds of land and Rs. 54 per acre for cultivated land in 1904, the price paid by Don-agriculturists was Rs. 24 per acre for all kinds of land and Rs. 58 per acre for cultivated land.[3] Between 1901 and 1911, therefore, a sharp rise was apparent in the price of land particularly in the districts of Montgomery, Multan and Jhang. (Figure 1).

Irrigation and Land Price

During the 1880's and 1890s, land alienations continued to increase rapidly. At the same time, the introduction of canal irrigation and the emphasis on agriculture and cultivation instead of grazing combined to raise the value and demand for land. While in 1890-91, the price of land was under Rs. 30 per acre in almost all the Punjab Canal Colony Districts, by 1900-01, it was above Rs. 30 per acre in all the districts with the exception of Montgomery. (Table 1). Within the districts the change was equally great. In the *bar* areas in particular, land prices rose phenomenally. In the Hafizabad tehsil, while the average price of land in the Bangar Circle increased from Rs. 11 per acre to Rs. 20 per acre during the period 1887-92 to 1900-03, in the Bar Circle the increase was from Rs. 12 to Rs. 34 for the same period. The rise in the price of land was totally disproportionate to the rise in the price of agricultural produce which increased at a very slow rate till 1910. The reason for rising land prices lay, therefore, in its demand, generated not only by the improved quality of the land itself, but the absence of other investment avenues. Under these circumstances, canal irrigated land or even land which hoped to get canal water in the forseeable future was rated at a very high value.[4]

In the canal colonies, for example, as soon as the colony grantees had paid for their leases, land prices were exaggerated to enhance the value of the land for re-sale, In the Sidhnai Canal irrigated area, leases sold by the government at the rate of Rs. 3 per acre, were re-sold at Rs. 56 per acre.[5] In the riverine villages, on the other hand, especially where canal construction had depleted the water supply in the rivers, the rise in price was less. This was clearly apparent in the case of the Chenab Assessment Circle of the Hafizabad tehsil which was adversely affected by the construction of the Lower Chenab Canal.. In districts like Jhang, where the rainfall was low and extremely unreliable, the mere possibility of getting regular supplies of irrigation water inflated the price of land. Thus,

> 'As soon as it became known that canal irrigation was to be afforded to the circle, spectulative purchasers at once brought up any land which was

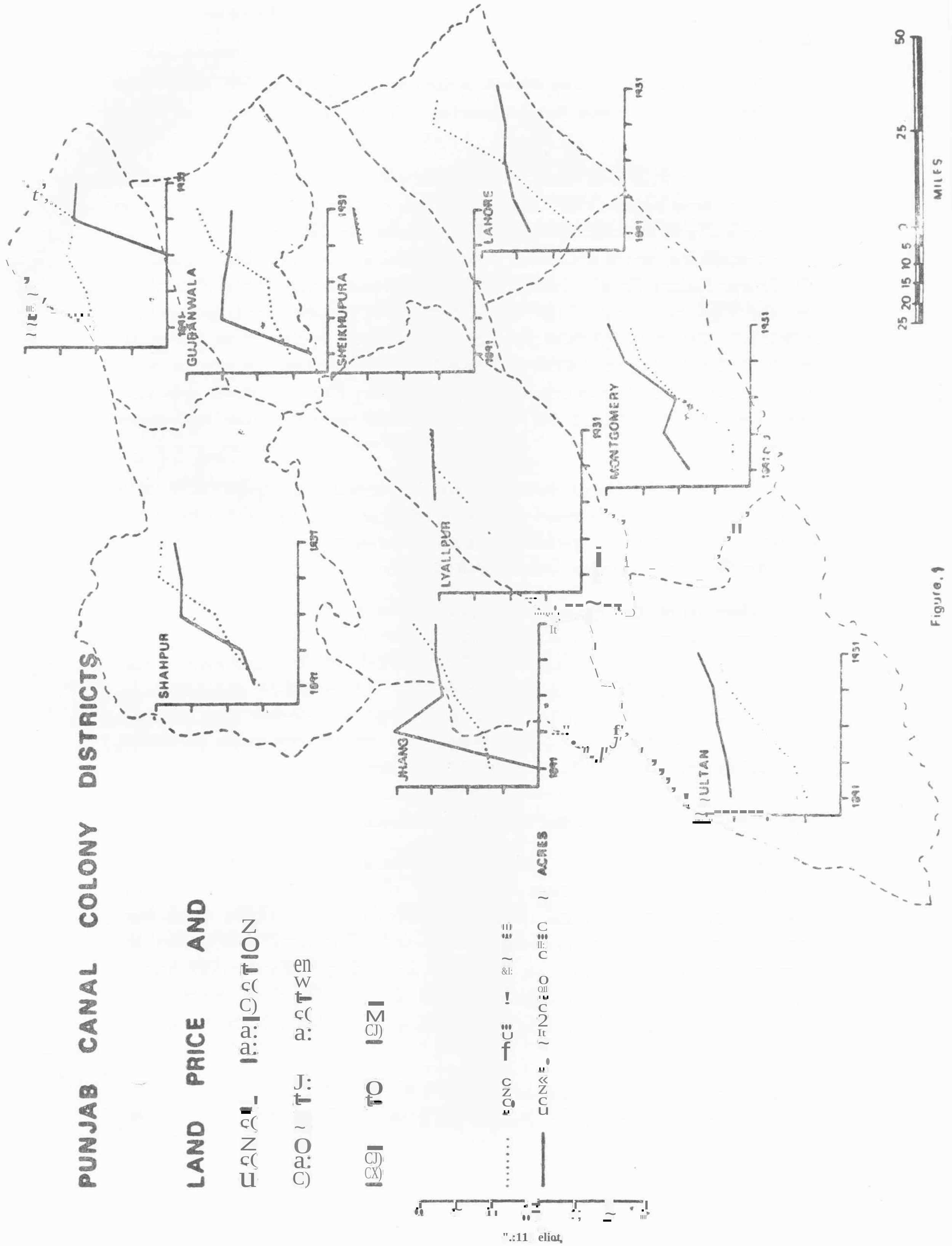
PUNJAB CANAL COLONY DISTRICTS
LAND PRICE AND
SHAHPUR
GUJRANWALA
SHEIKHUPURA
LAHORE
LYALLPUR
MONTGOMERY
JHANG
MULTAN
ACRES
MILES
25 20 15 10 5
25
50
1891
1931

Figure 1

> in the market, and many owners in the northern part of the tehsil Were unable to withstand the temptation afforded by the sight of ready money ..,'6

The losers of land in such cases were mostly the small landowners, while the buyers were big landlords, and in the case of Jhang district belonged to both agricultural and non-agricultural tribes. In the Shahpur district, most such speculation was in undivided common land which was to be irrigated by the Lower Jhelum Canal. Much fighting was expected at the time of partition of the land as many of the speculators were pleaders and government officials.7 The very high price paid for such land was evidcnt from the statement of the Settlement Officer of Jhang district stating that the average price given by the figures for the sale of land for the year 1899 though double that for the period to 1894 1898 was below the actual increase which had taken place.8

Thus, large landlords belonging to the agricultural tribes were also responsible in helping to raise the price of land. In the 1916 Assessment Report of the Bhera, Shahpur and Sargodha tehsils, noted for their big landlord families, the Settlement Officer noticed that,

> ;... in each of the quinquennial periods since the last Settlement, the prices paid by agriculturists are almolit identical in Bhera and Shahpur, though all other statistics point to the superiority of land generally in the former tehsil. The explanation seems to be that would-be purchasers in Shahpur are the Tiwana Maliks or other large landowners who (if they are not more prone than others to overstate prices) are eager to secure land as an investment even at vcry high prices.'9

Agricultural Production and the High Price of Land

By 1910, the prices of agricultural produce had begun to rise in the Punjab Canal Colony Districts as a result of increasing local demand and export.. During the 1910's and 1920's of therefore it Wasthis factor which was largely responsible for the rise in the price of land. The rise in the prices of crops was connected in particular, with the increasing cultivation of wheat and cotton in the canal colonies, and the demand for these in the world market.. The Report of the Royal Commission on Agriculture in India in 1927 noted that,

> '... These American cottons have entirely altered the standard of quailty of cotton produced by the Punjab and have raised the price of land in the Province. '10

Table shows the decade 1910-11 to 1920-21 to be the most significant regarding the rise of land prices. With the exception of Montgomery and

TABLE 1

PUNJAB CANAL COLONY DISTRICTS, CHANGES IN THE PRICE OF LAND,
1890-91 to 1930-31 (in Rupees per acre)

	District	1890-91	1900-01	1910-11	1920-21	1930-31
1.	Lahore	25	85	241	1,511	1,291
2.	Lyallpur	x	x	180	466	533
3.	Gujrat	55	72	124	266	404
4.	Shahpur	22	47	77	356	329
5	Gujranwala	21	35	39	178	272
6.	Multan	19	29	75	171	248
7.	Jhang	29	36	77	116	242
8.	Montgomery	12	12	60	157	220
9.	Sheikhupura	x	x	x	162	213

PERCENTAGE CHANGE IN LAND PRICE

	District	189091 to 1900-01	1900-01 to 1910-11	1910-11 to 1920-21	1920-21 to 1930-31
1.	Lahore	236	187	527	-15
2.	Lyallpur	x	x	159	14
3.	Gujrat	31	72	115	52
4.	Shahpur	114	64	362	-8
5.	Gujranwala	67	11	356	53
6.	Multan	53	159	128	45
7.	Jhang	24	114	51	109
8.	Montgomery	0	400	162	40
9.	Sheikhupura	x	x	x	31

Source: Punjab Land Revenue Administration Reports.

Multan districts, which registered the highest increase in the price of land during 1900-01 and 1910-11 because of the extension ofcanaI irrigation to areas of wasteland and the Jhang district which formed part of the Chenab Colony between 1900 and 1904, the remaining districts registered increases of between one hundred and five hundred per cent in the price of land. For the same period, the growing urbanisation of the Lahore tehsil was expressed in the very high price of land in the district of Lahore as a whole, but even in Lyallpur an acre of ordinary land fetched upto Rs. 500, with as much as Rs. 1,000 per acre being paid for extremely fertile land. (Figure 1). This trend continued through most of the following decade until 1929, when the depression had a temporary lowering effect on the price of land. Within a few years, however, land prices began to rise and the upward trend was resumed.

Effect of Actions on Land Price in the Colony Areas

Yet another factor which pushed up land prices in colony areas in particular, was the regular auctioning of land carried *Qut* by the government. Usually the land auctioned was of good quality and this coupled with the fact that the non-agricultural classes were eager to get into the colony areas, or wanted to extend their existing holdings in these areas, helped to raise the price of land. The result of an auction sale of colony land in 1899 in the Chenab Colony near Lyallpur; is indictive of the type of agriculturist who bought land. In this particular instance, the honourable Baba Khem Singh Bedi acquired 545 acres of land at Rs. 127 per acre, while Sodhi Ram Narain Singh of Anandpur bought 568 acres at Rs. 125 an acre, and Nawab Muhammad Ali Khan Kazilbash bought 611 acres at Rs. 182 an acre.[11] All three were large landlords. The average price of land in the district of Jhang as part of the Chenab Colony in 1900-01 was Rs. 36 per acre. Even if the land auctioned was assumed to be of the best quality, the auction price was high. The size of plots offered for auction also determined who would purchase them, although this was not always the case. In the case cited above one plot was more than 600 acres, two were more than 500 acres, while in all thirteen plots were more than 100 acres in size. Apart from this, the landlord who bought large plots was usually interested in acquiring as many small plots located nearby in order to enlarge his estate to the maximum.

Even where the land was not of good quality or where irrigation was less secure and small purchasers bid for the land, their attempts to enter the land market only served to raise the bids of the capitalists even when the land was not worth the price being offered for it.[12] The result was that the government usually got more money than it had expected. The willingness

of affluent landlords to buy land at any cost also gave the government the opportunity to decide in favour of certain individuals. For example,

> 'Experience in the Chenab Canal Colony has shown that there is no dearth of men who are only too ready and willing to purchase land even at a full price and that it is a mark of the favour of Government to let one man buy in preference to another ...'[13]

The policy of auctioning part of colony land, therefore, raised the price of land considerably, especially because of the competition amongst a few rich men.[14]

It further became apparent that the same people bought the large plots offered for sale at different auctions, while many small plots were bought by the same person in order to accumulate a large holding.[15] The policy of having small plots was aimed at the need of small proprietor, but in actual practice, these were bought at very high prices by capitalists. In most cases, the original small bidders gave up competing once they found that a large land-owner had acquired most of a *mauza* or village.[16]

The higher price of auctioned land compared to the best land in the same locality was evident in the result of an auction sale on the Jhelum Canal. The best land was sold by owners at Rs. 100 to Rs. 110 an acre on an average in 1902, while the price realised at auction was Rs. 153 an acre. The Punjab Administration Report for the year 1901-02 went so far as to state that,

> 'Of all the economic facts of the decade perhaps the most remarkable is this rise in the market price of agricultural land. The sale and mortgage transactions entered in the village records indicate an enhancement of 40 percent within the last ten years ...'[17]

The highest land prices without doubt prevailed in the colony areas, and were realised at auctions. This tendency continued throughout the p~riod of colony formation, and was a significant feature of each new colony. In 1920, a resume of all auction sales between 1914 and 1920 showed that, while the average price per acre offered at the auctions had been Rs. 281, the highest bid was of Rs. 1,105 per acre by a grantee of a cattle farm in the Okara tehsil of Montgomery district.[19] The rising price of cotton also contributed to the rise of land prices during this period.

Conclusion

In the Punjab, therefore, while fixation of land rights by the British had given a value to the land, initially the price of land remained low. Speculation in the land market and the improved productivity of land as a result of canal irrigation increased the demand for land and its price. At the turn

of the century, the Alienation of Land Act created an artificial scarcity in the land market which escalated the price of land, especially in Canal Colony Districts. With the rise in prices of agricultural produce and the auctioning of land in the colony areas the upward trend in land prices continued. High land prices and competition among and from large landlords who were willing to buy land and at any price, made it difficult for the small cultivators and landowners to buy land. Consequently, with the concentration of land in fewer hands, land prices continued to rise unchecked, and the feudal system was firmly entrenched in the Punjab.

References and Notes

1. The Punjab Canal Colony Districts, include the districts of Gujrat, Lahore, Gujranwala, Jhang, Lyallpur (now Faisalabad), Sheikhupura, Montgomery (now Sahiwal), Multan, and Shahpur (now Sargodha).
2. Assessment Report of the Chenab, Jhelum and Joint Circles of Jhang District, Lahore, May 1905, para 11.
3. Assessment Reports of the Hafizabad and Khangah Dogran Tehsils, Gujranwala District, Lahore, September 1904, p. 16.
4. The question of rising land prices in the Punjab has been dealt with by Calvert (1922), Mukerjee (1965), and Hirashima (1978) but they have ignored the impact of Land Alienation Act and the policy of auctioning land in the colony areas on land prices.
5. Assessment Report of the Kabirwala Tehsil of the Multan District, Lahore, November 1899, p. 34.
6. Assessment Report of the Jhelum Nehri Circle of Jhang District, Lahore, March 1906, p. 14.
7. Report on the Land Revenue Administration of the Punjab, 1899-1900, p.13.
8. Assessment Report of the Jhelum Nehri Circle of the Jhang District, Lahore, March 1906, p. 14.
9. Assessment Report of the Bhera, Shahpur and Sargodha Tehsils of the Shahpur District, Lahore, November 1913, p. 14.
10. Report of the Royal Commission on Agriculture in India, Vol. VIII, Evidence taken in the Punjab, p. 184.
11. Proceedings, Department of Revenue and Agriculture, General, No. 197, dated 15th March, 1899, para 3.
12. The Annual Report of the Canal Colonies, 1901-02, p. 4.

13. Proceedings, Department of Revenue and Agriculture, Irrigation, No.- dated October 1901, in Govt.. of Punjab, Proceedings, 1902, para 5.

14. Proceedings, Department of Revenue and Agriculture, General, No. 308, dated 20th February, 1899.

15. Proceedings, Department of Revenue and Agriculture, Irrigation, No. 655, dated 27th March, 1899, in Govt.. of Punjab Proceedings, 1900.

16. *Ibid.*

17. Report on the Administration of the Punjab, 1901-02, p. vii.

18. Proceedings, Department of Revenue and Agriculture, Irrigation, No. 499. date 20th March, 1920, para 4.

SHELTER IN URBANIZING LAHORE

M. AZIMUSHAN*

An increasing economic activity, the formation of a strong administrative establishment and accumulation of social services (i.e., health, education, cultural and recreational facilities) in Lahore have caused rapid increase in population and as a result the city is today confronted with the problems of an exploding metropolis. (Fig. 1.) In census "An Urban Area" includes the place having a municipal corporation, municipal committee, cantonment board or town committee. In general an urban area is a concentration of population of at least 5,000 persons in a continuous agglomeration of houses, where the community sense is well developed and the community maintains the public utilities such as roads, streets, lighting, water supply, the sanitary arrangements etc. The rate of growth of our nation's urban population in such urb3.n areas is higher than the rate of growth of the total population, perhaps as high as 4.3 per cent. Based on this rate, with:n 20 years by the turn of this century, the urban population of the country may reach 60 million. The massive foreseeable urbanization is not likely to be reversed in the future. The forces ac::elerating the urbanization are ba~ic one. As agricultural productivity increases the employment generated by a particular level of demand for agriculture, output decreases and pressure for migration from rural to urban areas increases. As population and income grow, the markets for urban output expands and as a result urbanization concentrates population in relatively productive centres, since some areas have higher potential for urbanization than other's, the process of urban growth is likely to be accompanied by m:uked regional and urban rural "imbalances." Therefore, the congestion and human miseries that accompany the rapid urbanization become the prime concern of the tLMA planning efforts. The population figures of Lahore IMA Which comparises of the areas of Lahore Municipal Corporation and Lahore Cantonment are given below in Table 1 which reveals that the population of Lahore has increased at a much faster rate between 1951 and 1980.

t LMA=Lahore Metropolitan Area. IMA=Inner Metropolitan Area. OMA=Outer Metropolitan Area. IMA+OMA=LMA

*Dr. M. Azimushan is Direct01' Urban Planni;zg, Lahore Development Authority Lahore.

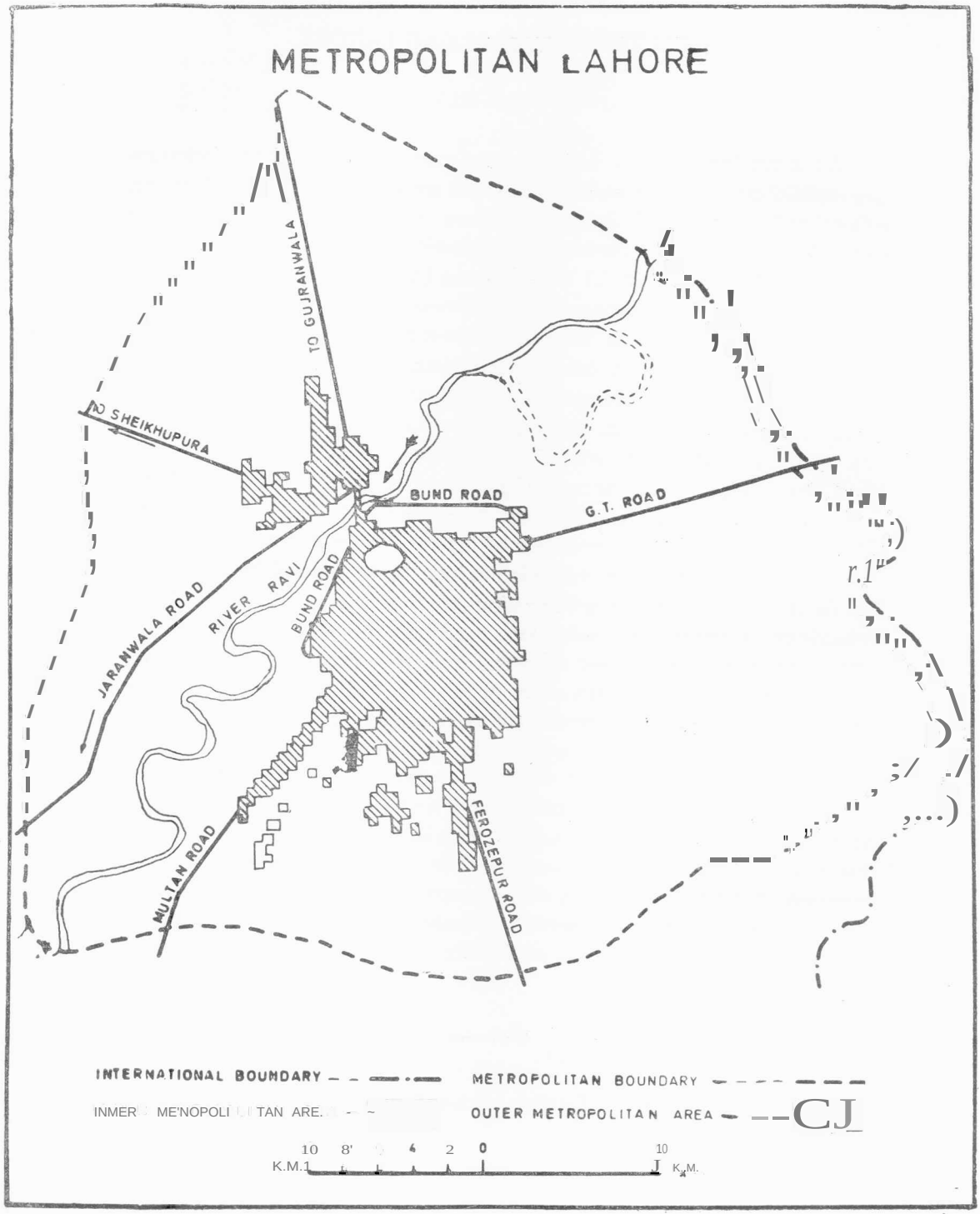
METROPOLITAN LAHORE
TO GUJRANWALA
TO SHEIKHUPURA
BUND ROAD
G.T. ROAD
JARANWALA ROAD
RIVER RAVI
BUND ROAD
MULTAN ROAD
FEROZEPUR ROAD
INTERNATIONAL BOUNDARY
METROPOLITAN BOUNDARY
INNER METROPOLITAN AREA
OUTER METROPOLITAN AREA
10 8 6 4 2 0 10
K.M.
K.M.

Fig. 1

TABLE 1

POPULATION OF LAHORE

Inner Metropolitan area

Year	Population in millions	Growth rate per year
1951	0.85	4.3%
1961	1,38	4.8%
1972	2.24	4.5%
1980	3.0 (estimated)	

The growth rate indicated in the above Table is due to natural increase in births over deaths including considerable migration from rural areas. The rate of increase of population amounts to 1,50,000 inhabitants and between 20,000 and 25,000 households per year.

The Shelter Issues:

The problem of shelter is becoming acute day by day in Lahore as the provision of housing is not keeping peace with the increasing and the environmental conditions of LMA are constantly deteriorating. In Lahore where "Pull" force are responsible for large scale rural urban migration the housing problem is collossal and complex, may social, economic and techno-logical inter-related problems impinge upon each other. The following table shoWS the housing shortage and needs in Lahore for the period 1261 to 1980.

TABLE 2

HOUSING SHORTAGE AND NEED IN LAHORE

Year	Popula-tion in million (esti-mated)	House-hold size	Dwelling units	Available stock	Shortage	Sub standard	Total need
1961	1,3	5,4	240088	194566	45522	19456	65032
1972	2.2	4.9	442804	344471	98333	34447	132780
1980	3.0	4.8	625120	590302	34818	59030	93848

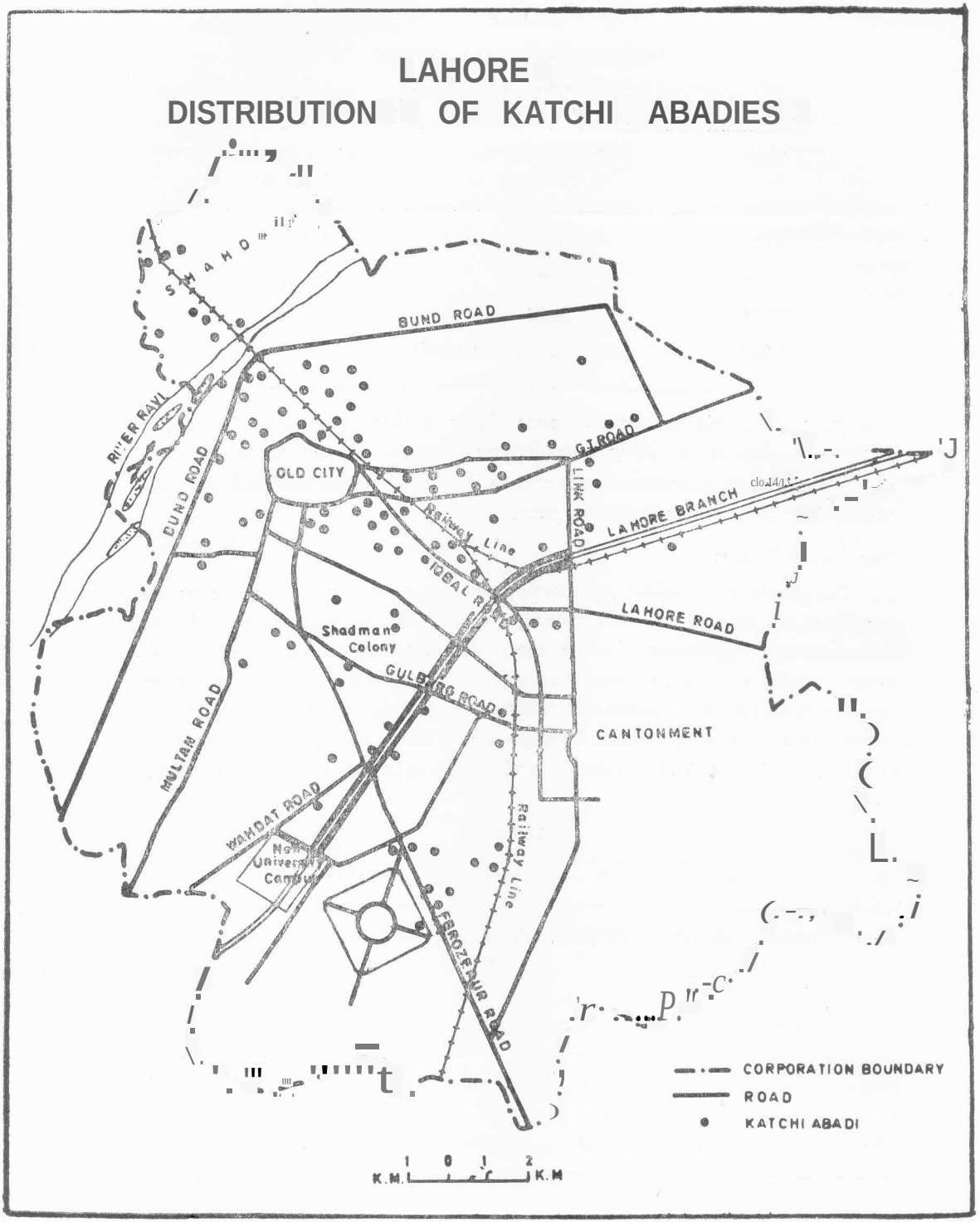
LAHORE
DISTRIBUTION OF KATCHI ABADIES
SHAHDARA
BUND ROAD
RIVER RAVI
BUND ROAD
OLD CITY
G.T.ROAD
LINK ROAD
LAHORE BRANCH
Railway Line
IQBAL ROAD
LAHORE ROAD
Shadman Colony
GULBERG ROAD
MULTAN ROAD
CANTONMENT
WAHDAT ROAD
Railway Line
FEROZEPUR ROAD
CORPORATION BOUNDARY
ROAD
KATCHI ABADI
K.M.
K.M

Fig. 2

Even if sufficient finances were available for new housing, it is doubtful whether the building industry would have the capacity to meet the present and future needs. Taking some conservative assumptions (i.e., no backlog, no substandard units), the yearly housing need is 2500) units per year.

Katchi Abadies-Improvised Shelter.

Considering the rapid growth rate plus rapid urbanization of the city when projected over the last 33 years, it is estimated that the population of the city would be yearly 3.0 million in 1980. The population of the city is expected to double by the year, 2000 adding further 1,50,000 people annually. This growth would result in an acute shortage of housing and other civic amenities in the city. A large section of population, economically weaker and falling within low income bracket shall have no alternative but to live in improvised shelter, in a equalid environments, devoid of even minimal civic facilities. Presently a large number of low income group people live in unplanned settl~nts known as katchi Abadies"' which are scattered in various parts of the city. Fig. 2.

These Abadies date back to 1947, when a large influx of mainly homeless refugees migrated from India to Pakistan and m'Jstly to large urban centres including Lahore. Due to high demand for housing, squattering became prevalent on open lands of the city. The problem was further confound-ed by the process of urblnization. These settlements developed as rural pockets in the urban area with their physical environments resembling the villages. The quality of housing, material and technology used for construction depends largely on the age of the settlements. However, m'Jst settlements comprise a numb~r of small dwellings which are made from an assorted salvage material. . They are spacious having one or two rooms and a verandah in the front. . T,le plot sizes range from 200 square feet to 1,500 sft and have high densities as there are narrow streets and no open spaces. Water supply, sewerage, drainage, school and health facilities are also completely missing in these abadies. There are about 100 recognized katchi abadies spread out in different locations within the limits of the city of Lahore. The major concentration is in the central parts of the city in view of greater accessibility to job opportunities. According to an estimate about 500 thousand persons are living in these abadies consisting of 35 thousand households. This is roughly 15% of the total population of Lahore. Out of the total, 45 abadies are situated on state land, 25 situated on private land and 30 are situated both on state and private land. Fifteen abadies mostly on state land have earmarked for shifting whereas the balance 85 are to be regularized as per decision of the Government

Proposal for Shelter Issue

Now from the above paragraphs it is evident that as compared to the demand the supply is only a trickle. The Government is fully aware of the dimensions of the shelter problem and is keen to solve it, but it leaves the question open as to how to go about it. For example, it is a highly doubtful proposition that the rate of house construction can be increased tremendously particularly when not only the construction costs have skyrocketed but cement is also in short supply. Similar questions can be raised about the number of plots proposed to be developed in the coming years. Then there is that all important question of funds. Where is all the money going to come from? This, plus the fact that other ancillary facilities for the development of the construction industry are not present, makes one sceptic about the whole project.

One way to go about solving the housing problem is to enlist the support of the private sector. There is already precedent private construction companies that have built some big housing projects in the cities of Karachi and Lahore and thus have greatly helped to ease the overall situation in the sector. They have been doing their best to increase the scale of their operations to match the dimensions of the problem. It is necessary that the Government extend essential facilities to them by way of soft-term credit, plot at concessional rates and reduction in the duty on the import of construction equipment. A development authority may have to forego part of its income by giving a piece of land to construction company but the sacrifice must be weighed against the large social benefits that will accrue from it in the shape of more houses for the shelterless and reduction in the liability of the Government on that account.

In the long term perspective the housing industry calls for a new revolutionary approach to the problems of construction both methodology and material if it has ever to reach the take off stage. The old brick laying system is slow, cumbersome besides being labour intensive and totally unsuited for the mass production to meet the memands of an exploding population. If we continue with conventional masonary, we can never hope to close the gap between supply and demand, since by the time new housing colonies are built and become usable, newer bigger needs emerge and the overall situation further deteriorates.

May new building systems have been evolved and experimented within recent years to make the construction process cheaper, faster and more efficient but none has proved as successful as Con-Tech Forming System. It is a surprisingly fast, smooth and unexpensive method of building houses on

a mass scale which has already been profitably put into operation in over 30 countries in various parts of the World. Its chief merit lies in eliminating the use of skilled workers (of which there is now an acute shortage in Pakistan) and big construction equipment thus saving on both labour charges and capital outlay. A standard one storey housing unit can be built in only two days at 30 percent of the cost of conventional construction and it would also have double the life of an ordinary structure since the basic material used in it is concrete.

Con-Tech Forming System in its basic design, comprises lightweight aluminum moulds, containing architectural patterns, which are fastened together. Concrete or other castable materials are pourd in the cavity to form walls. The entire structure can be poured at the same time. Later the panels are removed revealing solid, strong, finished walls which as desired may be smooth or have the appearance of bricks. Conttruction of the method is very cheap for it eleminates the employment of various kinds of building materials and elements, large scale loadings and unloadings and need for finishing. And the pouring job is mostly done by unskilled hands. The savings thus affected are estimated at 20 to 30 percent of the total construction material and labour corsts.

An important factor is speed. For instance, only 10 workers can erect the mould, pour the material and remove the panels of house measuring approximately 1,000 square feet in one day. In Mexico under this system 200 houses are at present being built every month with the help of 100 workers and 10 sets of moulds. More and more developing countries are adopting the method to meet the housing needs of their people. Among them are Iron, Iraq, Nigeria, Venezuela and number of other countries.

The best way to go about for adopting this method in Pakistan would be to set up a committee of private builders, architects and expects on mass housing for devising a quick policy. Secondly there is also a strong case for constituting a National Housing Authority to co-ordinate private and public building activities and keep the problems of the shelter sector under secruitiny on a continuing basis.

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PROFESSOR R. OGILVIE BUCHANAN

1895-1980

The loss of Professor R Oglivie Buchanan who died on July 9th 1980 at the age of 85 years will be felt in countries all over the world. To his door at the London School of Economics came students from all quarters of the globe : none went away disappointed. His teaching of economic geography was clear and lucid : his lectures were well thought out and students went away inspired and with new questions to follow up. He was at his best with postgraduate students most of whom are now university teachers spread world wide. He was a keen director of research, quick to spot flaws in argument or casual expression. He expected and obtained high standards and in return provided experience, wise advice, good judgment and an unrivalled knowledge of his subject. He was, in short, a model university teacher.

His interests in agriculture had begun in boyhood in the South Island of New Zealand. He experienced hard times for his father died when his son was very young and he learnd to work on the farm while still at school. He worked his way to the University of Otago to read economics but his studies were interrupted by service in the New Zealand forces in the first World War. He was badly wounded. He returned to his home country to complete his degree and then to take a job in Auckland as one of the first teachers of geography in New Zealand. In 1925 he went to London to study geography at LSE and his brilliant work earned a post in University College, London.

In 1935 he produced his monograph *The Pastoral Industries of New Zealand* which revealed his ability to apply economic principles to the study of a changing environment. Its theme was the interaction of economic and geographical conditions. This piece of writing has established itself as a classic in the history of economic geography. But once again his work was to be interrupted by war and he served in the Royal Air Force for six year eventually to be given the responsibility for organising a maps service to meet the special need of the RAF.

In 1~49 he became Professor of Geography at LSE and very infvential years followed. He rose to high levels as a university administrator, for example as Depty Vice-Chancellor in the University of London and as Honorary Treasurer of the Association of Commonwealth Universities. He travelled widely and especially enjoyed his visits to countries in Southern Asia, par~icularly Pakistan where he has many friends and old students. He always

loved to return to his room at LSE to be among his students and to advise them. In his own writing he was concise and he urged others to follow his example. For him economic geography was the study of man's work and the explanation of his example. For him economic geography was the study of man's work and the explanation of his approach which he published in the Indian Geographical society's Silver Jubilee Volume 1951 is a medel of its kind.

Professor Buchanan retired from his chair in 1961 but be continued to come to LSE on almost every working day to carryon with his studies, his editing of books and his advice to coIleagues and students. He never reaIIy retired. He was proud that until the end students and friends form many countries continued to seek him out and to ask his advice. No one went from his door without a word of encouragement. He devoted his life to international scholarship and set an example that, wherever it faIls to us to play our part, we must continue to follow.

The Geography Deartment of the University of the Punjab was fortunate enough to have very cordinal relations with Prof.. R. O. Buchanan. Some of the eminent geographers in Pakistan ha ve been his pupils. Prof.. Buchanan also visited the Department of Geography during the Chairmanship of late Prof.. Kazi S. Ahmad and wIS honoured by the Pakistan Geographical Association for his contribution in the field of geography. Even after his retirement he remained as an Adviser to the University of the Punjab for the selection of senior posts of teachers in Geography. He also served for a long period as a corresponding editor of the Pakistan Geographical Review. The news of his death was a shock to all the geographers in Pakistan. Pakistan Geographical Association passed a condolence resolution on the sad demse of a geographer of such a high calibre,

ANIS A. ABBASI.

Professor R. Ogilvie Buchanan 1895—1980

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